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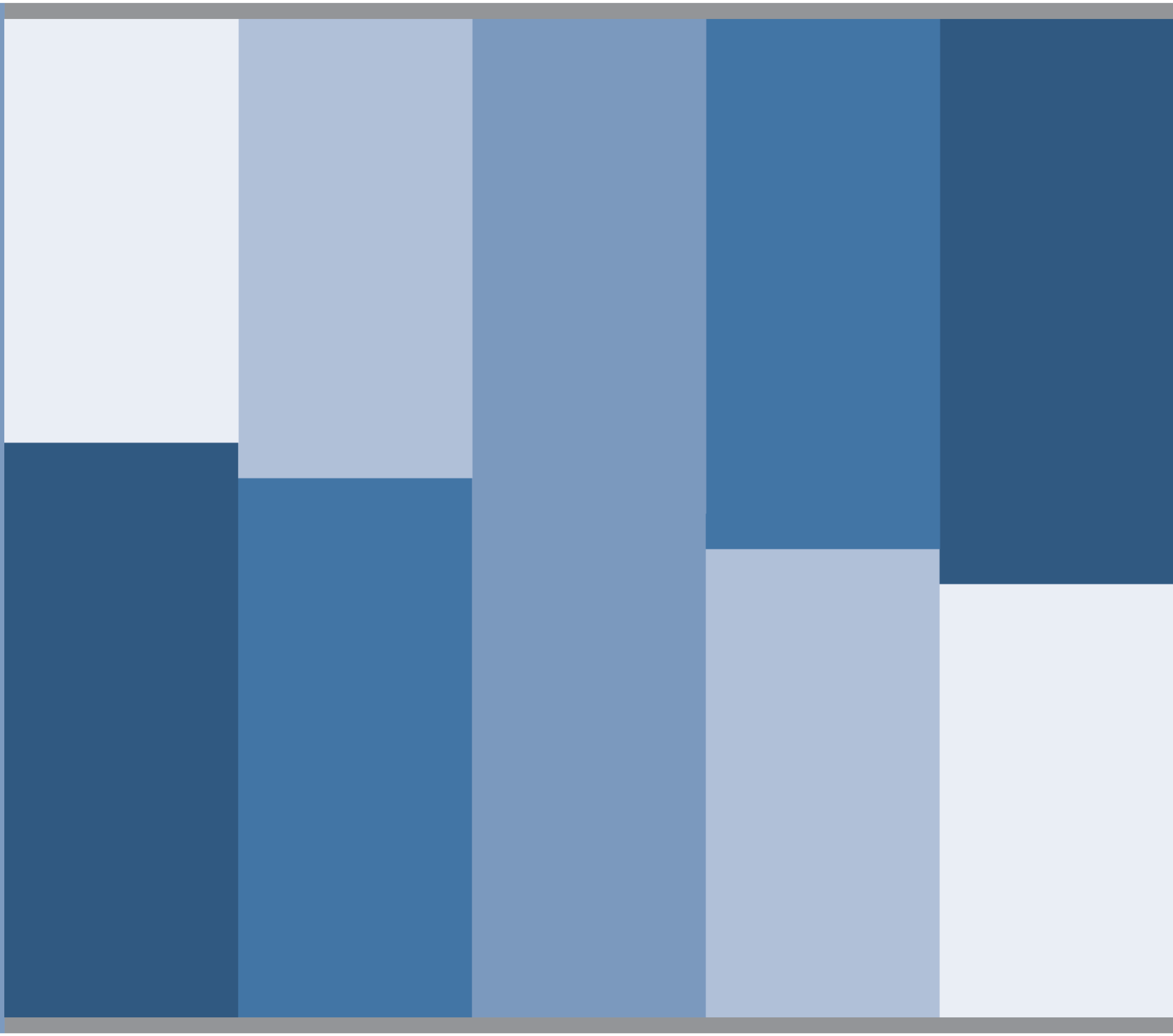

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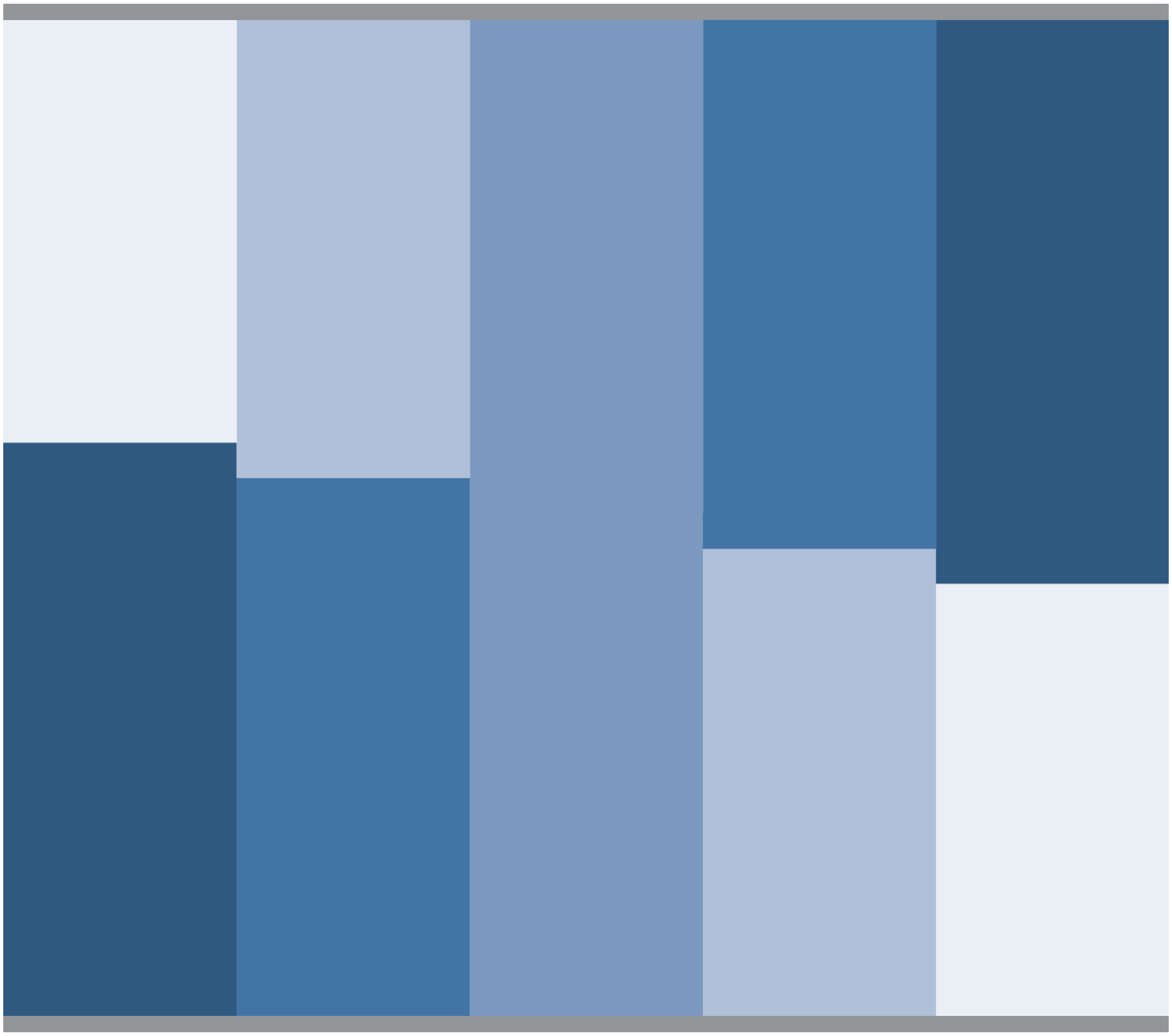

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CONTENTS

Model for Computational and Predictive Analysis of Dried Length during Initial Air-Drying of Wet Clay Products

Chukwuka I. Nwoye[1*] and Ihuoma E. Mbuka[2]

*1 Department of Materials and Metallurgical Engineering, Nnamdi Azikiwe University, Awka, Nigeria.
2 Department of Materials and Metallurgical Engineering, Federal University of Technology. Owerri, Nigeria.
chikeyn@yahoo.com

Abstract: A model for computational and predictive analysis of dried length during initial air-drying of wet clay products has been derived. Three clay types were mined, sorted, prepared, molded into shape and dried in air to reduce the moisture content. Initial and dried lengths measured were used for calculating the resultant fractional volume shrinkage (using conventional equation). Values of the fractional linear shrinkage (due to drying) were used for calculating the fractional volume shrinkage. The derived model;

$$L_1 = L\left([- \gamma^3+3\gamma^2 - 3\gamma + 1]^{1/3}\right)$$

was found to be made up of three parameters, initial length, L dried length L_1 and fractional linear shrinkage γ. The model-predicted dried length L_1 was found to depend on the values of the initial length and fractional linear shrinkage. The validity of the model was found to be rooted directly on the expression $(L_1/L)^3 = [- \gamma^3+3\gamma^2 - 3\gamma + 1]$ where both sides of the expression are correspondingly almost equal to 0.8. The maximum deviation of the model-predicted dried length L_1 from the corresponding experimental values is less than 2% which is within the acceptable range of deviation limit for experimental results. It was also found that the cube of the ratio of dried length to initial length is equal to 1-fractional volume shrinkage due to drying. [Academia Arena, 2010;2(7):1-6] (ISSN 1553-992X).

Keywords: Model, Computational and Predictive Analysis, Dried Length, Clay.

1. Introduction

Several studies (Barsoum,1997; Viewey and Larrly,1978;Keey, 1978) carried out on shrinkage of clay during drying indicate that porosity influences the swelling and shrinkage behaviour of clay products of different geometry. Reed (1988) has shown that firing proceed in three stages; preliminary reactions which include binder burnout, elimination of gaseous product of decomposition and oxidation, sintering as well as cooling which may include thermal and chemical annealing.. It has been reported (Reed, 1988) that drying occurs in three stages; increasing rate, constant and decreasing rate. He pointed out that during the increasing rate; evaporation rate is higher than evaporating surface hence more water is lost. At constant rate, the evaporation rate and evaporation surface are constant. The researcher posited that shrinkage occurs at this stage. Keey (1978) also in a similar study suggested that at this stage, free water is removed between the particles and the inter-particle separation decreases, resulting in shrinkage. During the decreasing rate, particles make contacts as water is removed, which causes shrinkage to cease.

Model for calculating the volume shrinkage resulting from the initial air-drying of wet clay has been derived by Nwoye (2008). The model;

$$\theta = \gamma^3 - 3\gamma^2 + 3\gamma \qquad (1)$$

calculates the volume shrinkage when the value of dried shrinkage γ, experienced during air-drying of wet clays is known. The model was found to be third-order polynomial in nature. Olokoro clay was found to have the highest shrinkage during the air drying condition, followed by Ukpor clay while Otamiri clay has the lowest shrinkage. Volume shrinkage was discovered to increase with increase in dried shrinkage until maximum volume shrinkage was reached, hence a direct relationship.

Nwoye et al. (2008) derived a model for the evaluation of overall volume shrinkage in molded clay products (from initial air-drying stage to completion of firing at a temperature of 1200^0C). It was observed that the overall volume shrinkage values predicted by the model were in agreement with those calculated using conventional equations.

The model;

$$S_T = \alpha^3+\gamma^3-3(\alpha^2+\gamma^2)+3(\alpha+\gamma) \qquad (2)$$

depends on direct values of the dried γ and fired shrinkage α for its precision. Overall volume shrinkage was found to increase with increase in dried and fired shrinkages until overall volume shrinkage reaches maximum.

Nwoye (2009a) derived a model for calculating the quantity of water lost by evaporation during oven drying of clay at 90^0C. The model;

$$\gamma = \exp[(\ln t)^{1.0638} - 2.9206] \qquad (3)$$

indicated that the quantity of evaporated water, γ during the drying process is dependent on the drying time t, the evaporating surface being constant. The validity of the model was found to be rooted in the expression $(\text{Log}\beta + \ln\gamma)^N = \ln t$.

Model for predictive analysis of the quantity of water evaporated during the primary-stage processing of a bioceramic material sourced from kaolin has been derived by Nwoye (2009b). The model;

$$\alpha = e^{(\ln t/2.1992)} \qquad (4)$$

shows that the quantity of water α, evaporated at 110^0C, during the drying process is also dependent on the drying time t, where the evaporating surface is constant. It was found that the validity of the model is rooted on the expression $(\ln t/\ln\alpha)^N = \text{Log}\beta$ where both sides of the expression are correspondingly approximately equal to 3. The respective deviation of the model-predicted quantity of evaporated water from the corresponding experimental value was found to be less than 22% which is quite within the acceptable deviation range of experimental results.

Model for quantifying the extent and magnitude of water evaporated during time dependent drying of clay has been derived (Nwoye et al.,2009). The model;

$$\gamma = \exp((\ln t/2.9206)^{1.4}) \qquad (5)$$

indicates that the quantity of evaporated water γ during the drying process (at 90^0C) is dependent on the drying time, t the evaporating surface being constant. It was found that the validity of the model is rooted in the expression $\ln\gamma = (\ln t/\text{Log}\beta)^N$ where both sides of the expression are correspondingly almost equal.

Nwoye and Mbuka (2009) derived a model for prediction of the quantity of absorbed water in clay materials exposed to hot-humid environment. These clay materials were prepared using different grain sizes; <100µm, 100-300µm, 300-1000 µm and their respective mixtures. The derived model;

$$\beta = \left(\left(\frac{\gamma}{\alpha\,(S)^{0.995}}\right)\right) \qquad (6)$$

was found to be dependent on the bulk density, apparent porosity and the shrinkage sustained on the clay body at any point in time under the hot-humid condition. The validity of the model is rooted on the expression; $S = (\gamma/\alpha\beta)^{1.005}$ where both sides of the expression are correspondingly almost equal. The maximum deviation of the model-predicted quantity of absorbed water from the corresponding experimental values is 8% which is within the acceptable range of deviation limit for experimental results.

Nwoye [10] derived a model for predicting the quantity of water evaporated during drying of clay at a temperature range 80-110^0C. The model;

$$E = \exp[0.3424(\text{Log}T)^{2.3529}] \qquad (7)$$

indicates that the quantity of evaporated water during the drying process is dependent on the drying temperature, the evaporating surface being constant. The validity of the model is rooted in the expression $(\ln E \times \text{Log}\ \beta)^N = \text{Log}\ T$ since both sides of the expression are correspondingly approximately equal to 2. The respective deviation of the model-predicted quantity of evaporated water from the corresponding experimental value is less than 20% which is quite within the acceptable deviation range of experimental results, hence depicting the usefulness of the model. Water evaporation per unit rise in the drying temperature evaluated from experimental and model-predicted results are 0.078 and $0.0502\text{g}/^0$C respectively, indicating proximate agreement. The present work is to derive a model for mathematical analysis and predicting of the shrinkage-induced final length of fired clay products.

2. Materials and Methods

Experimental processes and the respective methodologies involving the clay preparation, molding and drying are detailed in previous report (Nwoye,2008). The volume shrinkages based on length were evaluated using the conventional equation (Cooke,1988) while volume shrinkages based on dried shrinkage were evaluated using model from Nwoye (2008).

2. 1 Model Formulation

Results of the experiment previously carried out (Nwoye,2008) were used for the model derivation.

$$\theta = \gamma^3 - 3\gamma^2 + 3\gamma \qquad (8)$$

$$V_D = 1 - \left(\left(1 - \left(\frac{L - L_1}{L}\right)\right)^3\right) \qquad (9)$$

Studies carried out on equation (8) (Nwoye,2008) and the conventional equation (Cooke,1988) in equation (9) indicates that;

$$V_D = \theta \qquad (10)$$

Results from equation (10) as shown in Tables 1, 2 and 3 indicate that;

$$1-\left(\left(1-\left(\frac{L-L_1}{L}\right)\right)^3\right) = \gamma^3-3\gamma^2+3\gamma \qquad (11)$$

Where

L_1 = Dried length of sample after air-drying (mm)

V_D = Fractional volume shrinkage due to drying

And

θ = Fractional volume shrinkage in terms of dried shrinkage during drying (just before firing)

γ =Fractional linear shrinkage during drying (just firing)

$$1-\left(\left(1-\left(\frac{L-L_1}{L}\right)\right)^3\right) = \gamma^3-3\gamma^2+3\gamma \qquad (12)$$

$$-\left(\left(1-\left(\frac{L-L_1}{L}\right)\right)^3\right) = \gamma^3-3\gamma^2+3\gamma - 1 \qquad (13)$$

$$\left(\left(1-\left(\frac{L-L_1}{L}\right)\right)^3\right) = -[\gamma^3-3\gamma^2+3\gamma - 1] \qquad (14)$$

$$\left(1-\left(\frac{L-L_1}{L}\right)\right)^3 = -\gamma^3+3\gamma^2-3\gamma+1 \qquad (15)$$

$$\left(1-\left(\frac{L-L_1}{L_1}\right)\right) = [-\gamma^3+3\gamma^2-3\gamma+1]^{1/3} \qquad (16)$$

$$-\left(\frac{L-L_1}{L}\right) = [-\gamma^3+3\gamma^2-3\gamma+1]^{1/3} - 1 \qquad (17)$$

$$\frac{L_1-L}{L} = [-\gamma^3+3\gamma^2-3\gamma+1]^{1/3} - 1 \qquad (18)$$

$$\frac{L_1}{L} - \frac{L}{L} = [-\gamma^3+3\gamma^2-3\gamma+1]^{1/3} - 1 \qquad (19)$$

$$\frac{L_1}{L} - 1 = [-\gamma^3+3\gamma^2-3\gamma+1]^{1/3} - 1 \qquad (20)$$

$$\frac{L_1}{L} = [-\gamma^3+3\gamma^2-3\gamma+1]^{1/3} \qquad (21)$$

$$L_1 = L\,[-\gamma^3+3\gamma^2-3\gamma+1]^{1/3} \qquad (22)$$

Equation (22) is the derived model.

Table 1: Variation of shrinkages with initial and dried lengths (Olokoro Clay)

L(exp)	L_1(exp)	(γ)	$\theta = V_D$
70	64.40	0.0660	0.1852
70	64.52	0.0662	0.1857
70	64.63	0.0660	0.1852
70	64.38	0.0658	0.1847
70	64.49	0.0648	0.1821

Table 2: Variation of shrinkages with initial and dried lengths (Ukpor Clay)

L(exp)	L_1(exp)	(γ)	$\theta = V_D$
70	65.00	0.0714	0.1993
70	64.99	0.0716	0.1998
70	65.02	0.0711	0.1985
70	64.80	0.0743	0.2067
70	64.70	0.0757	0.2103

Table 3: Variation of shrinkages with initial and dried lengths (Otamiri Clay)

L(exp)	L_1(exp)	(γ)	$\theta = V_D$
70	65.80	0.0600	0.1694
70	65.08	0.0617	0.1739
70	65.60	0.0629	0.1771
70	65.99	0.0673	0.1886
70	65.82	0.0697	0.1946

3. Boundary and initial conditions

Consider a rectangular shaped clay product of length 70mm and width 30mm, exposed to air for drying, while it was in wet condition and thereafter fired to a temperature of 1200^{0}C. Initially atmospheric levels of oxygen are assumed. Atmospheric pressure was assumed to be acting on the clay samples during air-drying and firing. The grain size of clay particles used is 100µm, and air-drying duration; 48hours.

The boundary conditions were therefore the atmospheric levels of oxygen at the top and bottom of the clay samples, since they were dried under the atmospheric condition. No external force due to compression or tension was applied to the drying and fired clays. Clay products were air-dried during which shrinkage sets in. Dried linear shrinkage was assumed to be dried shrinkage. The sides of the particles and the rectangular shaped clay products were taken to be symmetries.

4. Model validation

In order to establish the validity and precision of the derived model, clay samples from three clay deposits (Olokoro, Ukpor and Otamiri) in south-eastern Nigeria were obtained, prepared and molded into rectangular shaped solids. The solids were air-dried at room temperature for 48hrs. Furthermore, the lengths L_1 obtained directly from experiment were compared with L_1 from the derived model and extent of deviation determined.

5. Results and Discussion

Result of chemical analysis of the clay materials used as presented in Table 4 shows variations in the Al_2O_3 and SiO_2 content, which affected shrinkage significantly. There are unquantifiable percent concentrations of TiO_2 and MgO in Olokoro and Otamiri clays respectively.

Table 4: Result of chemical analysis of clay materials used

Source	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)	MgO (%)	CaO (%)	SiO_2 (%)	Na_2O (%)	K_2O (%)	Loss of ignition (%)
Ukpor	31.34	0.63	2.43	0.14	0.06	51.43	0.04	0.10	12.04
Olokoro	29.10	7.95	-	0.75	1.26	45.31	0.05	0.09	11.90
Otamiri	15.56	0.05	1.09	-	0.29	69.45	0.01	0.21	13.01

Comparison of equations (8) and (22) shows that the model in equation (22) is mathematically the same as $L_1 = L[(1-\theta)^{1/3}]$ since $\theta = \gamma^3 - 3\gamma^2 + 3\gamma$. It was found that on re-arranging equation (22) for the value of L_1, the model becomes; $L = L_1 [-\gamma^3 + 3\gamma^2 - 3\gamma + 1]^{-1/3}$. Furthermore equation (22) shows that the ratio $(L_1/L)^3 = -\alpha^3 + 3\alpha^2 - 3\alpha + 1$.This invariably means that the cube of the ratio of dried length to initial length is equal to 1-fractional volume shrinkage due to drying.

Table 5: Variation of $(L_1/L)^3$ with $[(1-\theta)^{1/3}]$ (Olokoro Clay)

L_1/L	$(L_1/L)^3$	$(1-\theta)$
0.9200	0.7787	0.8148
0.9217	0.7830	0.8143
0.9233	0.7871	0.8148
0.9197	0.7779	0.8153
0.9213	0.7820	0.8179

Table 6: Variation of $(L_1/L)^3$ with $[(1-\theta)^{1/3}]$ (Ukpor Clay)

L_1/L	$(L_1/L)^3$	$(1-\theta)$
0.9286	0.8007	0.8007
0.9284	0.8002	0.8002
0.9289	0.8015	0.8015
0.9257	0.7933	0.7933
0.9243	0.7897	0.7897

Table 7: Variation of $(L_1/L)^3$ with $[(1-\theta)^{1/3}]$ (Otamiri Clay)

L_1/L	$(L_1/L)^3$	$(1-\theta)$
0.9400	0.8306	0.8306
0.9383	0.8261	0.8261
0.9371	0.8229	0.8229
0.9427	0.8378	0.8114
0.9403	0.8314	0.8054

The validity of the model was found to be rooted on equation (22) where $(L_1/L)^3 = -\gamma^3 + 3\gamma^2 - 3\gamma + 1$. Since $\theta = \gamma^3 - 3\gamma^2 + 3\gamma$, $(L_1/L)^3 = -\gamma^3 + 3\gamma^2 - 3\gamma + 1$ is equivalent to $(L_1/L)^3 = [(1-\theta)^{1/3}]$. Based on this mathematical analysis, the validity of the model directly stems on $(L_1/L)^3 = [(1-\theta)^{1/3}]$ where both sides of the expression are correspondingly almost equal to 0.8. Tables 5, 6 and 7 also agree with this equation following the values of $(L_1/L)^3$ and $[(1-\theta)^{1/3}]$ evaluated from Tables 1, 2 and 3 as a result of corresponding computational analysis.

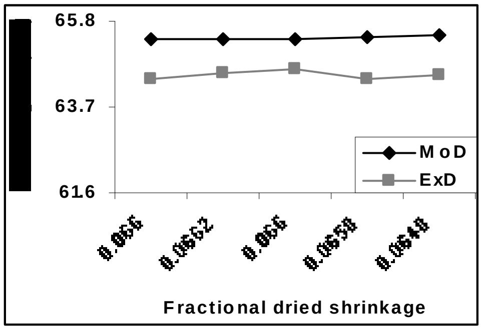

Figure 1: Comparison of the dried lengths L_1 as obtained from experiment (Nwoye,2009) and derived model. (Olokoro clay)

Figures 1, 2 and 3 show a comparison of the dried length L_1 in relation to the fractional dried shrinkage as obtained from experiment (Nwoye,2009) and as predicted by derived model. These figures show very close alignment of the curves from model-predicted values of dried length (line MoD) and that from the corresponding experimental values (line ExD).The degree of alignment of these curves is indicative of the proximate agreement between both experimental and model-predicted dried length.

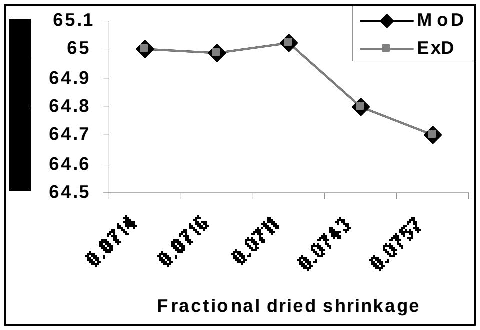

Figure 2: Comparison of the dried lengths L_1 as obtained from experiment (Nwoye,2009) and derived model. (Ukpor clay)

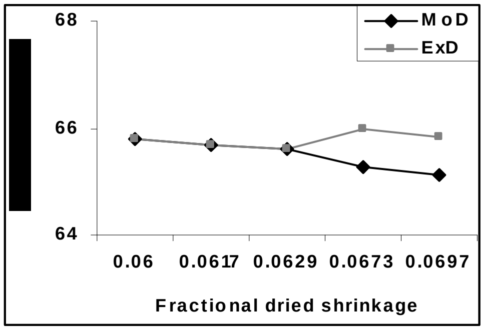

Figure 3: Comparison of the dried lengths L_1 as obtained from experiment (Nwoye,2009) and derived model. (Otamiri clay)

Table 8: Variation of model-predicted L_1 with its associated deviation and correction factor (Olokoro Clay)

L_{1M}	Dv (%)	Cf (%)
65.38	+1.52	-1.52
65.37	+1.32	-1.32
65.38	+1.16	-1.16
65.39	+1.57	-1.57
65.46	+1.50	-1.50

Table 9: Variation of model-predicted L_1 with its associated deviation and correction factor (Ukpor Clay)

L_{1M}	Dv (%)	Cf (%)
65.0012	+0.0018	-0.0018
64.9877	-0.0035	+0.0035
65.0228	+0.0043	-0.0043
64.8003	+0.0005	-0.0005
64.7022	+0.0034	-0.0034

Table 10: Variation of model-predicted L_1 with its associated deviation and correction factor (Otamiri Clay)

L_{1M}	Dv (%)	Cf (%)
65.8004	+0.0060	-0.0060
65.6814	+0.0021	-0.0021
65.5965	-0.0053	+0.0053
65.2895	-1.0615	+1.0615
65.1281	-1.0512	+1.0512

Analysis and comparison between the L_1 values reveal deviations of model-predicted L_1 from those of the experimental values. This is believed to be due to the fact that the surface properties of the clay and the physiochemical interactions between the clay and binder, which were expected to have played vital role during the evaporation of water were not considered during the model formulation. This necessitated the introduction of correction factor, to bring the model-predicted L_1 value to that of the corresponding experimental value.

Deviation (Dv) (%) of model-predicted values of L_1 from the experimental values is given by

$$Dv = \left(\frac{L_{1M} - L_{1exp}}{L_{1exp}}\right) \times 100 \qquad (23)$$

Correction factor (Cf) is the negative of the deviation i.e

$$Cf = -Dv \qquad (24)$$

Therefore

$$Cf = -100 \left(\frac{L_{1M} - L_{1exp}}{L_{1exp}}\right) \qquad (25)$$

Where

L_{1M} = Model-Predicted dried length (mm)
L_{1exp}= Dried length obtained from experiment (Nwoye, 2009) (mm)

Introduction of the value of Cf from equation (25) into the model gives exactly the corresponding experimental L_1 value.

Tables 8, 9 and 10 show that the maximum deviation of the model-predicted dried length L_1 from the corresponding experimental values is less than 2% which is within the acceptable range of deviation limit for experimental results.

Conclusion

The model computes and predicts the dried length L_1 during drying of clay. The model-predicted dried length L_1 is dependent on the values of the initial length and dried shrinkage. The validity of the model was found to be rooted on the expression $(L_1/L)^3 = [-\gamma^3+3\gamma^2 - 3\gamma + 1]$ where both sides of the expression are correspondingly almost equal to 0.8. The maximum deviation of the model-predicted dried length L_1 from the corresponding experimental values is less than 2% which is within the acceptable range of deviation limit for experimental results. The cube of the ratio of dried length to initial length is equal to 1-fractional volume shrinkage due to drying.

Correspondence to:

Dr. Chukwuka Ikechukwu Nwoye
Department of Materials and Metallurgical
Engineering, Nnamdi Azikiwe University P.M.B
5025, Awka, Anambra State, Nigeria.
Cellular phone: +234 0806 800 6092
Email: chikeyn@yahoo.com

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5/5/2010

Technical Report

Systematic Assessment of the Effect of Quantity of Supplied Electricity on the Solution pH during Electro-extraction of Iron from Haematite

Chukwuka I. Nwoye[1]* Ihuoma E. Mbuka[2] and Joseph O. Kalu[2]

[1]Department of Materials and Metallurgical Engineering, Nnamdi Azikiwe University Awka, Nigeria.
[2]Department of Materials and Metallurgical Engineering, Federal University of Technology, Owerri, Nigeria.
chikeyn@yahoo.com

Abstract: Attempt has been made to assess the effect of the quantity of supplied electricity on the solution pH during electro-extraction of metal iron from the ore concentrate. The results of the investigation reveal that the pH of the electrolyte during the electrolytic process increases with increase in the mass of Fe deposited at the cathode as a result of the simultaneous liberation (at the anode) of chlorine gas (acidic) which forms part of the electrolyte. Increase in the quantity of electricity supplied for the electrolytic process increases the pH of the electrolyte since increased supply of electricity for the process translates to increased concentrations of ions migrating to the electrodes. The initial pH of the electrolyte drops at the beginning of the process as a result of the addition of the iron oxide ore. This is attributed to the physiochemical interaction between the ore and electrolyte. At constant process time and voltage, increase in the current supplied increases the mass of Fe deposited on the cathode. [Academia Arena, 2010;2(7):7-10] (ISSN 1553-992X).

Keywords: Assessment, Supplied Electricity, Solution pH, Electro-extraction, Iron, Haematite.

1. Introduction

Electro-winning is the oldest industrial electrolytic process. Sodium metal has been obtained in elemental form for the first time in 1876 by electrolysis of molten sodium hydroxide (Conway and White, 1983).

Several studies on leaching have shown that the solution pH influences the leaching out of metals and other elements from its ore.

Panias et al. (1996) reported that the optimum pH for dissolving iron oxide is pH 2.5 – 3.0. The solution pH governs the distribution of various oxalate ions in the leach system.

Nwoye et al. (2008) derived a model which predicted that the concentration of phosphorus removed is dependent on the final pH of the leaching solution and weight input of the iron oxide ore. The model indicates that the concentration of phosphorus removed is inversely proportional to the product of the weight input of the iron oxide ore and the final pH of the leaching solution.

Nwoye (2008a) predicted that the concentration of haematite dissolved during the leaching process is directly proportional to the final pH of the leaching solution and inversely proportional to the weight input of the iron oxide ore.

Nwoye (2008b) derived a model for evaluating the final pH of the leaching solution during leaching of iron oxide ore in oxalic acid solution. The model evaluates the pH value as the sum of two parts, involving the % concentrations of Fe and Fe_2O_3 dissolved. It was also found that the model (Nwoye, 2008b) could predict the concentration of Fe or Fe_2O_3 dissolved in the oxalic acid solution at a particular final solution pH by taking Fe or Fe_2O_3 as the subject formula. The prevailing process conditions under which the model works include: leaching time of 30mins., constant leaching temperature of 30°C, average ore grain size; 150µm and 0.1M oxalic acid.

Nwoye (2009) reported that the concentration of phosphorus dissolved in oxalic acid is dependent on the final pH of the leaching solution during leaching of iron oxide ore in oxalic acid solution.

The present work is an attempt to extract iron from its ore using electrolytic method. In this work, the cathode and anode electrodes used are carbon rods (graphite) and the electrolyte, aqua ragae which is a combination of hydrochloric and nitric acid.

2. Materials and Methods

86 cm^3 of 4M hydrochloric acid (HCl) and 64 cm^3 of 4M nitric acid were measured out giving volumes of 344cm^3 and 256cm3 respectively. Each of the two solutions was made up to 1000cm^3 by addition of distilled water. The two solutions were poured into the electrolytic cell box and the initial pH; 1.75, taken using the pH meter (at the Materials Laboratory of Federal University of Technology, Owerri) before current is supplied to the system. The connecting cables were passed through a rheostat and voltmeter to measure the current flow.

Weighed quantity (30g) of Itakpe iron ore concentrate (as received from National Metallurgical Centre (NMC) Jos) was poured into the aqua raegae electrolyte and thoroughly mixed. A current of 0.042A and 9.5V was allowed to pass through the set-up for 5 minutes after which the cathode electrode was removed and weighed to determine the mass of iron deposited. This was repeated for process duration of 10, 15, 20, 25 and 30 minutes respectively. At these process durations highlighted, the pH of the electrolyte was also taken to know how the current supply affects the solution pH.

3. Results and Discussion

The as-received concentrate used for this work was analyzed chemically to determine the chemical composition of the various elements and compounds present. The result is presented in Table 1.

Table 1: Chemical composition of the iron concentrate used

Element/Compound	%Composition
SiO_2	17.38
P_2O_5	0.38
Al_2O_3	8.93
CaO	0.36
MgO	0.06
Fe	63.0
Na_2O	3.60
K_2O	4.20
TiO_2	0.40

In order to understand the effect of quantity of supplied current on the solution pH, the whole electrolytic system was set-up and run at constant voltage of 9.5V and varied current values of 0.02, 0.04, 0.06, 0.08, and 0.1A for 10minutes process duration respectively. The initial pH of the electrolyte was also maintained at 1.75. Also the pH of the electrolyte was taken for each variation in supplied current.

Following faradays first law of electrolysis (Obi, 1998)

$$Q = It \qquad (1)$$

Where

Q = Quantity of electricity (C)
I = Current (A
t = Time of flow of current (s)

At constant current flow and voltage while process time varies (up to 1800s), the pH of the electrolyte during the electrolytic process increases with increase in the mass of Fe deposited on the cathode as shown in Figure 1.

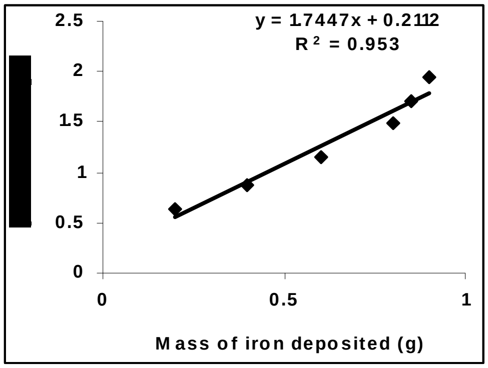

Figure 1: Variation of pH of electrolyte with mass of Fe deposited (at constant current flow and voltage)

It was also observed that increase in the quantity of electricity Q (supplied for the process) increases the pH of the electrolyte. This is shown in Figure 2. This is believed to be correct since increase in the quantity of electricity supplied increases the mass of Fe deposited. This is in agreement with Faradays law (Obi, 1998).

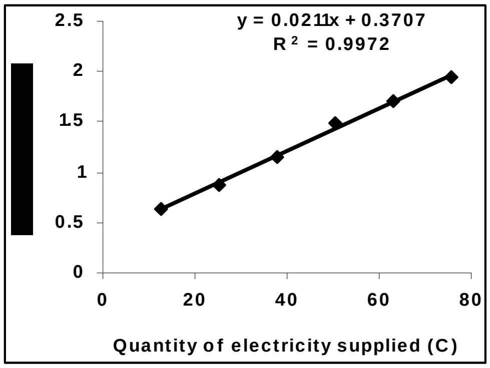

Figure 2: Variation of pH of electrolyte with quantity of electricity supplied (at constant current flow and voltage)

At constant process time and voltage, Figures 3 and 4 shows also that during the electrolytic process, pH of the electrolyte increases with increase in the mass of Fe deposited on the cathode and quantity of electricity supplied respectively. The associated correlation coefficients R are 0.9967 and 0.9989 respectively.

Equation (1) shows that quantity of electricity supplied Q is directly proportional and a function of current supplied I. Based on the foregoing, Figures 5 and 6 shows that increase in the supplied current increases the pH of the electrolyte as well as the mass of Fe deposited. This is because increase in the quantity of electricity Q (supplied for the process) increases the pH of the electrolyte as shown in Figures 2 and 4. The correlation coefficients R associated with Figures 5 and 6 are 0.9934 and 0.9989 respectively. The correlation coefficients of Figures 4 and 6 are the same but the curve gradient of Figure 6 (20.9) is greater than that of Figure 4 (0.0348). Furthermore, the intercept on the Y-axis (0.038) is the same for Figures 4 and 6. This also indicate that both current and quantity of electricity supplied affect the pH of the electrolyte the similarly.

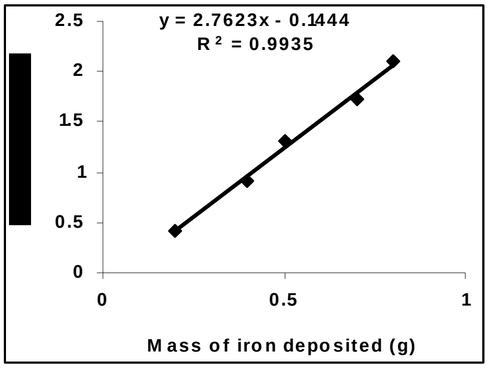

Figure 3: Variation of pH of electrolyte with mass of Fe deposited (at constant process time and voltage)

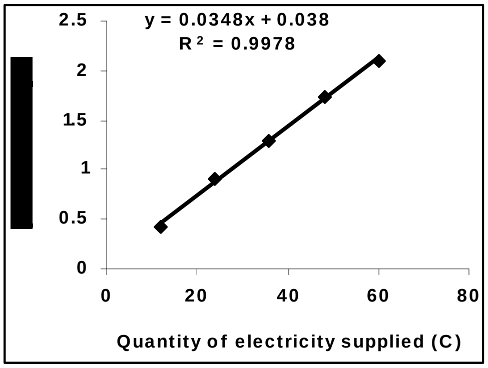

Figure 4: Variation of pH of electrolyte with quantity of electricity supplied (at constant process time and voltage)

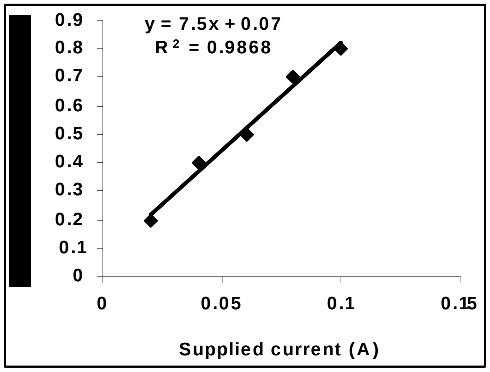

Figure 5: Variation of mass of Fe deposited with supplied current (at constant process time and voltage)

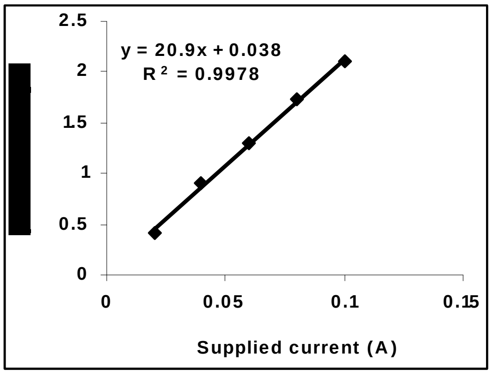

Figure 6: Variation of pH of electrolyte with supplied current (at constant process time and voltage)

Considering that the initial pH of electrolyte before the addition of the ore was 1.75, the pH dropped to lower values at the beginning of the electrolytic process and then increased. The lower pH values obtained at the inception of the process is attributed to the physiochemical interaction between the ore and electrolyte at contact. The increase in the pH of the electrolyte as the mass of Fe deposited increases (Figures 1 and 3) indicate decrease in acidity. This is attributed to the liberation of chlorine gas at the anode, considering the possibility of Cl^- being preferentially discharged eventhough both Cl^- and NO_3^- migrated to the anode. Based on the foregoing, Cl^- loses an electron at the anode to become electrically neutral Cl atom which pairs up to form chlorine molecules; gas. The anodic reaction gives;

$$Cl^- (aq) \longrightarrow Cl + e^- \qquad (2)$$

$$Cl + Cl \longrightarrow Cl_2 \qquad (3)$$

It is believed that since chlorine is part of the electrolyte (HCl) which is acidic, its liberation from the electrolyte decreases the acidity which translates into increases in the pH of the electrolyte.

Similarly Fe is deposited at the cathode as a result of the preferential discharge of Fe^{2+} in place of H^+ at the cathode. Fe^{2+} on being discharged at the cathode gains two electrons and become electrical neutral Fe atom which is then deposited on the cathode. The cathodic reaction gives;

$$Fe^{2+} (aq) + 2e^- \longrightarrow Fe (s) \qquad (4)$$

4. Conclusion

Based on the electrolytic extraction of Fe (from its ore) carried out, the following conclusions have been drawn. (1) The pH of the electrolyte during the electrolytic process increases with increase in the mass of Fe deposited at the cathode as a result of the simultaneous liberation of chlorine gas (acidic) which forms part of the electrolyte.

(2) Increase in the quantity of electricity supplied for the electrolytic process increases the pH of the electrolyte since increased supply of electricity for the process translates to increased concentrations of ions migrating to the electrodes.

(3) The initial pH of the electrolyte drops at the beginning of the process as a result of the addition of the iron oxide ore. This is attributed to the physiochemical interaction between the ore and electrolyte.

(4) At constant process time and voltage increase in the current supplied increases the mass of Fe deposited on the cathode

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Correspondence to:
Dr. Chukwuka Ikechukwu Nwoye
Department of Materials and Metallurgical
Engineering, Nnamdi Azikiwe University, P.M.B
5025 Awka, Anambra State, Nigeria.
Cellular phone: 0803 800 6092
Email: chikeyn@yahoo.com

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05/28/2010

Standardization of extraction of genomic DNA and PCR-RFLP conditions of *Allium stracheyi*: A high altitude plant

Shashi Ranjan[1] Garima Kishore[1], Vikash S Jadon [1], JP Bhatt [2] and Sanjay Gupta[1]

[1]Department of Biotechnology, SBS PG Institute of Biomedical Sciences & Research, Balawala, Dehradun, Uttarakhand, India
[2] Department of Zoology and Biotechnology, HNB Garhwal University, Srinagar, Uttarakhand, India
*Corresponding Author E-mail: shashiranjan16@gmail.com

Abstract

DNA extraction is difficult in many plants because of metabolites that interfere with DNA isolation procedures and subsequent applications such as DNA restriction, amplification and cloning. We developed a simple, rapid and efficient method for isolating genomic DNA from seeds of *Allium stracheyi* that is free from polysaccharides and polyphenols. This newly developed protocol include the use of 2.5 M NaCl, 3% polyvinylpyrrolidone (PVP), 3% mercaptoethanol, 0.15% sodium sulfite, and 80% ethanol in the extraction as well as reducing the centrifugation times during the separation and precipitation of the DNA. Isolated genomic DNA showed high purity and high quantity. The purity of isolated genomic DNA was confirmed by biophotometric analyses ($A_{260/280}$ of 1.840). [Academia Arena, 2010;2(7):11-14] (ISSN 1553-992X).

Key words: DNA isolation, *Allium stracheyi,* Secondary metabolites, Seeds & Polyphenols.

Introduction

Allium stracheyi (Jambu) is a perennial herb, flowers are white in color about 35-40 centimeters in height and is traditionally being used by the local people as spice for flavoring. It is mainly found at the height of 2500-3000 meters of Alpine Himalayas of Uttarakhand, India near moist rock, dry rock and steep slope with a strong preference of sunny site. Edible plant part used includes flowers, leaves, root and bulb. In the genetic improvement process, it is desirable to use molecular markers for screening of accessions, choosing of parents and selection of progeny. The presence of certain metabolites can hamper the DNA isolation procedures and reactions such as DNA restriction, amplification and cloning. Problems encountered in the isolation and purification of high molecular weight genomic DNA from seeds comprise: co-isolation of highly viscous polysaccharides, and inhibitor compounds like polyphenols and other secondary metabolites which directly or indirectly interfere with the further enzymatic reactions (Weishing *et al*., 1995). The presence of polyphenols, which are powerful oxidising agents present in many plant species, can reduce the yield and purity of extracted DNA (Porebski *et al*., 1997). The use of β-mercaptoethanol, ascorbic acid, bovine serum albumin (BSA), sodium azide, and polyvinylpyrrolidone (PVP) (Dawson and Magee, 1995; Clark, 1997). Phenol extractions coupled with SDS are also helpful. However, SDS-phenol tends to produce low DNA yields of plants rich in polyphenolics.

Plant species belonging to the same or related genera can exhibit enormous variability in the complexity of pathways of dispensable functions. Thus, the biochemical composition in plant tissues of different species is expected to vary considerably. The chemotypic heterogeneity among species may not permit optimal DNA yields from one isolation protocol, and perhaps even closely related species may require different isolation protocols (Weishing *et al*., 1995). Most of the protocols recommend isolation of DNA from fresh tissues, but it is also required to isolate DNA from seeds. These situations imposed the development of the protocols for isolating DNA from different plant organs, including dry tissues and seeds. In addition to this, from the previously recommended protocols we could not recover a reasonable amount of purified, digestible genomic DNA. The seeds of *Allium stracheyi* are considered to be difficult for DNA isolation due to its high polyphenolic content and cold temperature at high altitude (3000 m). Here we described a rapid DNA isolation protocol that can be used for isolation of DNA from leaves of *Allium stracheyi* collected from thirteen different landraces varied in their altitudes of Uttarakhand, India. However, to the best of our knowledge, no such studies have been performed previously on *Allium stracheyi* seeds of high altitude.

Materials and Methods

We performed several experiments before finding one that yielded a good amount of genomic DNA from seeds of *Allium stracheyi*. A number of experiments were set up to close down the polysaccharide contamination of the DNA by using sodium chloride (concentrations 1.0- 3.0 M) and polyphenols. For removing the polyphenol content from the isolated genomic DNA we used β-mercaptoethanol (2-5%), PVP (2-6%) and sodium sulfite (0.06-0.16%). An optimized protocol was design on the basis of results obtained from the above experiments.

Plant materials for DNA isolation

The seeds of *Allium stracheyi,* which were collected from thirteen different altitudes of Uttarakhand, India, during October-November 2009. Immediately after collection, the leaves and seed were stored at 4ºC till the start of experiments. Before extraction, the seeds were washed with autoclaved distilled water. Specimens of seed samples were submitted in the National Bureau of Plant Genetic Resources (NBPGR), Pusa Campus, New Delhi. The taxonomic identification of these specimens was performed and the accession no. is IC-56745.

Reagents and chemicals

- Extraction buffer: 100 mM Tris-HCl (pH 8.0), 25 mM EDTA, 2.5 M NaCl, 2.5% CTAB, 3.0 % β-mercaptoethanol (v/v) (added immediately before use) and 3% PVP (w/v) (added immediately before use)), 0.15% sodium sulfite.
- High salt TE buffer: 1 M NaCl, 10 mM Tris-Cl (pH 8.0) and 1 mM EDTA.
- TE buffer : 10 mM Tris-HCl (pH 8) and 1 mM EDTA (pH 8).
- Enzymes: Alu I and *Taq* DNA Polymerase (Genei, India).
- Buffers: Alu I buffer and *Taq* DNApolymerase buffer (Genei, India).
- Nucleotides: dNTPs (G, A, T, C) and primers (Genei, India).

DNA isolation and purification

Five hundred mg of seed samples was weighed and placed on a precooled mortar. Liquid nitrogen was poured onto the sample and allowed to evaporate completely. The seeds were macerated into fine powder with a pestle and added to 5 ml of preheated (60°C) extraction buffer. The mixture was incubated for 1 ½ h at 60°C, with constant shaking at intervals followed by cooling at room temperature (RT) with gentle shaking. An equal volume of chloroform-isoamylalcohol (24:1) was added to the mixture. The tubes were mixed gently at RT for 15 min to produce a uniform emulsion. The emulsion was centrifuged at 10, 000 rpm for 15 min at 4°C.

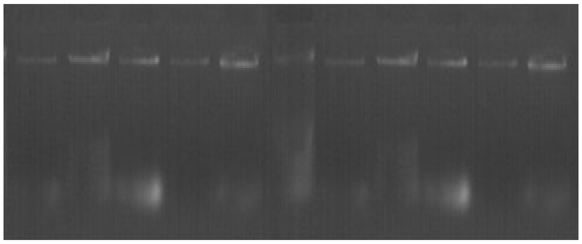

Fig. 1: Showing Bands of genomic DNA

The upper aqueous layer was separated and collected into a fresh tube. A second chloroform-isoamylalcohol extraction was performed. The supernatant was carefully decanted and transferred to a new tube and then precipitated with chilled 2/3 volume of isopropanol. The precipitated nucleic acids were collected and washed twice with the buffer (80% ethanol; 10 mM ammonium acetate; TE: 1 mM Tris and 0.1 mM EDTA [pH 8]). The pellets were washed twice with 70% ethanol followed by centrifugation at 4ºC and 10,000 rpm for 10 min. Finally, pellets were air dried and resuspended in TE buffer. The dissolved nucleic acids were brought to 2.5 M NaCl and reprecipitated by using 2 vol of 70% ethanol. The pellets were washed twice with 80% ethanol, dried, and resuspended in 100 μL of TE buffer. The tube was incubated at 40°C for 10 min to dissolve genomic DNA, and RNase treatment was followed.

Quantification of Genomic DNA

The DNA yield per microgram of seed samples was measured by using a Biophotometer (Eppenndorf) at 260 nm. DNA purity was determined by calculating the absorbance ratio A260/280. Pure DNA has a ratio of 1.8 ± 0.1 (Clark, 1997). The DNA sample was also quantified on 0.8% agarose gel electrophoresis.

PCR amplification

Polymerase chain reactions (PCRs) for amplification of DNA preparations were carried out in a 25 μl reaction volume. A reaction tube contained 100 ng of template DNA, 1× PCR buffer, 1 units of *Taq* DNA polymerase, 50mM each of dNTPs, 3 mM $MgCl_2$ and 5 pmol of decanucleotide primers. The amplifications were carried out using PCR thermal cycler (Eppendrof, Germany). Initial denaturation was for 3 min at 94ºC followed by 35 cycles of 3 min at 94ºC, 2 min at 54ºC, 3 min at 72 ºC, and a 10 min final extension step at 72ºC. The success each PCR reaction was verified by electrophoresis. The amplified products were loaded in a 1.2% agarose gel containing 5 mg ml−1 of ethidium bromide. Custom decanucleotide primers were synthesised from M/S Bangalore Genie, India. The primer had the following sequences:

Forward primer
5'- CGAAATCGGTAGACGCTACG - 3'
Reverse primer
5'- GGGGATAGGGACTTGAACGG- 3'

Results and Discussion

The plants that are sources of natural products or bio-active substances also produce large amounts of secondary metabolites and valuable for human being. Thus, while working with a seed samples enriched with secondary metabolites it is common to encounter problems arising from the polysaccharides, polyphenols and other secondary metabolites in the lysate and the DNA preparations. The secondary compounds may hamper DNA isolation as well as any further reaction to be carried out on DNA preparations for example; restriction enzymes may be inhibited because of the presence of unusual substances.

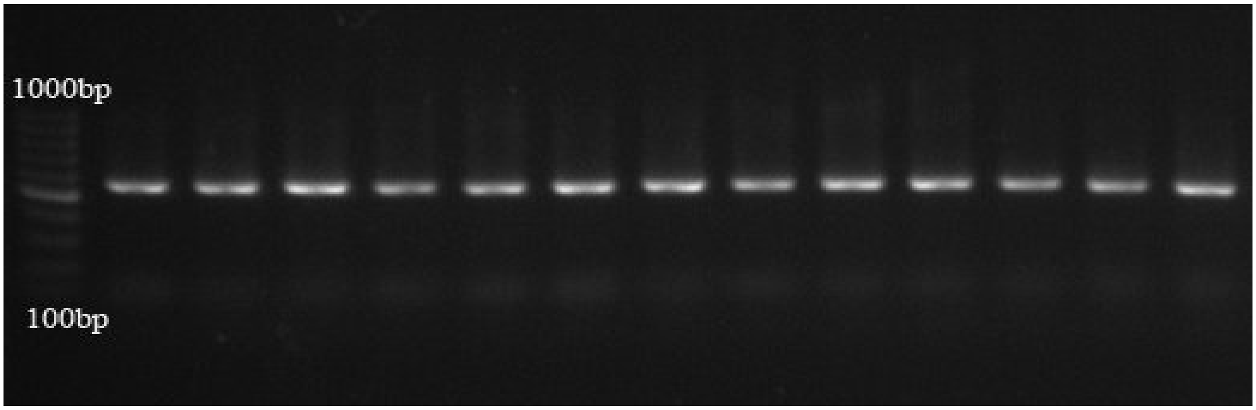

Fig 2: Showing amplified bands from seeds of *Allium stracheyi* using PCR-RFLP primer

In our experiments we encountered difficulties from the stage of cell lysis to DNA separation in the supernatant and subsequent reactions when following the procedures described by Doyle and Doyle (1990), Murray and Thompson (1980), Dellaporta *et al.* (1983) and Porebski *et al.* (1997). Major problems encountered were low DNA yield or poor PCR amplification reactions and restriction endonuclease digestion. Our protocol involves several modifications with one parameter tested at a time to address the problem of phenolics. Modifications included use of different concentrations of β-mercaptoethanol (2-5%), use of PVP at different concentrations (2-6%), and use of sodium sulfite (0.06%, 0.17%). Use of 4% β-mercaptoethanol, 3% PVP and 0.15% sodium sulfite was found to be most appropriate.

Highly purified genomic DNA was obtained when the optimised protocol described in "Materials and Methods" was used. A sufficient amount of clean genomic DNA was obtained with this method (Figure 1). The yield was ranged from 20-50 µg per gram of seed material collected from different locations. The A260/230 nm ratio was 1.826, while the A260/280 nm ratio was 1.840. Our protocol involves isopropanol precipitation of DNA initially at room temperature. Moreover, the procedure also eliminates the necessity of phenol, which makes the method less hazardous. Further, the addition of high concentration of PVP and β-mercaptoethanol were helpful in removing the polyphenols from the seeds of *Allium stracheyi*. The problem arising from the presence of high levels of polysaccharides was overcome by using NaCl at a higher concentration. The use of sodium sulfite is also recommended to prevent oxidation (Aljanabi *et al.*, 1999), it was included in the extraction buffer but at a (Mr 10000), DNA free from phenolics. The amplified product is having molecular weight of around 515 base pair to 605 base pair.

This protocol provides good quality of genomic DNA from the seeds of *Allium stracheyi*, which was not, reported earlier. The secondary metabolites, when isolated along with the DNA, do inhibit PCR amplification and restriction digestion.

This indicated that the isolated DNA was amenable to further processing in cloning experiments as well as DNA finger printing. The method described here for the extraction of genomic DNA will be useful for molecular, genetic diversity, and transgenic studies in *Allium stracheyi*. The utility of the isolated DNA for use in DNA finger printing was demonstrated with several random primers. Thus the method is simple rapid and less hazardous.

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6/1/2010

Antimicrobial potentials of some spices on beef sold in Gwagwalada market, FCT, Abuja

Agarry Olubunmi Olaitan*, Ugoh Sylvanus Chukwudi andYusuf Abeku Margaret

Department of Biological Sciences, University of Abuja, Nigeria

Corresponding author: oluagarry@yahoo.com

Abstract: Studies on the antimicrobial activities of some spices on beef sold in Gwagwalada market, F.C.T, Abuja were carried out. The spices were chopped to sizes and were mixed with the beef sample. The bacterial load count of the beef sample before treatment is 1.9×10^7 and after treatment were $1.5 \times 10^{3,}$ 1.6×10^3 and 1.0×10^3 cfu/ml for thyme bayleaf, and garlic while the fungal spore count of beef sample before treatment is 1.0×10^2 and $x0.510^{2,}$ 0.1×10^2, 0.6×10^2 for the thyme, bayleaf and garlic respectively. The fungal spore count for the beef and sample after treatment with the spices combined is 0.1×10^1cfu/ml. The microbial isolates of beef sample include: *Staphylococcus aureus, Pseudomonas* sp., *Proteus* sp. and *Bacillus* sp. for bacterial isolates and fungal isolates were *Aspergillus niger*, *Mucor* sp., *Rhizopus* sp. and *Aspergillus flavus* the combined effect of the three spices inhibited the growth of *S. aureus*, *Bacillus* sp., *Proteus* sp,, *A. flavus* and *Mucor* sp. [Academia Arena, 2010;2(7):15-17] (ISSN 1553-992X).

Keywords: Antimicrobial agents, spices, meat

INTRODUCTION

Spices are strongly flavoured parts of plants usually rich in essential oils used in fresh or dry forms (Iwu, 1993) .Some spices are reported to have bactericidal or bacteriostatic activities (Onwuliri and Wonang, 2005). The inhibitory effects of spices are mostly due to the volatile oils present in their composition (Arora-Daljit and Kaur, 1997), factors that determine the antimicrobial activity of spices are the concentration and composition of the spices, the amount of spices used, type of microorganisms, composition of the food, P^H value, temperature of the environment and proteins, lipids, salts and phenolic substances present in the food (Sagdic, 2003).

Bayleaf is the dried leaf of *cinnamon jamale*. It is a medium sized tree which grows in many parts of India, more likely in Khasi hills. The leaves are commonly used as a spice for flavouring various kinds of curries, some sweet preparation of vegetables, fruits and in food preservation. Bayleaf is used as medicines (Chandarana *et al.*, 2005).

Thyme (*thyme vulgaries*) belongs to the family laminaceae. The oil of thyme is important and is obtained by distillation of the fresh leaves and flowering tops of *thyme vulgaris*. Its chief constituents are from 20-25% of phenols, thymol and carvacol. They are valuable for medicinal purposes (Juven *et al.*, 1994). Thyme has a partial or complete anti-flatulence, anti-phlegmasia effect in addition to regulating digestion. Thyme is enemy of poison. It is antispasm and pain. It eases blood flow and invokes sexual activities and promotes consciousness and intelligence (Muhammad and Ali, 2006).

Garlic (*Allium sativum*) is a perennial plant of the family of Alliaceae. Garlic is widely used in many forms of cooking for its strong flavour when crushed or finely chopped. It yields allicin - a powerful antibiotic (Prescott *et al.*, 2008), it also contains Allin, Ajoene, enzymes, vitamin B, minerals and flavonoids. Garlic consists of not less than 200 components, these include antioxidants, the volatile oils, (allin, allicin and ajoene) consisting of sulfur, enzymes (allinase, peroxidase and miracynase), carbohydrates (sucrose, glucose), mineral (germanium, selenium, Zinc), amino acids like cysteine, glutamine isoleucine and methionine, bi-flavonoids like quercetin and cyanidin and allistatin I and II,C,E and A vitamins and niacin, B_1,B_2 vitamins and beta carotene (Gulsen and Erol, 2010).

Meat is a highly perishable food items, the high perishability is due to high temperature (Buchanan, 1986). Meat is frequently involved in food- borne illnesses because they provide ideal media for the growth of disease – causing microorganisms (Pearson and Dutson, 1986). Ouattara *et al.*, 1997 stated that essential oils from plant products that contain carvacrol and eugenol have been shown to exhibit the strongest antimicrobial activity (Prescott *et al.*, 2008). This study therefore aims at isolation and identification of microorganisms associated with meat spoilage and to evaluate the potency and the inhibitory effects of spices as preservative agents.

MATERIALS AND METHODS

Collection of samples

The spices used (garlic, thyme and bayleaf) and beef were purchased from Gwagwalada main market, F.C.T Abuja in sterile containers and conveyed to the laboratory for microbial analysis.

Determination of antimicrobial activity

The spices were not grinded or blended mechanically according to the standard method of the American Spices Trade Association (ASTA, 1997) to avoid contamination of samples. The beef sample was divided into two halves, one half was analyzed for associated microflora and the other half was analyzed combined with the spices. About 0.2g of each spice was mixed with 1.8g of beef in sterile beakers while three spices (0.2g each) were combined with the beef (1.8g) in another beaker sealed and left for 15 minutes. The resultant stock was thereafter pipetted and used for the microbial analyses. All preparations were carried out under aseptic condition. The plates were incubated for 24-48hours for bacterial isolates and 72 hours for fungal isolates. The colonies were counted with the aid of colony counter. MacConkey and Nutrient agar were used for bacterial isolates and Sabrauds Dextrose Agar (SDA) for the fungal isolates. The number of isolates were expressed as colony forming unit per ml. The morphological, microscopical and biochemical characterization of isolates were determined.

RESULTS AND DISCUSSIONS

The bacterial load count (cfu/g) of beef sample before treatment is $1.9\times10^7$and after treatment were 1.0×10^3, 1.5×10^3,1.6×10^3 for garlic, thyme and bayleaf respectively (table 1).

Table 1: The Bacterial load count of beef sample (cfu/g)

	Garlic with beef	Thyme with beef	Bayleaf with beef
Before treatment	1.9×10^7	1.9×10^7	1.9×10^7
After treatment	1.0×10^3	1.6×10^3	1.6×10^3

The fungal spore count of beef sample before treatment was 1.0×10^2 and after treatment were 0.5×10^2, 0.1×10^2 and 0.6×10^2 for thyme, bayleaf and garlic respectively (table 2). The fungal spore count for the beef sample after treatment with the spices combined was 0.1×10^1.

The microbial isolates of beef sample include:- *Staphylococcus aureus*, *Pseudomonas* spp, *Proteus* spp, and *Bacillus* spp for bacterial isolates and the fungal isolate were *Asperglllus niger, Mucor* spp, *Rhizopus* spp and *Aspergillus flavus*/

Garlic inhibited the growth of *Bacillus* spp, *A. flavus, S. aureus, proteus* spp and *Rhizopus* spp in the beef sample (table 3). This was not in agreement with the report of Yin and Tsao, 1999 who reported the non availability of antifungal effect of garlic extracts on *A. niger and A.flavus*, but in this study garlic inhibited *A. flavus* but not *A. nigerBacillus* spp, *Proteus* spp and *Rhizopus* spp and thyme inhibited the growth of *S. aureus, Bacillus* spp, *Proteus* spp, *Rhizopus* spp, *Mucor* spp and *A. niger*. (table 3)

Table 2: The fungal spore count of beef sample (cfu/g).

	Garlic with beef	Thyme with beef	Bayleaf with beef
Before treatment	1.0×10^2	1.0×10^2	1.0×10^2
After treatment	0.5×10^2	0.1×10^2	0.6×10^2

This result was in agreement with the work of Muhammad and Ali, (2006) who reported the antimicrobial activity of thyme on *S. aureus, Salmonella* spp, *Escherichia coli*, *Shigella sp* and *Helicobacter pylori* that has been implicated to course gastric ulcer.

Bayleaf inhibited the growth of *Bacillus* spp, *Pseudomonas* spp, *A. niger*, *A. flavus* and *Rhizopus* spp (table 3).

Table 3: Inhibition of Microorganisms by Spices

Treatment	Organisms inhibited
Beef treated with garlic	*Bacillus* spp, *A.flavus, S.aureus, Proteus,Rhizopus* spp
Beef treated with thyme	*S.aureus, Bacillus* spp,*Proteus* spp, *Rhizopus* spp, *Mucor* spp, *A. niger*
Beef treated Bayleaf	*Bacillus* spp, *Pseudomonas* spp, *A.niger, A. flavus, Rhizopus* spp,
Beef treated with the three spices combined	*S.aureus, Bacillus* spp, *Proteus* spp, *A. flavus, Mucor* spp

The synergic effect of the three spices inhibited the growth of *S. aureus, Bacillus* spp, *Proteus* spp, *A. flavus* and *Mucor* spp.

The combined the effect of the spices was not as effective as would have been expected. This could be as a result of the interactions of the biochemical compounds of these spices.

Beef contamination begins immediately after the slaughter of the animal. This is due to poor hygienic procedure adopted in slaughter and cutting of beef when sold which serves as a medium for transfer of microbes. *Bacillus* spp as isolated in this study are capable of producing enterotoxins in food during their growth and multiplication, thus they cause abdominal cramps, nausea, vomiting and diarrhea. *S. aureus* is a well known pathogen and has been incriminated in many food poisoning cases (Prescott *et al.*, 2008). Garlic inhibited the growth of *Bacillus* spp, *A flavus*, *Proteus* spp and *Rhizopus* spp and this is in agreement with the work of Onwuliri and Wonang, 2005, An *et al.,* 2009, Ayaz and Alpsy, 2007, although they reported on *A.niger* instead of *A.flavus*. Zaika, 1988 reported the antimicrobial activity of thyme and bayleaf and Onwuliri and Wonang, 2005 on garlic which are in agreement with this study.

From this study it being reported for the first time that *A. flavus* was isolated from meat sample. This calls for caution in the handling of meat for human consumption because *A.flavus* has been incriminated as a producer of mycotoxins which have been reported to be carcinogenic.

Correspondence to:
Agarry Olubunmi Olaitan
Department of Biological Sciences,
University of Abuja, Nigeria
Telephone: +234-807-8160565
Email: oluagarry@yahoo.com

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Studies on the Pretreatment of wheat straw for improve production of Carboxymethyl Cellulase by thermophilic *Trichoderma viride*-FBL1 in Solid State fermentation

Muhammad Irfan[*a], Quratualain Syed[a], Muhammad Yousaf[b], [a] Muhammad Nadeem [a], Shahjhan Baig [a] and Saghir Ahmed Jafri[b]
[a]Food & Biotechnology Research Center, Pakistan Council of Scientific & Industrial Research (PCSIR) Laboratories Complex, Ferozpur Road Lahore, 54600- Pakistan.
[b]Institute of molecular Biology & Biotechnology, The University of Lahore, Pakistan.
[*a] (Corresponding Author, mirfanashraf@yahoo.com)

Abstract: Cellulases are important group of enzymes which are used for the conversion of lignocellulosic biomass into a variety of products. *Trichoderma viride*-FBL1 was employed for the production of CMCase enzyme in solid state fermentation using wheat straw as a substrate. The substrate was physico-chemically pretreated with different concentrations of HCl/NaOH to enhance the CMCase yield. 2% HCl for pretreatment of wheat straw was found suitable treatment for maximum enzyme yield. Various cultural conditions were also optimized and optimum parameters found were initial medium pH of 5, incubation temperature of 45°C, substrate level of 15g, initial moisture content of 40%, inoculum size of 5% for seven days of fermentation period. Various extractants such as distilled water, Tab water, Tween-81, 0.2M citrate buffer (pH 4.8) and 0.2M citrate-phosphate buffer (pH 5.0) was used to recover the enzyme from fermented mash and distilled water was found best extractant. The enzyme produced from *Trichoderma viride* show its optimum activity at pH 5 using citrate buffer with incubation time of 15min. [Academia Arena, 2010;2(7):18-30] (ISSN 1553-992X).

Key words: Wheat straw, Pretreatment, CMCase, Trichoderma viride, Solid state fermentation

Introduction

The major polysaccharides (cellulose and hemicellulose) present in the lignocellulosic biomass need to be hydrolyzed with acids or enzymes in order to liberate fermentable sugars (Camassola et al. 2009). In many processes in the enzymatic conversion of lignocellulose biomass to ethanol and other chemical products, a pretreatment stage is required to break the lignin structure and to partially solubilize the polysaccharides (Keller et al. 2003). Cellulose, a major polysaccharide constituent of plant cell walls, is a β-1, 4 linked linear polymer of 8000–12,000 glucose units (Saha 2004) whose natural degradation represents an important part of the carbon cycle within the biosphere. The ability to decompose the cellulosic biomass into glucose, which in turn can be converted into other valuable chemicals and energy (Mukataka et al. 1998) has made cellulases one of the most extensively investigated multicomponent enzyme systems. Cellulases are enzymes that degrade crystalline cellulose to glucose. Three types of cellulases, endoglucanases (EC 3.2.1.4, endo-1,4-β-D-glucanases), cellobiohydrolases (EC 3.2.1.91), and β-glucosidases (EC 3.2.1.21), are considered to be needed to degrade crystalline cellulose to glucose in vivo, and they act synergistically (Henrissat et al. 1985). Endoglucanases are produced by a wide variety of organisms like fungi (Wood 1992) bacteria (Beguin et al. 1992), plants (Ohmiya et al. 1995), and certain insects like termites (Inoue et al. 1997). Fungal endoglucanases are mostly important in the textile and detergent industries, many fungal endoglucanases from members of the subdivision Deuteromycotina, such as *Aspergillus* sp., *Fusarium* sp., *Humicola* sp., *Penicillium* sp., and *Trichoderma* sp., have been purified and characterized (Murashima et al. 2002). Among the cellulolytic fungi, Trichoderma and Aspergillus have been extensively studied particularly due to their ability to secrete cellulose-degrading enzymes (Adsul et al. 2007). Cellulases have been investigated mainly with respect to their industrial use for the bioconversion of agricultural biomass resources into useful products (George et al. 2001) and are commonly used in various industries, including food, brewery and wine, agriculture, textile, detergent, animal feed, starch processing, extraction of fruit and vegetable juices pulp and paper, as well as in research development (Jan and Chen 2003, Gao et al. 2008,Zhou et al. 2008).

Material and Methods

Lignocellulosic Biomass

Wheat straw was purchased from local market of Lahore city, Pakistan which was used as a substrate for the production of CMCase. The substrate was washed and oven dried at 65°C and then ground to powder form (2mm) by hammer beater mill.

Pretreatment of Substrate

Wheat straw samples (10g) were soaked in different concentration of NaOH and HCl ranging from 1-4% solution at the ratio of 1, 10 (solid, liquid) for 2hr at room temperature (Solomon et al.1999, Gharpuray et al. 1983). After then the samples were autoclaved at 121°C for 15 min. Then samples were filtered and solid residues were washed up to neutrality.

Microorganism

Trichoderma viridi- FBL1 was obtained from Fermentation Biotechnology Laboratory, PCSIR Labs. Complex Ferozpure road Lahore, and was used for the production of CMCase. It was maintained on PDA slants and revived biweekly.

Inoculum Preparation

Inoculum was prepared by adding sterilized distilled water into the 5-day old slant. With the help of inoculating loop the mycelia was mixed and one ml (2 x 10^8) of spore suspension was used as inoculum. Inoculum size was measured with heamacytometer as described by Sharma (1989).

Fermentation Methodology

Solid state fermentation was carried out for CMCase production using *Trichoderma viridi*-FBL1. In 250ml conical flask 5g of ground pretreated wheat straw was moistened with diluent (g/l, ammonium sulphate 10. Calcium chloride 0.5, Magnecium sulphate 0.5, Potassium dihydrogen phosphate 4) and then autoclaved at 121°C for 15 min. After sterilization the media was inoculated with 1ml of spore suspension and incubated at 30 ±1 °C.

Optimization of Initial Cultural conditions

Different cultural conditions like fermentation period (24, 48, 72, 96, 120, 144hr) initial medium pH (4,4.5, 5, 5.5, 6.0, 6.5, 7.0, 7.5 and 8.0) Temperature (25, 30, 35, 40, 45, 50°C) substrate concentration (5,10,15,20,25and30g) Inoculum size (5, 10,15,20,25,30%) moisture level (20, 40, 60, 80 and 100) were optimized for CMCase production using *Trichoderma viride*-FBL1.

Analytical Methods

Proximate Analysis of Substrate

Total carbohydrates were estimated by the method of Duboise et al. 1956. The moisture, ash contents of the substrate were determined by the methods of AOAC (2005). The lignin content in the biomass was estimated by the method of Milagres (1994). Cellulose was estimated by the methods described by Gopal and Ranjhan (1980).

Enzyme Recovery

CMCase from the fermented mash was extracted by simple contact method as reported by Krishna and Chandrasekaran (1996). In 5g substrate of flask 50ml of distilled water (1,10 solid to liquid ratio) was mixed and placed on shaker at the agitation speed of 150 rpm for 2hrs. After complete mixing it was filtered through muslin cloth and the residues was discarded and the filtrate was used for further analysis.

Estimation of CMCase

500µl of the enzyme sample along with 500µl of 1% (w/v) CMC in 50 mM acetate buffer pH 5 was incubated, in a water bath at 50 °C for 30 min. After incubation 3ml of DNS was added and boiled for 5 minutes and absorbance was taken spectrophotometrically at 540nm. The reducing ends liberated were then measured with DNS (Wood and Bhat 1988)

Effect of pH on enzyme activity

The effect of different pH on CMCase activity was determined by incubating the reaction mixture at different pH values. The pH was adjusted using the following buffers Citrate phosphate (pH 4.8-5.5), Phosphate (pH 6.0-7.0), and Tris-HCl (pH 8.0-9.0). Reaction mixtures were incubated at 50°C for 15 minutes, and the activity of the enzyme was measured spectrophotometrically.

Effect of Temperature on Enzyme activity

The activity of the crude enzyme was measured at different temperature (40, 45, 50, 55, 60, 65, 70, 75 and 80 °C) for 30 minutes. The reaction mixture was assayed and the CMCase activity was measured with standard assay procedures.

Estimation of Total Proteins

Total proteins in the culture filtrate were estimated by Lowery (1951) method using bovine serum albumin as standard protein.

RESULTS

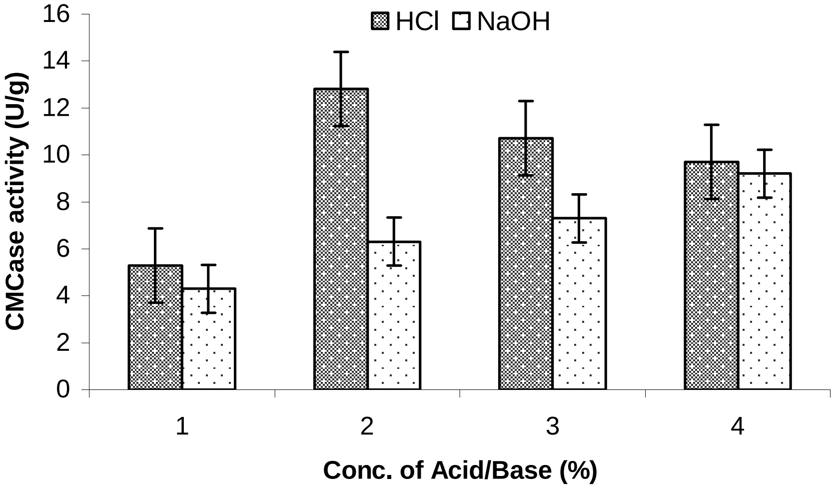
The proximate analysis of the wheat straw indicated that it contained 39.4% cellulose and 17.3% lignin (table 1).

Table. 1. Proximate analysis of wheat straw

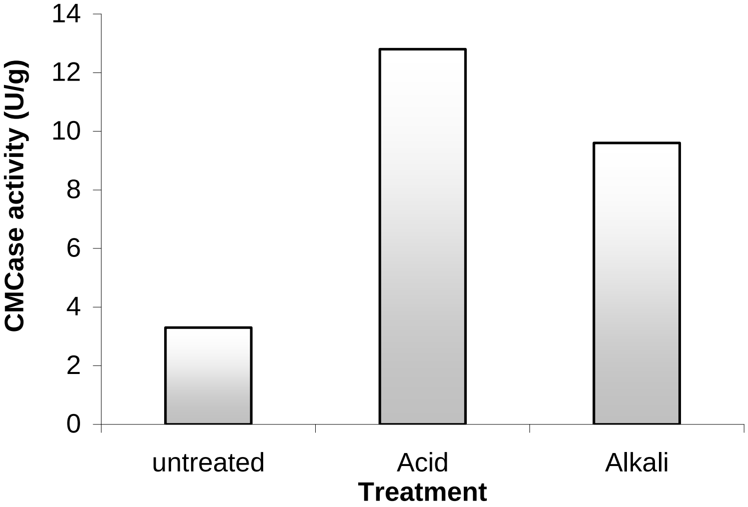
Component	Dry weight (%)
Cellulose	39.4± 0.21
Lignin	17.3± 0.13
Total Carbohydrates	1.54± 0.06
Total Protein	1.57± 0.01
Moisture	5.074± 0.24
Ash	7.201± 0.32

Effect of Pretreatment on CMCase Production

Wheat straw, a lignocellulosic material used in present study contains highly crystalline cellulose and large amounts of arabinoxylan, the major hemicellulosic fraction. Results indicated that (Fig.1A) 2% HCl gave maximum yield (12.8 ± 0.43 U/g) of enzyme while the 4% NaOH gave the enzyme yield of 9.2 ± 0.21 U/g. As the concentration of acid increased decline in enzyme production was observed. Figure 1B describe the general comparison of untreated, acid and base treated wheat straw on CMCase production.



(A)



(B)

Figure 1. (A) Effect of Different concentration of NaOH/HCl pretreatment on CMCase production from *Trichoderma viride*-FBL1. (B) Comparison of untreated, acid treated and base treated wheat straw on CMCase production.

Effect of different Leaching agent on CMCase activity

The recovery of the enzyme from the fermented mash is very critical hence selection of a suitable extractant is necessary. Different leaching agents were used in this study were distilled water, Tap water, Tween-81, 0.2M citrate buffer (pH 4.8) and 0.2M citrate-phosphate buffer (pH 5.0). It was noted (Fig. 2) that maximum enzyme recovery was obtained with distilled water (14.85 ± 0.12U/g) followed by Tween-81(12.08 ± 0.81 U/g). Tap water and different buffers slightly reduced the enzyme recoveries.

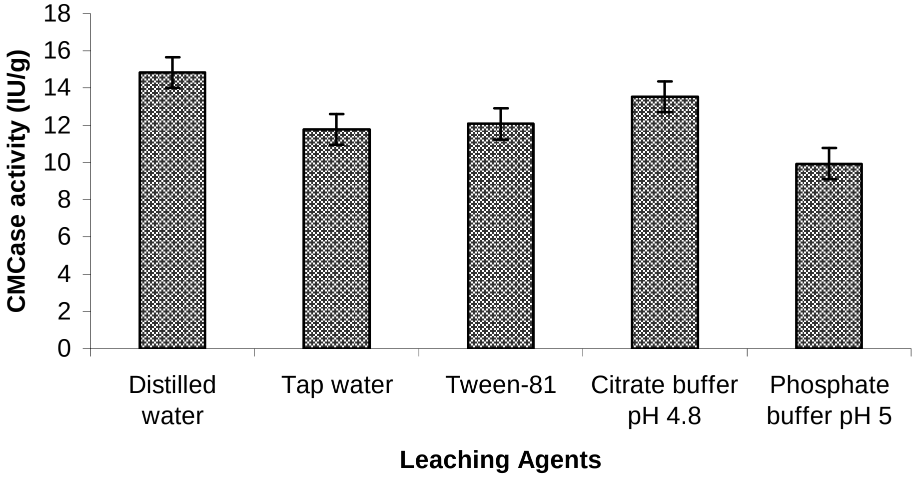


Figure 2. Effect of Different leaching agents on the recovery of CMCase from fermented sugar cane bagasse by *Trichoderma viride*-FBL1 at 30 °C for seven days.

Time coarse study of CMCase production

Different fermentation experiments were carried out to study the secretion time of CMCase by *Trichoderma viride*-FBL1. Maximum CMCase secretion was obtained during the seventh day of incubation period yielding 8.6 ± 0.32 IU/g. Further increase or decrease in cultivation time reduce the enzyme production (Fig. 3).

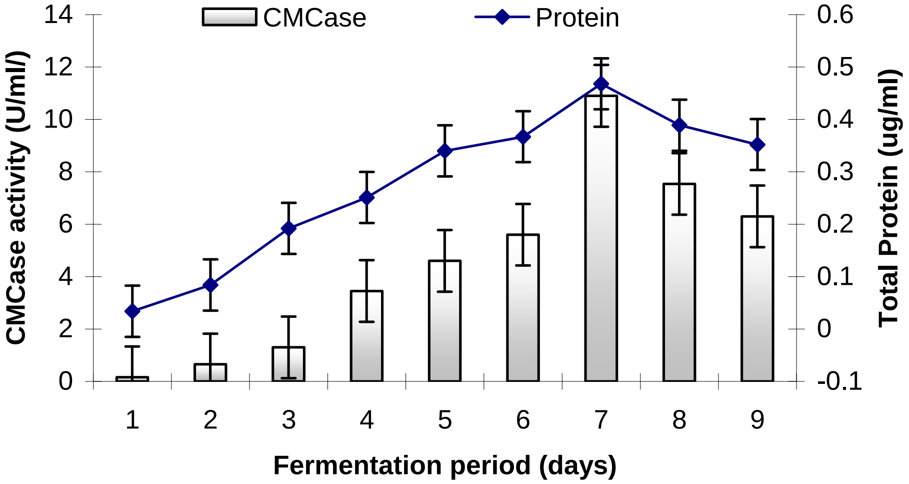


Figure 3. Effect of Different fermentation periods for CMCase production from *Trichoderma viride*-FBL1.

Effect of Initial Medium pH

Different sets of experiments were carried out to test the optimum pH for CMCase production. The initial pH of the medium was varied from 3-8 and adjusted with 1N NaOH/HCl before sterilization and each experiment was carried in triplicates. From these experiments it was observed that maximum CMCase production was found at pH 5 yielding 13.67 ± 0.76 U/g (Fig. 4). Further increase or decrease in initial medium pH affects the enzyme synthesis.

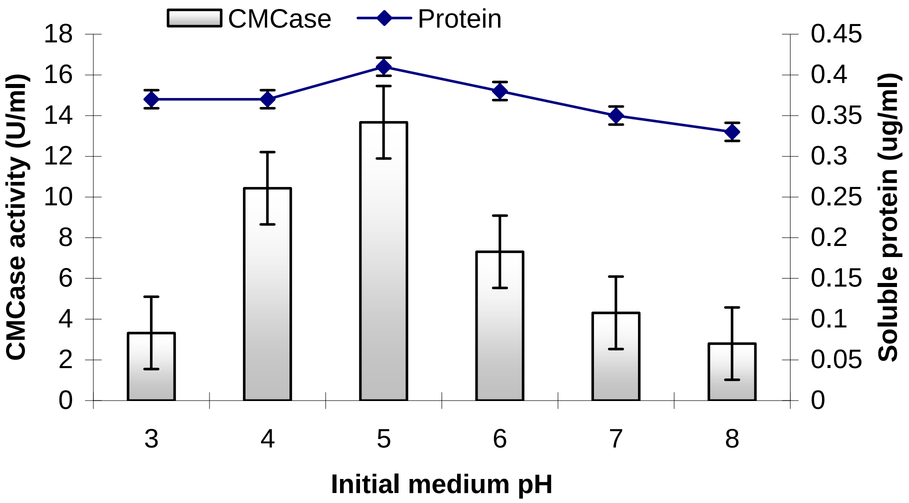


Figure 4. Effect of Different initial medium pH for CMCase production from *Trichoderma viride*-FBL1.

Effect of incubation Temperature

Incubation temperature and pH is very important in enzyme production (Smits et al. 1996). To investigate the optimum incubation temperature for CMCase production a set of experiments were carried out ranging from 25 to 50^{o}C as shown in the figure 5. From the data it was observed that 40^{o}C was found best for CMCase secretion and producing 0.68 mg/ml of protein in the fermented mash.

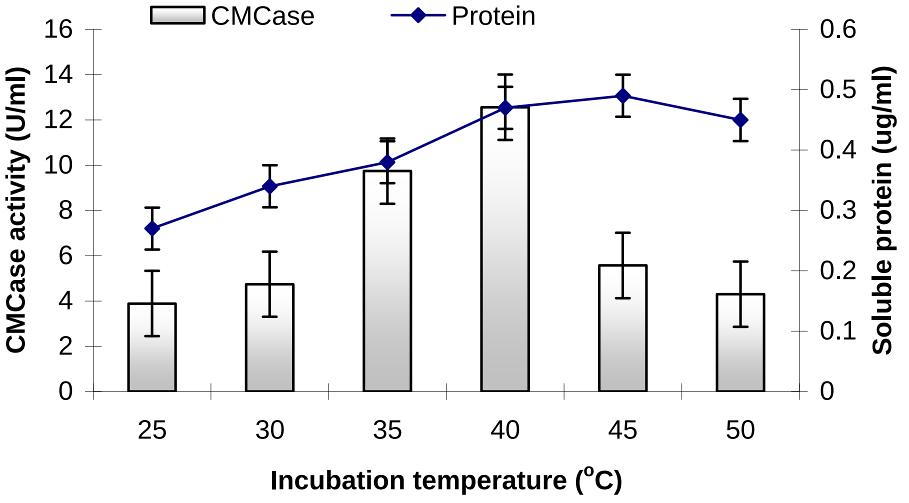


Figure 5. Effect of Different incubation temperatures on CMCase production from *Trichoderma viride*-FBL1.

Effect of Substrate

To investigate the optimum substrate concentration for CMCase production, experiments with different substrate level was conducted and it was observed that 15% substrate concentration was found optimum (Fig. 6).

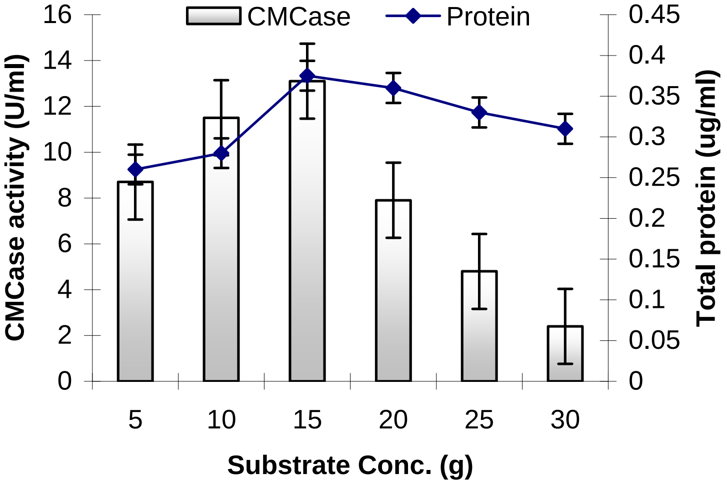


Figure 6. Effect of Different substrate concentrations for CMCase production from *Trichoderma viride*-FBL1.

Effect of Inoculum size

Effect of inoculum size on CMCase production was shown in the figure 7 which indicated that 5% inoculum size gave maximum enzyme yield (12.2 ± 0.21 U/g).

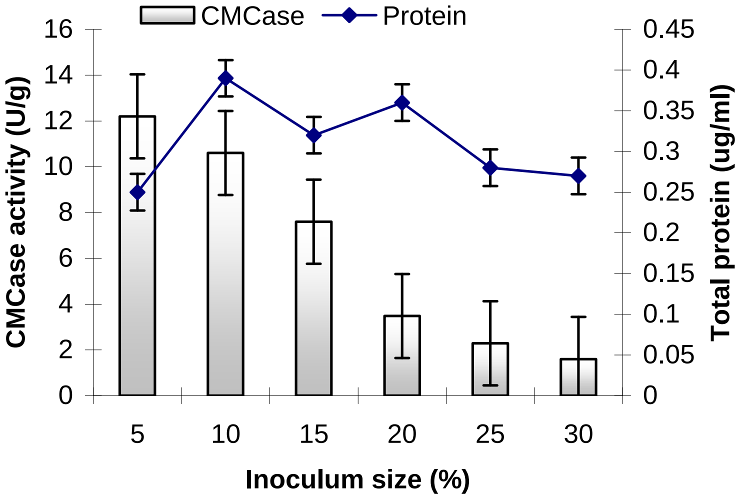


Figure 7. Effect of Different inoculum size on CMCase production from *Trichoderma viride*-FBL1.

Effect of Moisture Level

For CMCase production moisture level was optimized and found that 40% moisture level was best for production as shown in the figure 8. Increased moisture level lowered the enzyme production.

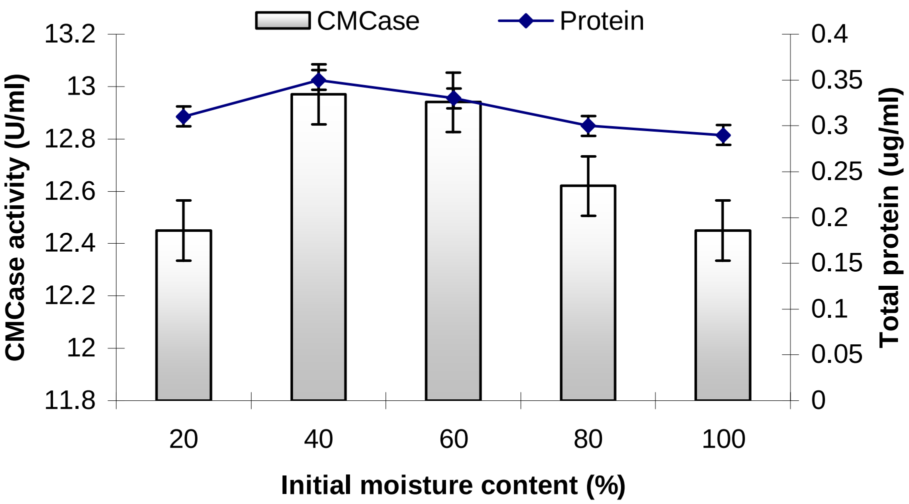


Figure 8. Effect of moisture level on CMCase production from *Trichoderma viride*-FBL1.

Effect of pH on enzyme activity

The CMCase activity was determined at different pH values ranging from 4-9. Maximum activity (16.2 ± 0.32 U/ml) was obtained at pH 5.5 using citrate phosphate buffer, as the pH of the substrate solution was increased the activity was also increased but increased pH toward alkalinity reduces the enzyme activity as shown in the Fig.8. These findings indicated that enzyme produced by *Trichoderma viride* was acidic in nature.

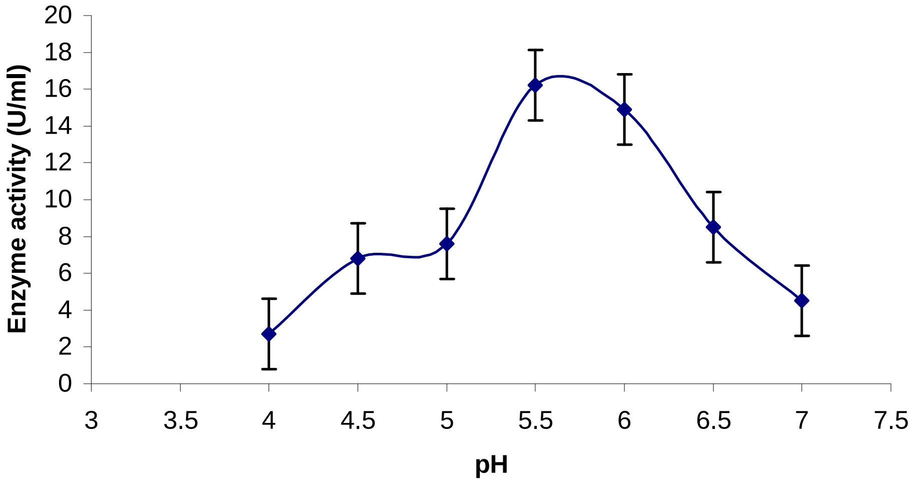
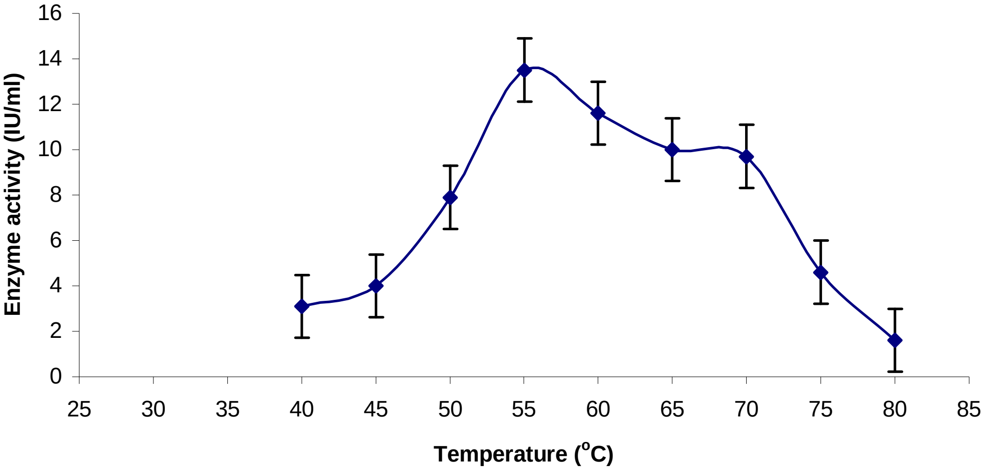


Figure 9. Effect of different pH on CMCase activities isolated from *Trichoderma viride*-FBL1

Effect of Incubation Temperature on CMCase activity

The CMCase enzyme isolated from *Trichoderma viride* was incubated at different incubating temperatures ranging from40- 80° C to check the optimum temperature of enzyme. It was observed that the enzyme activity was gradually increased by increasing temperature and optimum activity (13.5 ± 0.14 U/ml) was obtained at 55°C but as the incubation temperature increases the enzyme activity decreases as shown in the figure 10. At 80°C temperature the enzyme activity was 1.6 ± 0.21 U/ml.



Figure, 10 Effect of incubation temperature on CMCase activities isolated from *Trichoderma viride*-FBL1

DISCUSSION

Already available information of the properties of biomass materials is useful in order to evaluate their suitability as chemical feedstock in different processes. Many studies show that wood morphology and chemical composition vary with location, genetics, and growth conditions. In Pakistan different varieties of wheat straw contained holocellulose 58.5% and lignin 16-17% and ash content in the range of 7.5-8.5 (Ali et al. 1991). Indian wheat straw contained lignin and ash content of 23.0 and 9.99 respectively (Mohan et al. 1988). Norwegians wheat straw consists of 16-20% lignin and 4-9% of ash (Utne and Hegbom 1992). American and Denmark wheat straw contained 16.7 and 20.5% of lignin and 6.6 and 3.7% of ash respectively (Misra1987). Some workers (Reshamwala et al. 1995, Cheung and Anderson 1997, Dewes and Hunsche 1998, Boopathy 1998) reported that wheat straw consist of 30% of cellulose and 50% of hemicellulose and 15% of lignin content.

In the present study wheat straw was pretreated with different concentrations of NaOH and HCl. Main purpose of the treatments was to delignify the substrate. Greater the delignification more cellulose was exposed which was freely available to microbes and hence greater enzyme production. 2% HCl was found optimum for maximum enzyme production. Increase in acid concentration decreased the enzyme production. The enzyme activities decreased which might be due to the formation of such compounds which have inhibitory action on enzyme synthesis by the fungus.

In acid treated samples CMCase production was better which might be due to the rapid hydrolysis of cell wall component into free sugars which are available to the microorganism. In base treated samples enzyme production was comparatively low as compared to acid treated samples. This low production of enzyme might be due to alkalinity in substrate during alkaline treatment which inhibits the growth of the fungus. The major purpose of the pretreatment is to reduce the cellulose crystalinity which might be reduced by various techniques. Steam treatment has been reported to both decrease cellulose crystallinity index and completely solubilize hemicellulose (Puri 1984, Dekker 1985). Moreover, solubilized sugars in steam-treated lignocellulosics are known to occur as a mixture of oligomers (Overend and Chornet 1987). However, the degree of polymerization (DP) of the soluble sugar fraction varied significantly according to the treatment applied. Both the concentration of acid and treatment reaction time was important factors in determining degree of polymerization. Therefore, an enzyme preparation designed to breakdown cell wall polysaccharides and derived oligomers in steam-treated wheat straw into a mixture of monomeric sugars would require high enzymic activity against crystalline cellulose, arabinoxylan, and xylo-oligomers.

If more concentration of H_2SO_4 (>4.5% H2SO4 on DM basis) was applied, more hemicellulose (>95%) contents should be hydrolyzed (Cunningham et al. 1984, Grohmann et al.1985). Two further aspects that might have influenced the response of the steam treatment are; a) type of substrate and b) amount of water might have influenced the efficiency of heat transfer and acid impregnation. Previous studies (Wong et al. 1988, Grous et al. 1986) have shown that in addition to changes in chemical composition alteration in physical microstructure occurred during treatment. Such physical changes are also partly responsible for improving cell wall hydrolysis by cell-free enzymes. Cell wall swelling can also be affected by impregnating the substrate with sulphuric acid prior the treatment and thereby greater cellulose hydrolysis by cell-free enzymes was achieved (Toussaint et al. 1991).

Pretreatment with dilute hydrochloric acid were also investigated by many workers (Israilides et al. 1978, Mehlberg and Tsao 1979). The major advantage of dilute acid pretreatment is that higher yield of xylose was obtained in this process. Alkaline pretreatments are basically delignification processes and significant amount of hemicelluloses were solublised during the treatment (Millet et al. 1976, Goel and Ramachandram 1983). In comparison with acid – base pretreatment, base is more expansive than acid and concentration of alkali used is generally comparable to or higher than that of the acid (Chemical Marketing reporter, 1994).

Enzyme recovery from the fermented mash is a critical problem. To solve this problem different extractants were used, distilled water followed by Tween-80 and citrate buffer found best extractants. Ikram-ul-Haq et al. 2003 stated that the chemical composition of the buffer might show inhibitory effect on the enzyme activity. Aikat and Bhattacharyya, (2000) also reported highest enzyme yield when potassium phosphate buffer pH 8.0 was used as an extractant, which showed comparatively less activity than distilled water extraction.

Incubation time also affects the enzyme production .As the incubation period increased there might be the depletion of nutrients and production of certain toxic metabolites which inhibit the further microbial growth and physiology resulting in the inactivation of secretary machinery of the enzymes (Nochure et al. 1993). Enzyme production in short incubation period offers the potential for inexpensive production and it varies from enzyme to enzyme from single substrate (Sonjoy et al. 1995). It was found that incubation period needed for enzyme production is shorter in solid state fermentation than in submerged fermentation process (Macris et al. 1989, Illanes et al. 1992, Jiafa et al. 1993). Ahmed at al. 2009 reported the time course of 5days for endoglucanase production from *Trichoderma harzianium.* Gomes et al. 2006 also reported the maximum time of CMCase production of 7days of fermentation period for *T.viride* which was similar to our findings. Zhang et al. 1999 reported the maximum production of cellulase after 6days of fermentation period. Ogel et al. 2001 reported that time course required to reach maximum levels of activity may be affected by several factors, like the presence of different ratios of amorphous to crystalline cellulose.

Optimum pH is very important for growth and metabolic activities of microorganism. Best enzyme production was observed at pH 5. Different workers (Ahmad et al 2009, Margaritis and Merchant 1986, Xia and Cen 1999, Kocher et al. 2008) reported that initial medium pH in the range of 4.5-5.5 was optimum for carboxymethyl cellulose production. Liu and Yang (2007) stated that initial medium pH has strong influence on enzyme production, if the pH is too low or high there was poor growth and the optimum growth and enzyme production was observed at pH 5. Most fungal cultures require slightly acidic pH for their growth and enzyme biosynthesis (Haltrich et al 1996).

Ahmed at al 2009 reported the optimum fermentation temperature of 28^oC for endoglucanase production from *Trichoderma harzianium.* Stutzenberger (1971) studied on cellulytic activities of *Thermonospora curvata* using solid municipal waste as a substrate and reported the optimum cellulose production at 45^oC. Margaritis and Merchant (1986) reported the incubation temperature of $44\text{-}55^oC$ was optimal for cellulase production which was near to our findings.

Selection of a proper substrate is another key aspect of SSF. In SSF, solid material is non-soluble that acts both as physical support and source of nutrients. Solid material could be a naturally occurring solid substrate such as agricultural crops, agro-industrial residues or inert support (Pandey 2003). Low quantity of substrate exhibit low fungal growth and cellulase accumulation while higher substrate level may show extensive growth but cellulase accumulation was reduced. Haq et al. 2006 reported that 10% substrate level was best for CMCase production by using *Trichoderma viride*. Xia and Cen (1999) reported that 30% substrate was best for cellulase accumulation.

Number and density of spores is an important factor in the fermentation experiments. Inoculum size controls and shortens the lag phase, smaller inoculum size increased the lag phase whereas the larger inoculum size increases the moisture content which ultimately decreased the growth and enzyme production (Sharma et al. 1996). The pretreated wheat straw had maximum enzyme production with 10% of inoculum size which was in good agreement with our findings (Fadel 2000). Omojasola and Jilani (2009) worked on cellulose production and reported that maximum glucose production was observed with 8% inoculum size.

Every microorganism requires some moist environment for their growth. In SSF the optimal moisture content depends on the requirement of microorganism, type of the substrate and the types of end products (Kalogeris et al. 2003b). Gao et al. 2008 reported the moisture level of 80% was best for enzyme production. Xia and Cen (1999) reported that cellulase production was maximum when water content of 70% was acquired in koji fermentation. Alam et al. 2005 also reported the moisture level of 50 % was best for CMCase production. High moisture level enhanced fungal growth and cellulase production when lignocellulosic substrates were the carbon sources in the SSF (Kalogeris et al. 2003b, Panagiotou et al. 2003). The demand of moisture level in solid state fermentation differs on enzyme production, substrate, microorganism and particle size of the substrate (Sharma 1989, Fadel 2000, Omojasola and Jilani 2009, Kalogeris et al. 2003b). When the moisture level was too increased the media become clumped and there is poor aeration and poor growth so the enzyme production will decrease (Alam et al. 2005). Muniswaran and Charyulu (1994) observed that high moisture level increases the free excess liquid in the medium which ultimately decrease in growth and enzyme production.

Cellulase enzyme extracted from termite showed the optimum pH of 6.2 (Purwadaria et al. 2003). Peciulyte (2007) isolated cellulolytic fungi from waste paper gradual recycling materials and stated the optimum pH of 4.5, 5.5, 6.5 and 6.0 for *Aspergillus niger* DPK-cl-12, *Gliomastix murorum* var. *murorum, Stachybotrys chartarum* DPK-cl-111 and *Penicillium funiculosum* DPK-cl-19 rspectively at 30°C. In an other study (Soni et al. 2008) a wide variation was seen in optimum pH of CMCase produced by different fungus such *Aspergillus sp* showing optimum pH of 6.0, *A. terreus* pH 6.0 and *M.fergusii* T41 showing the optimum pH of 4.0. Lee et al 2008 purify and characterize the cellulase produced by *Bacillus amyoliquefaciens* DL-3 utilizing rice hull and reported the optimum pH of 7.0. Optimum pH of 6.5 for cellulose was also reported by Kim et al. 2009 which were isolated from marine bacterium *Bacillus subtilis* subsp. *subtilis* A-53. The wide variation in pH might be due to the different substrates and different microbial origin.

Cellulase enzyme from different microbes show its highest activities at different temperatures. Cellulase enzymes of termites have optimum temperature in the range of 45-50°C (Purwadaria et al. 2003). In another study (Kim et al. 2009) the CMCase isolated from *Bacillus* sp show the optimum temperature of 50°C. Temperature profile of endoglucanase from *Penicillium chrysogenum* showed that the enzyme was most active at temperature of 48°C (Nwodo et al. 2008). Our findings were in good agreement with Gomes et al. 2006.

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Management of Job-Related Teacher Burnout in Nigerian Schools

Lekia Nwikina[1], Anthonia Nwanekezi[2]

1. Department of Educational Management
University of Port Harcourt
2. Department of Curriculum Studies
University of Port Harcourt
omadesope@yahoo.co.uk

Abstract: The paper helps teachers in Nigerian schools manage burnout, an emotional exhaustion from excessive demands on their energy, strength, and resources. It helps them, to understand the burnout syndrome, the causes, symptoms, prevention and remedies. It emphasizes that burnout is experienced by many Nigerian school teachers and that it need not be a silent disease. It recommends that further research is necessary to document its incidence upon the teacher's physical condition and the student's education. Exposing its causes, symptoms, and types of prevention is vital if it is to be eliminated among teachers. It recommends also that management should hold regular meetings that can be used for staff support; should foster a sense of teamwork among the staff; restructure jobs so that teachers do not unduely spend as much time with particularly demanding students and assignments. Workshops in stress management or time management should be mounted regularly. [Academia Arena, 2010;2(7):31-38] (ISSN 1553-992X).

Key words: Job-Related Teacher Burnout, Nigerian Schools

1. Introduction

The term "burnout" is often described as "emotional exhaustion resulting from the stress of interpersonal contact" – an exhaustion from excessive demands on energy, strength, and resources. It is a specific type of stress-induced condition that affects individuals engaged in "people" work (Davis, 1983). The term takes on particular significance for those individuals working within the field of the helping professions, which include teachers, psychologists, social workers, mental health clinicians, and police. Papalia and Olds (1995) define the term burnout as,

> *A reaction to work-related stress; it involves emotional exhaustion, a feeling of being unable to accomplish anything on the job, and a sense of helplessness and loss of control. It is especially common among people in the helping professions – who feel frustrated by their inability to help people as much as they would like to (p.442).*

A further explanation of the concept, according to Stueart and Moran (2002:297) is that "individuals suffering from burnout typically experience exhaustion, both physical and emotional; a negative shift in the way they respond to other people; a loss of self-esteem". Evidence and reported experiences by teacher union-leaders and educational administrators regarding explanations of the frequent strike actions in Nigeria education demonstrate that many teachers have been suffering severely psychologically, in silence at least, that burnout is real, not simply a stylish fad or a cry of wolf by teachers, or even an excuse to cover up teachers incompetence or laziness. One of the highly articulated explanations of a concluded three-month strike actions (July-September, 2009), by university teachers in Nigeria is that their job environments have been very or extremely stressful especially by the lack of basic infrastructure, poor salary payment and poor condition of service. Oboegbulem and Ogbonnaya (2004) have found that poor working conditions, time pressure and poor school structures are some of the sources of burnout among Nigerian school personnel.

Admittedly hard data is not available relative to the incidence of burnout among teachers in Nigeria. However, there exists widespread acknowledgement in literature that teachers do burnout due to stress related to their job, that burnout is both real and a problem, that there is significant associated attrition rate, and that the need to deal effectively with teachers' personal/professional frustration related to their position is very important (Adesina, 1990; Ajayi, 1997; Ejiogu, 1997). The reality of burnout among teachers as a very important problem which needs to be recognized and treated is summed this way:

> *Teacher burnout has a debilitating effect on the process of education, the teachers' personal health, and the delivery of services to students. Because of these effects, a need exists to help teachers understand the burn syndrome; its causes, symptoms, preventions and remedies--- Ultimately burnout affects the children. Burned out teachers, think only of their personal survival in the classroom. They are not caring or listening to their students. At best, a burned out teacher neither prevents progress nor furthers it. At worst, since (some) children usually lack the ego strength – a cynical, negative teacher could impair their progress academically and socially (Davis, 1983:10)*

A review of the available literature suggests that symptoms of burnout vary widely. It may often go undetected especially at early stage. Among the most commonly cited early symptoms are general feelings of uneasiness and distress. Gradually, the person begins to experience such feelings as boredom, irritability, and mild depression. If the burnout syndrome is not recognized and treated the individual teacher becomes less flexible and responds to students with cynicism or negativism – limited in social contacts and withdrawn from people and activities. Signs of "advanced burnout" include such teacher behaviours as missed faculty meetings, attempts to avoid all social contacts among colleagues, immersion in work (the workaholic syndrome), severe depression, and even alcoholism and drug abuse (Papalia & Olds, 1995).

A review of available literature suggests also that teacher burnout may result from factors other than those related simply to one's job. What produces stress within an individual may be totally a personal nature. Worries due to family problem, illness, or even concerns over the current social and political climate of the country, none of which are directly job-related could cause high level of stress. It is however pointed out that job stress imposes itself upon all aspects of a person's life, consequently damaging the person's health and well-being.

Burnout in the workplace is also a management problem. Stueart and Moran (2002) assert that:

> *"It is important to try to prevent burnout because it is rarely confined to one worker. If one worker complains of the work environment and/or questions the worth, rewards or necessity of his or her work, it is sure to have some effect on co-workers. To keep burnout from spreading, managers need to recognize the symptoms and prevent it wherever possible (p.297)*

All these problems imply that burnout syndrome among teachers is an important subject and should be studied. This paper highlights some of the factors that may help in the management of teacher-burnout in Nigerian schools. It specifically highlights the causes, symptoms, preventions and remedies of teacher burnout in Nigerian schools. Management in the context of this paper refers to seeking out alternatives, resolving conflicts bringing about changes, creating problem solving and decision-making. It comprises measures taking to cope with trying periods, so that a state of psychological and physiological equilibrium is established and subsequently maintained.

2. Causes of Teacher Burnout

Sparks and Hammond (cited in Davis, 1983) in their review of the literature related to teacher burnout, conclude that the predominant causes of this syndrome are a sense of isolation, poor interpersonal relationships, feelings of responsibility without power, role conflicts, life changes, lack of time to relax, school policies and practices and public criticism of teachers and schools. These authors specifically mention involuntary transferal, managing disruptive children, notice of unsatisfactory performance, threats of personal injury and overcrowded classroom as major stress factors among teachers. Stueart and Moran (2002) assert that Burnout results from emotional strain and stress of interpersonal contact, especially dealing with people who are having problems, such as children with special needs.

Oboegbulem and Ogbonnaya (2004) explain that stress results when a teacher's working or living condition or circumstance makes demand beyond his capacity to handle physically or emotionally. It could be in form of disturbance in the system, strain, obstacles in the path of achieving goals, conflicting demands, uncertain role prescription such as ambiguity or role conflict and tasking work conditions. Ejiogu (1997) observed that there are many stressful factors in teaching that serve to increase the likelihood of burnout among members of this profession. Among the specific factors cited are perceived lack of satisfaction, minimal administrative support, relatively low pay, inadequate teaching preparation, administrative trivia and excessive paperwork, and that in education frequently attention is focused on the things that go wrong. Adesina (1990) offers an interesting observation namely, lack of, or inappropriate training. He suggests, that the major cause of burnout for many teachers is that they have not received adequate training in order to develop and implement appropriate student programme. He asserts,

> *Full professional preparation makes the task of teaching easier. Teaching is a wearing work and makes large demands on the nervous power and vitality of the teacher. When young people breakdown as a result of the strain of teaching, they do so more from worry and irritation rather than from the work of teaching itself. The direct cause of much of the worry and irritation is the fact that these young people undertake to do what they do not know how to do (p.174)*

Other sources of burnouts are position-specific factors. These according to Davies include:

(a) Unrealistic expectations relative to pupils' progress and perceived lack of success as a teacher. Some teachers tend to view themselves as "super teachers". They frequently place upon themselves unrealistic expectations and when they are unable to meet such expectations, they consider themselves failures, they blame themselves for lack of sufficient pupil progress, leading to low esteem and possibly burnout.

(b) Direct and continuous contact with difficult students. Among regular classroom teachers, the presence of one students who are considered difficult to control in the class is frequently cited ass a major source of teacher stress. Yet many teachers deal on a daily basis with not just one or two but large numbers of students who are considered difficult; and throughout not only the entire school day but the total year.

(c) Emotional drain of giving but not taking. Similar to others who work in the so-called helping professions, teachers often discover themselves emotionally drained by their perceived need and responsibility to help others. Some labour under the false assumption that they are the only ones who can help a particular student. Some teachers work with students who present complex problems. Frequently, such students come to the teacher not only with academic difficulties but with personal and social needs – they are very demanding, not only the teacher's skills and expertise, but a good share of personal attention and life.

Soon, the teacher often develops feelings of helplessness and frustration, and as the problems of students accumulate, the teacher's frustration increases. Furthermore, some teachers tend to take all of their students' problems home with them, causing varying degrees of disruption in their personal life.

(d) Isolationism and perceived lack of belonging. Some teachers, especially special education teachers continue to be isolated – physically, psychologically, and professionally – from colleagues, which perhaps may be their own fault. They isolate themselves from the mainstreams even from their own peers, in many environments. Many special education teachers especially appear to suffer less from physical isolation than from lack of available colleague support system in their immediate working environment. They appear to be perceived by other teachers as "different" – outsiders. Often they appear to withdraw even more from the total school environment, including regular contact with peers. A perceived lack of belonging, along with the loneliness that often accompany this feeling, appear to be one of the greatest sources of stress to these teachers.

In summary, the cause of stress that lead to burnout among teachers are many and varied. They include the following:

- Excessive paperwork and record keeping
- Frequent required meetings
- Lack of administrative support, often at the building but also at the state level
- Perceived ineffective communication and lack of cooperation with colleagues, parents and administrators
- Lack of role clarity and discrepancy between teacher's perception of role and others' expectations.
- Lack of time, energy, and skill required to plan and implement appropriate and effective instructional programmes for students with complex learning and behaviour needs.
- Inappropriate training (perceived or real) required to carry out specific job responsibilities effectively.

3. Symptoms of Teacher-burnout

Some of these problems affect all teachers, while other appear to be more directly related to the myths and realities surrounding the field of education. For some teachers one specific factor appears to result in an overwhelming amount of stress, while for others it is the cumulative effect of several factors that seems to produce a high level of anxiety. It should be noted that many of the factors are overlapping, interactive, and interrelated.

Regarding the symptoms of burnout Papalia and Olds (1995) write further that burnout is usually a response to long-term stress rather than an immediate crisis and that its symptoms, include fatigue, insomnia, headaches, persistent colds, stomach troubles, alcohol or drugs. A burned-out worker may quit a job suddenly, pull away from family and friends and sink into depression (p.492). Other symptoms are peptic ulcer, palpitation, colitis, asthma, cardiovascular disease, self-induced phobia and some severe cases of depression.

4. Suggestions for Remedying Burnout

Johnson (1967) in Schiefelbusch and McCormich (1981:109) says "A problem has members". Teacher burnout, like cases of alcoholism, typically affects not only the teacher himself but many others – family members and co-workers as well, who need to develop a greater awareness of the problem and become involved in teacher treatment programme. Thus because teacher burnout normally affect others in the teachers environment as many significant others as possible necessarily need to be involved in any burnout prevention activities. This why Weiskopf (1980), cited in Davis (1983:18) says "preventing burnout is not sorely the responsibility of the teacher. Administrators, parents, supervisors share in the success or failure of a teacher in preventing burnout. In most local school systems, teacher-related stress has been dealt with on both the individual and group or system levels. Although many stress-related problems for teachers are caused by the system – and therefore demand change, support and involvement at the system level, many teachers benefit from their individual initiative, with or without the support of administrators, supervisors, colleagues or counselors, in developing effective coping strategies. Stueart and Moran (2002) suggest that the individual burnout teachers should remedy their condition by structuring their lives outside of their work to give them a sense of comfort and control – they should pursue an active life outside of their work environment. The authors suggest also that the managerial responsibilities for aiding teachers with burnout should include knowing the symptoms of burnout and making them (teachers) families with them, holding staff meetings that can be used for staff support, and fostering a sense of teamwork among the staff. If staffing patterns permit, the head teachers (or principals) may also restructure jobs so that teachers do not spend as much time with some particularly problem children, or should revise schedules to shorten periods of time spent of some particularly demanding assignments. Workshops in stress management or time management can also be useful. Other specific suggestions may help teachers are discussed below:

4.1 Detect Stress Symptoms Early

Learn to recognize the early signs of burnout, such as vague feelings of distress and uneasiness. As Feldman (2004) asserts, one can not cope with burnout until he knows what is causing it. Attempt to deal with these symptoms before more serious symptoms develop. Do not be producing high levels of stress, try to arrive at reasonable solutions, through joint planning to remedy the problem.

4.2 Learn to Delegate Responsibilities

Part of the teacher's problem may be an unwillingness to give up control. Some teachers feel too busy to delegate- feel they don't have time to invest in delegating and supervising someone else. Others often feel guilty dumping on others undesirable or grant work. Some have difficulty depending on others. They are imprisoned by the mentality: "if I don't do it myself, it won't get done right". Others are afraid of becoming dispensable, that if someone else can do their job they would no longer be needed or have value.

Morgenstern (2000:171) however points out the delightful aspects of delegating responsibilities: "It allows for a very healthy interdependence among people. When you work as a team, it brings people together. Relationships solidify as you share the workload and learn to rely on one another". More important, a good deal of teacher stress often can be alleviated if only the teacher can learn to more effectively delegate job-related responsibilities. Very often the teachers job is made a great deal less frantic if certain responsibilities currently being handled by the teacher is dedicated to assistant teachers, teacher aides, volunteers and secretaries. The teacher has option to delegate to (1) experts, someone who can do it better, faster, more efficiently than he can, which makes instant time saving; (2) an equal, someone who is just as qualify as he does, and who can do it just as well as he can, with minimal time on his part to explain the job and give guidance (3) beginner, someone who doesn't know how to do it as well as the teacher but requires the teacher to invest some time to train and supervise him. Great rewards are accrued to this: The teacher becomes a mentor and a helper of someone to shine, this enhances his confidence in his abilities. As Morgensterns emphasizes, teachers should especially delegate the following kinds of jobs: (a) tasks they are not good at doing, and someone else can do better; (b) tasks they do not enjoy; (c) tasks that deplete them of energy or time needed for more important activities. Effective delegation of responsibilities could also enhance individual and school organization and coordination which can also minimize teacher-stress and burnout (Oboegbulem et al.)

4.3 Keep Informed and Professionally Active

One major source of stress for teachers is the fact that they frequently get so caught up with day-to-day activities that they do not stay fully informed of the critical issues in the field including their own professional rights as teachers. As McCay (1989) suggests, teachers can increase their output and reduce stress as they increase their capacity to get accurate, clear, fast impressions of what is going on around them, especially their profession. Among the numerous ways of "keeping above" professionally are participation in the activities, programmes of professional organizations and unions like the Nigerian Union of Teachers, the Teachers Registration Council of Nigeria, and the Classroom Teachers Association.

Teachers should subscribe to professional journals; attend professional meetings and conferences; organize local and professional rap-sessions. They should participate in inservice training, seminars and workshop sponsored often by the Schools Board, Ministry of Education, Nigerian Union of Teachers, Teacher Registration Councils of Nigeria (TRCN), the Nigerian Teacher Institute (NTI) and the Science Teachers Association of Nigeria (STAN). If nothing else, participation in such activities tends to prevent professional isolation. Although participation in such activities may not necessarily provide solutions to specific job-related problems, often it provides a forum for sharing ideas and frequently make the teacher aware of not only their rights but also that they are not alone in having to deal with certain problems and issues. This awareness may help to reduce stress (Fajana 1997). The recent successfully concluded legal battle, undertaken by the Academic Staff Union of Universities (ASUU) against the University of Ilorin in defence of their 42 colleagues whose appointments were illegally terminated by the University has shown teachers that membership to professional associations can serve as haven for their psychological, social and job security.

4.4 Seek and Demand Needed Training

Many teachers have discovered that their professional roles and responsibilities have evolved into something substantially different from that for which they were trained, or simply, that they are not meeting up their professional requirement for the work they do. For many of these teachers, the stress that they are experiencing is largely related to the fact that they have not had the appropriate training for carrying out their responsibilities effectively. For their own personal mental health and professional growth, they should make their training needs known to the necessary authorities. Local school districts, state departments of education, and university teacher training programmes collectively need to respond to this growing training need. Teachers, who are the ones on the firing line may have to take initiative to obtain such training. One way teachers can take initiative for their professional growth is by studying professional books. Adesina (1990) opines that,

> *Every teacher should have his own little library, however small, and should form the habit of professional reading. It is by doing so the teacher retain his consciousness as a teacher and stimulate young members of the profession along the lines of professional success. It is by doing so the teacher can be current or keep himself from stagnation and frustration (P.175)*

4.5 Engage in Public Relations

Many teachers do great things and invest much of their time and self for their students, their school, and the community at large. Often they perform above and beyond the call to duty by doing extra things to help. Notwithstanding their efforts have often not been significantly appreciated by beneficiaries of their service (Nwikina, 2009). However, teachers should continue and even increasingly widen out in their relationships with the community and its agencies. They should relate well with the privileged and less privileged of the community. For instance, they should visit relevant funeral, wedding and other ceremonies in community and where possible make practical contributions. They should contribute to the welfare of the under-privileged. They could encourage and lead their school children to clean or plant ornamental trees and flowers at relevant places in the community, and to consider what more to do to improve the condition of the school and the general society. They should be involved in volunteer works for community growth and welfare.

The advantages for doing these are mammoth. For examples, it has been shown that it brings deeper, richer and far more enjoyable rewards: it heighten people physiological demeanor and psychological well-being. People who volunteered have been found to be happier, healthier and live longer than those who do not (Nwikina, 2009). This explains the proverbial saying that “There is more happiness in giving than there is in receiving”.

4.6 Seek to be Professionally Developed

Dalton (1989) maintains that professional development can be an important means of the teacher personal renewal to help combat burnout and professional obsolesce. He argues that obsolesce occurs when staff lose the technical, interpersonal, and political skills necessary to perform their job roles. Teacher positions are so demanding in time and pressure that burnout and obsolesce are ever-present dangers. Effective professional development programmes can promote self-renewal and help teachers to stay current and relevant in the midst of a demanding and ever-changing profession.

4.7 Keep Active and Stimulated in Your Own Personal Life

As noted by Davis, much of the research that has been conducted dealing with stress among various groups of professionals suggests that job-related stress can be reduced through the positive use of leisure time. The bored, fatigued teacher on the job is frequently the same bored, fatigued person at home. One of the advanced symptoms of personal burnout is often total immersion in work. More frequent work breaks, “forced” vacation times, physical activities, hobbies totally unrelated to job, exercises and other diversions are often good methods for controlling burnout. Feldman (2004) suggests that teachers should make exercise a part of their life, that they should have a good night’s sleep, eat well and be physically prepared for stress since it takes toll on the body.

Papalia and Olds (1995) summarise the measures that help burned-out teachers as cutting down on working hours and taking breaks including long weekends vacations. Others are exercise, music and meditation. The advise by McCay (1989:13) is also relevant and timely namely, that teachers should learn and practice self-management/organization. He says “As you refine your techniques of self-management, you may expect as a first dividend a release from pressure of time (a d of work)”.

4.8 Recognize the Positive Aspect of the Job

Admittedly, some teachers appear to be in job situations that are truly endangering their physical and mental health and possibly the only viable solution for them, their students and perhaps the school administration, is for them to leave their position. This include both teachers who at one time were fulfilled personally and professionally by their work and who were excellent teachers by objective standards, and those who probably are in teaching for a number of reasons – all of them wrong.

However, the vast majority of teachers who find themselves experiencing symptoms of burnout fail to recognize the more positive aspects of their job, instead focusing exclusively on its deficits. This is not to suggest that teachers should ignore job-related problems. Rather, many teachers appear to allow relatively minor job-related frustrations to grow and engulf them completely. Some teachers often tend to dwell on what is wrong, not on things that are right. Possibly the system promotes such behavior. For instance, it is common to hear that "teachers rewards are in heaven, not on earth and now", and that "teachers' salary and condition of service are poor", at least in a relative sense. Ejiogu (1997:45) says "the present apparent devaluation of the teacher and his job (in Nigeria) has no doubt set in motion of self-fulfilling prophecy whereby the teacher internalizes a low opinion of himself/herself and the job". Teachers should however focus at the positive aspect of their job. Since the ancient times it has been imbued with nobility and dedication of purpose by philosophers and poets. For instance Cicero (cited in Sadker & Sadker, 1998:25) once asked "what noble employment is more valuable to the state than that of a man who instructs the rising generations?". Definitely none. Henry Adams (also cited by Sadker et al) says also "a teacher affects eternity; he does not know where his influence stops".

Feldman (2004) has further, an encouraging advice, namely, that teachers should "maintain an appropriate perspective on the events of life", and that they should "make peace with stress". He asserts that,

> *A life that presented no challenges would probably be – boring. So think about stress as an exciting, although admittedly sometimes difficult, friend. Welcome it, because its presence indicate that your life is stimulating, challenging, and exciting – and who would want it other way? (p.374)*

5. Conclusion and Recommendations

Teacher burnout in Nigerian schools is real, not a stylist fad. It has debilitating effect on the process of education, on the teacher's personal health and on the delivery of services to the students. Its proper management is vital. Teachers may find the above information helpful in understanding the syndrome, its causes, symptoms, prevention and remedies that aid in the management of the disease. Further research is necessary to document its incidence upon the Nigerian teacher's physical condition and the student's education. Burnout need not be a silent disease. Exposing its causes, symptoms, and types of prevention is vital if it is to be eliminated among Nigeria teachers. It recommends with emphasis that the school management should know the symptoms and make teachers be familiar with them; should regularly hold staff meetings that can be used for staff support; foster a sense of teamwork among the staff; and should restructure jobs so that teachers do not unduly spend as much time with particularly demanding students and assignments. Workshops in stress or time management should be mounted regularly. More teachers should focus on the more positive aspects of their job instead of focusing exclusively on the negative.

Correspondence to:
Dr Lekia Nwikina
Department of Educational Management
University of Port Harcourt
omadesope@yahoo.co.uk

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对黑洞的新观念和完整论证：黑洞内部根本没有奇点（上篇）***

==黑洞：所有黑洞之最后命运就是由于发射霍金辐射而收缩成为宇宙中的最小引力黑洞

($M_{bm} = m_p = 1.09\times10^{-5}g$,) 在爆炸中消亡于普朗克领域 Planck Era, 不可能塌缩成为奇点 ==

张 洞 生 Dongsheng Zhang E-mail: *ZhangDS12@hotmail.com*

1957 年毕业于北京航空学院, 即现在的北京航天航空大学 1/10/2009

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【内容提要】:在本文中，作者没有提出任何假设和附加条件，直接推导出“任何黑洞的引力塌缩不可能成为奇点，而是变成为等于普朗克粒子m_p的最小黑洞M_{bm}，即$M_{bm} = M_{bm} = (hC/8\pi G)^{1/2} = 1.09\times10^{-5}g$”，而爆炸消失在普郎克领域**Planck Era**。本文证明的关键在于：不官黑洞内部的状态和结构，只研究黑洞视界半径R_b上的变化，结果，黑洞视界半径R_b和质量M_b因向外发射霍金量子辐射，最后收缩成为最小黑洞$M_{bm} = M_{bm} = 1.09\times10^{-5}g$而消失在普朗克领域，不可能继续塌缩成为奇点。

广义相对论方程（**GTRE**）的基本缺陷是其中没有热力学作用以对抗引力的收缩，所以无限收缩的结果必然会出现奇点。这就是**S.**霍金和**R.**彭罗斯推导广义相对论方程的杰出成就。

现在本文根据霍金的黑洞理论公式结合其他的可靠的经典理论公式对黑洞视界半径R_b的收缩进行推导后，得出正确而极其重要的结果。因为霍金的黑洞理论公式是以热力学和量子力学为基础，而与广义相对论方程无关。本文得出的最重要的新公式是：

$$m_{ss} M_b = hC/8\pi G = 1.187\times10^{-10}g^2 \qquad (1d)$$

在上面的**(1d)**中，M_b是黑洞质量，m_{ss}是黑洞视界半径R_b上的霍金量子辐射的相当质量，m_{ss} M_b的成绩居然是一个常数。这就把对黑洞的研究变成为一个非常简单的问题。不仅如此，由于$M_b \neq 0$, 和$m_{ss} \neq 0$, 所以M_b 和m_{ss} 也都不可能为无限大，因此二者都必定有其极限。根据宇宙中任何事物中，其部分不可能大于全体的公理，m_{ss}和 M_b在极限的情况下，最大的m_{ss} 只能等于最小的M_b。因此由**(1d)**可得出，

$$m_{ss} = M_b = M_{bm} = (hC/8\pi G)^{1/2} = m_p = 1.09 \times 10^{-5}g \qquad (1f)$$

公式 **(1f)** 就是本文中最重要、正确的最终结论。它本身就已经表明黑洞M_b和R_b的最终塌缩不是奇点，而是普朗克粒子m_p。由于时空在普朗克领域失去了连续性，广义相对论方程在普朗克领域失效，m_p 不可能再收缩为密度无限大的奇点。

本文是对霍金的黑洞理论的进一步发展，还得出来许多新观点和新结论。在科学上有这样的说法，最简单的往往是第一流的。本文的论证方法确实是最简单的。但是否能入流，顺其自然吧。[Academia Arena, 2010;2(7):39-63] (ISSN 1553-992X).

【关键词】。黑洞 (BH); 最小黑锅 M_{bm}; 奇点；恒星级黑洞； 普朗克粒子--m_p; 普朗克领域；霍金辐射—HQR; 广义相对论方程 (GTRE); 恒星级黑洞-; 宇宙原初小黑洞；

在本文中，只研究无旋转、无电荷、球对称的引力黑洞，即史瓦西黑洞。

【1】。不管黑洞的内部的状态和结构，只研究黑洞的各种物理参数在其视界半径R_b上的变化，黑洞由于发射霍金辐射使黑洞的视界半径R_b收缩和黑洞质量M_b减少。根据霍金黑洞量子辐射的温度公式，其最后的收缩结果推导如下，下面是霍金黑洞的温度公式，

$$T_b M_b = (C^3/4G) \times (h/2\pi\kappa) \approx 10^{27}gk \text{ [2]} \qquad (1a)$$

按照引力能转换为辐射能的阀温公式，将公式(1b) 用于视界半径 R_b 上，

$$m_{ss} = \kappa T_b /C^2 \text{ [2]} \qquad (1b)$$

再根据史瓦西对广义相对论方程的特殊解，

$$GM_b/ R_b = C^2/2 \text{ [1][2]} \qquad (1c)$$

从 (1a) 和 (1b), 很容易得出下式，

$$m_{ss} M_b = hC/8\pi G = 1.187\times10^{-10}g^2 \qquad (1d)$$

公式 (1d) 是黑洞的视界半径R_b上普遍有效的公式。既然$\mathbf{m_{ss}M_b}$为常数，那么$m_{ss}\neq 0$，$\mathbf{M_b}\neq 0$，而且$\mathbf{m_{ss}}$和$\mathbf{M_b}$都不可能是无限大。就是说，$\mathbf{m_{ss}}$和M_b都必定有个极限。同样，**在(1a)**式，$\mathbf{T_b\ M_b}$为常数，那么，$\mathbf{T_b}\neq 0$，根据热力学定律，$\mathbf{T_b}\neq 0$，所以$\mathbf{M_b}\neq 0$，所以 $\mathbf{T_b}$**和**M_b都必定有个极限。再根据部分不可能大于全体的公理。这个极限就是最大的m_{ss}等于最小的M_{bm}，即是$M_b = M_{bm} = m_{ss}$. 从(1d)可得，

$$M_b = M_{bm} = m_{ss} = (hC/8\pi G)^{1/2} = 1.09\times10^{-5}g \qquad (1e)$$

从量子引力论得知 $(hC/8\pi G)^{1/2} = m_p$，[3] 所以

$$M_{bm} = m_{ss} = (hC/8\pi G)^{1/2} = m_p = 1.09\times10^{-5}g \qquad (1f)$$

$$m_{ss}R_b = h/(4\pi C) \qquad (1g)$$

由上面（1f）式可见，黑洞收缩的最后结果就是就是M_b收缩成为最小黑洞M_{bm}并等于普朗克粒子m_p而爆炸消失在普朗克领域（Planck Era）：T--黑洞的视界半径R_b上的温度，m_{ss}—黑洞在视界半径R_b上的霍金辐射。 h—**普朗克常数** = $6.63\times10^{-27}g_*cm^2/s$，， C –-**光速** =$3\times10^{10}cm/s$,， G –-**万有引力常数**= $6.67\times10^{-8}cm^3/s^2{}_*g$, 波尔兹曼常数$\kappa = 1.38\times10^{-16}g_*cm^2/s^2{}_*k$，$L_p$—普朗克长度；$T_p$—普朗克温度；$R_{bm}$，$T_{bm}$分别是最小黑洞 M_{bm}的视界半径R_{bm}和视界半径上的温度T_{bm}；

由于 $(hC/8\pi G)^{1/2} \equiv m_p$[3]，现将最小黑洞 $M_{bm}=m_{ss}=m_p$ 的其它参数得出如下，

$$m_{ss} = M_{bm} = (hC/8\pi G)^{1/2} \equiv m_p \equiv 1.09\times 10^{-5}g. \qquad (1f)$$

$$R_{bm} \equiv L_p{}^{[3]} \equiv (Gh/2\pi C^3)^{1/2} \equiv 1.61\times 10^{-33}cm \qquad (1g)$$

$$T_{bm} \equiv T_p{}^{[3]} \equiv 0.71\times 10^{32}k \qquad (1h)$$

$$R_{bm}m_{ss} = h/(4\pi C) = 1.0557\times10^{-37}cmg \qquad (1i)$$

从上面可得出黑洞最主要的结论是：1。从公式**(1b)，(1c)看，无法判断**M_b，R_b，T_b，m_{ss}是否为 0 或者为∞，这正是广义相对论方程会出现“奇点”的原因。但是从**(1a)，(1d) 和 (1i) 3 式来看，**M_b，R_b，T_b，m_{ss} 4 个数中没有 1 个可以为 0 或者为∞，这就是霍金黑洞理论运用热力学和量子力学的结果。2。当一个黑洞在吞噬完外界的能量-物质后，会不断地发射霍金发射而不断地收缩R_b，和不断地减少M_b 增加温度T，直到最后收缩成为 $M_{bm} = m_{ss} \equiv m_p$而爆炸消失在普朗克领域。 3。 4 个公式(1a), (1b), (1c), (1d)就是 4 个黑洞参数M_b，R_b，T_b，m_{ss}在黑洞视界半径R_b上的守恒公式。它们规定了黑洞 4 参数在视界半径R_b上的准确数值，**这些数值与黑洞内部的状态毫无关系，不管黑洞内部的状态如何千差万别，相同值的M_b，R_b，T_b，m_{ss}的黑洞的性质是完全相同的。4。其实，黑洞的性质是极其简单的，就是在吞噬外界能量-物质时，M_b和R_b 增大，T_b 和m_{ss}减小。**反之，在发生霍金辐射时，$\mathbf{M_b}$ **和**$\mathbf{R_b}$ 减小，$\mathbf{T_b}$ **和**$\mathbf{m_{ss}}$**增大。毫无例外。相同值M_b，R_b，T_b，m_{ss}的黑洞，当增加或减少相同的能量-物质时，结果是得到相同的黑洞在视界半径上相同的值，即相同的黑洞。**

【2】. 黑洞霍金量子辐射的机理。下面先研究原始星云（original nebula) 因发射能量-物质的塌缩过程，在它塌缩成为一个黑洞后，他会跟普通黑洞一样发射霍金发射而继续引力收缩，其最后结果同样成为最小黑洞M_{bm}，即$M_{bm} = m_p = (hC/8\pi G)^{1/2} \equiv 1.09\times10^{-5}g$. 因此，这就表明黑洞发射霍金发射的收缩和星云以及一团普通物质因发射能量-物质而收缩的机理是同样的，没有本质的区别。**任何物体包括黑洞，只有在向外发射能量时，才会收缩，广义相对论方程的等质能量收缩是违反热力学规律和宇宙中的实际收缩过程的。**

假设一团星云中的质点 m_s 在质量中心距离 R 处的末端，而处于热动力的平衡状态，动力方程为，

$$dP/dR = -GM\rho/R^2 \ {}^{[3]} \qquad (2a)$$

$$P = n\kappa T = \rho\kappa T/m_s \qquad (2b)$$

$$M = 4\pi\rho R^3/3 \qquad (2c)$$

上面公式 (2b) 是气体或粒子的状态方程, (2c)是球体公式， P 是 m_s 在 R 处的热压力。M 是 R 球体内的总质量，ρ 是 R 内的平均密度, T 是 R 末端的温度,

一并运用(2a)，(2b), （2c），(1a), (1c) 公式，(1a), (1c) 是只能用于黑洞视界半径R_b上的。而(2a)，(2b),（2c）则可通用于R球体的各处，**当将(1a)，(1c)在黑洞视界半径R_b上的恒等式作为**(2a)的附加条件解出(2a)**时，就得出来黑洞在其视界半径上的解和各参数的值。**因此下面得出的M，R等就应该是黑洞的M_b, R_b等.

从 $P = \rho\kappa T/m_s = \kappa/m_s\times(3M/4\pi R^3)\times(C^3/4GM)\times(h/2\pi\kappa) = 3hC^3/(32\pi^2GR^3m_s)$,

$\therefore dP/dR = d[3hC^3/(32\pi GR^3m_s)]/dR = -(9hC^3)/(32\pi^2Gm_sR^4)$, $(\therefore dP/dR \propto R^{-4})$, （2d）

$-GM\rho/R^2 = -(GM/R^2)\times(3M/4\pi R^3) = -(3G/4\pi R^3)\times(M^2/R^2)$,

再从 (1c), $M_b/R_b = C^2/2G = M/R$.

$\therefore -GM\,\rho/R^2 = -3C^4/(16\pi GR^3), (\propto R^{-3})$ （2e）

将（2d），（2e）代人（2a），

$--(9hC^3)/(32\pi^2 Gm_s R^4) = -3C^4/(16\pi GR^3)$,

或者 $3h/(2\pi\, m_s R^4) = C/R^3$

$\therefore R = 3h/(2\pi Cm_s)$, 或者 （2f）

$\therefore$ **$Rm_s = 3h/(2\pi C) = 1.0557\times10^{-37}$cmg** （2f）

从（2f） (1c), 得出

$m_s\, M_b = 3hC/(4\pi G)$ （2g）

现比较公式 (1d) 和（2g），(1i)和（2f），可以看出只有在 $m_s = 6m_{ss}$时， (1d) ≡（2g），(1i) ≡（2f）. 为什么会有 $m_s = 6m_{ss}$? 因为在推导 (2a) 到 (2g)的过程中, 并不知道密度ρ 和温度 T 在R球体内的分布，而是采用其平均值，因而使得平均的值比起R的末端大 6 倍。因此，如果限令$m_s = 6m_{ss}$, 则，

$\therefore$ **$m_s = 6\, m_{ss}$, (1d) ≡（2g），(1i) ≡（2f）** （2h）

可见，星云塌缩成黑洞前向外发射能量-物质与黑洞发射霍金辐射的机理没有区别，而变成黑洞后的最后塌缩就是所有黑洞的最后塌缩结局。即回归为，

$m_{ss} = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{-5}$g.

分析和 结论：1*. 既然（2h）符合真实的黑洞与一般物资（星云）的塌缩情况，这就明显地证实公式 (1d), (1f) 和 (1i)的正确性. 这表明所有的塌缩都是由于不停地发射能量后，最终变成普朗克粒子 m_p，而在普朗克领域消失，而不可能成为奇点。

2*. 公式(2a)实际上就是简化的 **Tolman-Oppenheimer-Volkoff** 方程，[7] (2a) 中取消了 TOV 方程中的 3 个修正项. 当 (2a)合并 (1a), (1c) 和 (2b) 作为边界条件，得出(2f) 和 (2g) 的结果的正确性是可靠的。

3*. 可见，任何黑洞发射霍金幅射和恒星及星云发射能量粒子或者吸收能量粒子并没有本质上的区别，能量粒子都是从高能高温高位逃脱物体引力而自然地流向低能低温低位的结果。然而，人们在宇宙中能够见到的恒星级黑洞有很高的密度，很强的引力，它发射的霍金幅射能量非常微弱，但几乎能够吸入一般所有的能量-物质，所以看起来黑洞是贪得无厌的吸物星。例如, 一个 $5M_\theta$（太阳质量）的黑洞, 它发射霍金幅射能量 HQR时 $m_{ss} =10^{-44}$g. 而 10^{15}g的微小黑洞, 他发射霍金幅射能量是HQR = $m_{ss} = 1.66\times10^{--24}$g = 一个质子的重量.

4*. 为什么黑洞的霍金幅射 HQR 能够逃出黑洞呢? 正如粒子或者能量子能够从星星或物体逃出来一样，因为霍金幅射处于震荡状态，当其瞬时值小于黑洞视界半径 R_b 上的阀温值 κT 时，就表示他的瞬时能量值低于阀温，它就可以离开黑洞视界半径 R_b 而逃离出去。

5*。在（2f）式中，既然 **Rm_s为常数，所以 $R \neq 0$，** **$m_s \neq 0$。**所以 **R 和 m_s 都有极限。**

【3】。No. 1。黑洞的本质属性。一旦一个黑洞形成之后，直到他最后变成为最小黑洞$M_{bm} = m_p = (hC/8\pi G)^{1/2} = 1.09 \times 10^{-5}$g在普朗克领域爆炸消失之前，不管它是因吸食能量-物质而膨胀，还是因发射霍金幅射而收缩，它将永远是一个黑洞。就是说，黑洞跟宇宙中的任何事物一样，它在生成之后至死亡消失之前的期间，黑洞的本质不会改变。而且所有黑洞的消亡结果完全一样，毫无例外。

按照史瓦西对广义相对论方程的特殊解（1c），

$R_b = 2GM_b/C^2$, (1c)

$\therefore C^2 dR_b = 2GdM_b$

$C^2\,(R_b \pm dR_b) = 2G(M_b \pm dM_b)$ (3a)

假设有另外一个黑洞 M_{ba} 与黑洞 M_b 合并或者碰撞，

$C^2 R_{ba} = 2GM_{ba}$ (3b)

从 (3a) +（3b）+ (1c)

$\therefore C^2\,(R_b \pm R_{ba} \pm dR_b = 2G\,(M_b \pm M_{ba} \pm dM_b)$ (3c)

公式 (3c)清楚地表明任何一个黑洞不管它是吸食能量-物质而膨胀，还是因发射霍金幅射而收缩，它永远只是一个不同质量的黑洞。

黑洞与黑洞的碰撞和合并—小黑洞吞噬大黑洞：当两个黑洞M_{b1} 和M_{b2} 发生碰撞和合并时，虽然较小的黑洞M_{b1} 由于其T_{b1} 温度较高而向大黑洞发射少量的霍金辐射m_{ss1}，但由于m_{ss1} 很小，而大黑洞M_{b2} 内有大量大于m_{ss1} 的能量-物质粒子会被黑洞M_{b1} 吞噬而膨胀。大黑洞M_{b2} 也会因内部有小黑洞M_{b1} 而扩张。最后当小黑洞M_{b1} 吞噬完大黑洞M_{b2}所有能量-物质后。二者就会完全合并成一个更大的黑洞，这个新黑洞的质量 = $M_{b1} + M_{b2}$，而其视界半径 = $R_{b1} + R_{b2.}$ 新黑洞的归属如上面的A或B.

在 1998 年，美国和澳大利亚的 2 组科学家在观测遥远的 Ia 型超新星爆炸时，发现我们宇宙在加速膨胀。许多科学家将宇宙加速膨胀的原因归结于宇宙中存在现在无法察觉的“暗能量”，说暗能量具有排斥力和负能量。作者以公式 (3c)为基础和依据，推测宇宙的加速膨胀，在于我们宇宙黑洞早期与与另外一个黑洞宇宙相碰撞的结果。[4]

【4】。**No. 2** 黑洞的本质属性。不管黑洞的内部状态和构造如何复杂和变化，它都影响不了黑洞视界半径R_b上的状态和性质，也就是影响不了黑洞视界半径R_b上的状态参数R_b ,T_b, m_{ss}的变化，只有黑洞质量M_b通过视界半径R_b而流入流出而增加或减少时，黑洞视界半径R_b上的状态参数R_b ,T_b, m_{ss}才因M_b的改变而变化。所以，从这个意义上来说，黑洞是宇宙中最简单的物体。

黑洞的简单性还表现在黑洞视界半径R_b上的各个参数之间只有相同的、单值的、线性的、唯一的简单关系。它们都服从公式(1a), (1b), (1c), (1d)。从这 4 个公式来看，任意 2 参数之间的关系都是 4 个自然常识 C,G, κ.h,的某种简单组合。一旦知道了黑洞的质量M_b，或者其它的任何一个参数R_b ,T_b, m_{ss}，其余的所有参数也就完全知道了。显而易见，所有质量M_b或者任意其它的参数相同的黑洞，在视界半径R_b上的各个参数值都是相同的，并有完全相同的黑洞属性。这个具有深刻意义的现象似乎表明我们宇宙本身与黑洞具有同一性。所以从逻辑和自然观上去推测我们宇宙就是黑洞是难以否定的。因为4 个个自然常识C,G, κ.h,就是我们宇宙存在的身份证。这也就是说，解决黑洞问题根本就不需要广义相对论方程，它是麻烦的制造者。奇点是广义相对论方程硬塞给黑洞的一颗炸弹。根据公式(1a), (1b), (1c), (1d)，所以有下面的公式，

$$M_b \propto R_b \propto 1/T_b \propto 1/m_{ss} \qquad (4a)$$

由于 $m_{ss} \neq 0$，有极限， $T_b \neq 0$，有极限。所以 M_b 和 R_b 都不为 0，而有极限。

【5】。**No. 3** 黑洞的本质属性。**黑洞不停地吞噬外界能量-物质或者发生霍金辐射是黑洞的另一本质属性。**正如任何星体对外发生能量或者粒子并同时吸收外界的能量或者粒子的机理是完全相同的。自由状态的辐射或粒子总是由高能高温流向低能低温，黑洞也不能违反这种自然规律。

视界半径R_b是黑洞的边界。能量-物质的吸入和流出只能通过视界半径R_b。由于黑洞霍金辐射的是量子，是热辐射，因此，它们有震荡，没有瞬时的确定值，只合乎统计规律。所以霍金辐射（HQR）在黑洞黑洞的视界半径R_b上是不稳定的。**黑洞在R_b上的阀温值$m_{ss}C^2$ = κT_b只表示当m_{ss}= κT_b /C^2时，m_{ss}能够在R_b上达到引力与热应力的平衡。但是实际上，由于m_{ss}的瞬时值可能稍大于或者小于T_b值，而T_b值是由的黑洞质量M_b所准确决定的。所以，当m_{ss}的瞬时温度稍小于T_b值时，它就会稍微离开R_b而暂时流浪在黑洞外边，但是在它离开的瞬时，黑洞因为失去一个m_{ss}而减少质量、R_b收缩和提高温度T_b。这样，黑洞视界与外逃的m_{ss}的能差就扩大了，m_{ss}就再也回不到黑洞里去了，这就是黑洞发射霍金辐射m_{ss}的机理。**

由于黑洞在不停地吞噬进或者发射出能量-物质，所以黑洞的视界半径 R_b 总是在不停的震荡，即不停地扩大或者缩小，并且用其扩大或者缩小的量精确地记录着进入或者流出黑洞的能量-物质的数量。黑洞发射的霍金辐射是能量，**而吞噬的物质也会通过视界半径 R_b 将物质转化为相当的能量。**

可见，**黑洞的视界半径R_b是黑洞的能力开关个记录器。**

1*. 当霍金辐射 m_{ss} 的瞬时温度<T_b**而>外界温度，或者** m_{ss}< κ T_b /C^2 **时，**m_{ss} 就会逃出黑洞的 R_b，黑洞会由于失去 m_{ss} 而收缩，并不停地发射霍金辐射而不停地收缩，直到最后收缩成为等于普朗克粒子的最小黑洞 $m_p = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{--5}$g 而爆炸消失在普朗克领域。

2*.当外界粒子m_o > m_{ss}，或者外界温度高于黑洞视界半径R_b上的阀温T_b**时，外界的能量粒子就会被**黑洞吞噬，黑洞就会增加质量降低阀温和扩大视界半径R_b，而与外界的能量差距愈来愈大，会不停地吞噬完外界所有的能量-物质，然后转变为不停地发射霍金辐射而收缩，直到最后收缩成为最小黑洞$m_p = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{--5}$g而爆炸消失在普朗克领域。

3*. 当外界 $m_o = m_{ss}$ 或者 $T_o = T_b$时，由于外界相应的能量粒子往往多于黑洞所能发射出的，所以黑洞开始就成为不停地吞噬外界的能量粒子，直到吞噬完为止，然后再不停地发射霍金辐射而收缩，直到最后成为 $m_p = M_{bm} = (hC/8\pi G)^{1/2} = 1.\,09 \times 10^{--5}$g 而爆炸消失在普朗克领域。

由此可见， 由于黑洞内部的强大引力场，黑洞好像绝对黑体。因此，当黑洞视界半径 R_b 内的粒子的质量大于阀温的 m_{ss} 的粒子时，这些粒子是不可能成为霍金辐射而逃出黑洞的。换句话说，黑洞的霍金辐射只会发射等于和小于 m_{ss} 而在 R_b 上的能量和粒子。同理，黑洞只会吞噬外界高于阀温和质量大于 m_{ss} 并在 R_b 外附近的能量和粒子。至于向黑洞飞奔过来的粒子，不管其质量大于或者小于 m_{ss}，黑洞会完全吞噬。一个太阳质量的黑洞 $M_{\theta b}$ =2×10^{33}g，其视界半径 $R_{\theta b}$ = 2.96×10^5cm, 而 $R_{\theta b}$上的阀温温度 $T_{\theta b}$= $0.4\times10^{--6}$k, 与其阀温相对应的粒子质量仅仅是，$m_\theta = 0.6\times10^{--43}$g.

可见，$m_{\theta s}$ 是非常小的能量粒子，因此，这个不大的太阳质量的黑洞 $M_{\theta b}$ 几乎可以吞噬其邻近的任何低能量-物质。这就是黑洞可以几乎吞噬任何能量-物质的原因。

根据霍金黑洞发射能量率公式，

$dE/dt \approx 10^{46} M^{-2}$ erg/s,[2] **(5a)**

假设黑洞质量$M = M_\theta = 2\times 10^{33} g = M_\theta$，$dE/dt \approx 10^{-20}$ erg/s, 一个太阳质量(M_θ)的黑洞，它现在发射的$m_{ss} = 1.187\times 10^{-10}/(2\times 10^{33}) = 6\times 10^{-44} g$，大约需要 10^{65} 年的时间才能最后爆炸消失在普朗克领域。

由上可见，霍金的黑洞理论和公式都是正确的，计算出来的数据是符合实际的。但霍金本人和绝大多数科学家都用真空出现“虚粒子对”来解释黑洞的量子辐射（HQR）是在以新物理概念来故弄玄虚，来忽悠无知的大众。他们说，真空是虚粒子的海洋，“虚粒子对”可以随时出现和湮灭。黑洞视界半径R_b上的粒子对中的虚粒子与真空中的正粒子湮灭后，黑洞的实粒子就跑到黑洞的外面与负粒子结合，于是黑洞就失去一个粒子，而成为霍金辐射。这种拐弯抹角经不起推敲的解释也许永远不可能为观测和实验所证实。霍金辐射中的m_{ss}和T_b都是根据公式$m_{ss}C^2 = \kappa T_b$严格地、随时为黑洞质量M_b所确定，真空中“虚粒子对”的能量或温度怎么能正好准量、准地、准时与黑洞视界半径R_b上的粒子对中的虚粒子对等地配合而互相湮灭呢？因此，只有作者前面的解释是简明、准确而合理的。

【6】。No. 4 黑洞的本质属性。任何黑洞在吞噬完外界的能量-物质后，因外界已几无能量-物质而近乎真空，即使有少许能量-物质，其温度和能位已低于黑洞视界半径R_b上的$m_{ss}C^2$ 和 κT_b。**因此往后**黑洞只能不停地向外发射霍金辐射，直到最后收缩成为最小黑洞M_{bm} 等于普朗克粒子m_p，而立即爆炸消失在普朗克领域。**现在论证一下为什么在$m_p = M_{bm}$时，会必然在普朗克领域爆炸而消失呢。**按照公式（1f），

$m_{ss} = M_{bm} = (hC/8\pi G)^{1/2} \equiv m_p \equiv 1.09\times 10^{-5} g$ （1f）

1*. 按照黑洞视界半径R_b上的守恒公式（1f），**如果M_{bm}再继续收缩，**就必然使得m_{ss}和 M_{bm}都小于$(hC/8\pi G)^{1/2} \equiv m_p \equiv 1.09\times 10^{-5} g$，这是违反公式（1e）和（1f）的，**是不可能存在的。**

黑洞的收缩因为要遵循其黑洞的 **4** 个守恒公式，这几个守恒公式中没有一个参数可以趋于 **0** 而导致另外一个参数发散成为无限大，所以不可能收缩成为“奇点”。再比如(1g)式中，**$Rm_{ss} = h/(4\pi C) = 0.176\times 10^{-37}$cmg** 。**$m_{ss}$**不可能为 **0**，因为**$m_{ss} = \kappa T_b/ C^2$**，根据热力学定律，**$T_b$** 不可能为 **0**，所以 **R** 就不可能成为无限大，而在最大的**$m_{ss} = M_{bm} = 1.09\times 10^{-5}$ g**时，其最小的**$R_{bm} = 10^{-33}$cm.**

2*. 一旦 **M_{bm} 达到 1.09×10^{-5}g,** 整个黑洞的能量 **$M_{bm} C^2 = 10^{16}$erg**，而其霍金辐射能 **$m_{ss} = \kappa T_b = 1.38\times 10^{-16}\times 0.71\times 10^{32} = 10^{16}$erg** 。即是,

$M_{bm} C^2 = \kappa T_b = 10^{16}$erg (6a)

$M_{bm} C^2/ \kappa T_b = 1$ (6b)

可见，**M_{bm}** 已经整体成为一个能量粒子，根本没有多一点引力能量转变为霍金辐射能 **m_{ss}，因此，只有将整体爆炸成高能的粉末 γ–辐射能。**

3*. 由于**$M_{bm} \equiv m_p$ 达到 1.09×10^{-5}g**时，其温度已经达到宇宙的最高温度 **10^{32}k，这样一个整体内部没有引力而无法收缩的粒子，在此 10^{32}k 的高温下，只能爆炸解体。**

4*. 按照量子力学的测不准原理**-- Uncertainty Principle**，

$\Delta E \times \Delta t \approx h/2\pi$ (6c)

对于 **M_{bm}, 其 $\Delta E = M_{bm} C^2 = \kappa T_b = 10^{16}$erg, 其$\Delta t$ =** 康普顿时间**-- Compton time = $R_{bm}/C = 1.61\times 10^{-33}/3\times 10^{10} = 0.537\times 10^{-43}$.**

$\Delta E \times \Delta t = 10^{16}\times 0.537\times 10^{-43} = 0.537\times 10^{-27}$, 但是 **$h/2\pi = 6.63\times 10^{-27}/2\pi = 1.06\times 10^{-27}$,**

非常明显，**$\Delta E \times \Delta t < h/2\pi$, ，** 这违反了**Uncertainty Principle.** 因此, **M_{bm} 不可能存在，只能爆炸解体消失在普朗克领域，根本不可能继续塌缩成为奇点。**

一些简单而明确的结论：

1*。所有的黑洞最后都会发射霍金辐射 **m_{ss}**$= \kappa T_b/C^2$ 而收缩蒸发下去，只不过大的黑洞由于 T_b 很低，所以沸腾得较慢，它们的辐射非常微弱，因此令人难以觉察。但是随着黑洞逐渐变小，这个过程会加速，以至最终失控。黑洞收缩时，在其视界半径上引力虽然会变大，但热压力增加的更大。因此会产生和排斥出更多更重的逃逸粒子，从黑洞中带出去的能量和质量也就越多。黑洞反而收缩的越来越快，促使蒸发的速度变得越来越快，当黑洞质量减少达到 **$M_{bm} \approx 10^{-5}$ g** 时，因 **M_{bm} 等于普郎克粒子 m_p** 而达到普郎克量子领域，**温度达到 $T_{bm} \approx 0.71\times 10^{32}$k，黑洞就会在普郎克量子领域中爆炸毁灭，由辐射自己的质量而完全蒸发掉。**因为 **M_{bm}** 已经成为一个完整基本粒子 m_p。

2*。广义相对论在普郎克领域失效的根本原因：按照广义相对论，物质粒子之间的引力是绝对存在的，可以收缩小到任何尺寸，甚至到无穷小的尺寸，如果真实世界的物质粒子间的距离可以无限小地收缩下去，当然会达到 “奇点”。当黑洞收缩到$M_{bm}\approx10^{-5}$ g最小黑洞的普郎克尺寸时，其所有物质的引力能都会因爆炸解体而变成为许多的高温热能的量子分散在普郎克空间，它们之间的引力或许变成不连续和不确定的了，或许因引力微弱而不能对抗其热排斥力而无法重新聚集在一起再继续塌缩下去了。**所以普郎克尺寸就是广义相对论所能达到的最小极限尺寸。在小于等于此尺寸的领域，广义相对论无效。广义相对论可以宣告牛顿力学在接近光速运动时失效。而黑洞量子理论也就宣告广义相对论在普郎克领域失效。**现在尚只从理论的推论知道黑洞收缩到最后能进入普郎克领域，除此之外，现代科学对普郎克领域还知之甚少。未来人类也未必能观测到普郎克领域的物质结构及其运动状态。人类对宇宙和物质的认知有无极限？

3*。. 既然所有黑洞的最后命运是塌缩成为$M_{bm}\approx10^{-5}$ g 的最小黑洞而爆炸消亡，而不是塌缩为“奇点”，那么，坚持根据广义相对论的数学公式推演到极端而存在“奇点”的结论的学者们就是非理性的，“奇点”只能由上帝创造。他们只不过是维护自己对广义相对论的信仰而已，很明显，**广义相对论在微观的普郎克量子领域是失效的。**在真实物理世界中，物质的引力塌缩会受其内部出现结构和运动状态的改变，这就是相变（临界点），而阻止塌缩成为“奇点”。**物体进入普郎克领域的实质就是发生“相变”。**统一微观世界与宏观世界的终极理论和数学方程也许超越人类的认识能力的范围。**所有新物理观念的终极理论，如果不采用“点结构“，比如弦论膜论等，虽然能够避免“奇点”的出现，但是如果其中没有热力学的作用，它们都不太可能成功。因为它们与真实的物理世界无法发生因果联系。**

4*。当所有的黑洞最后收缩而分裂至 $M_{bm}\approx10^{-5}$ g 时，就到达了 Planck Era 而量子化，其湮灭的时间应符合康普顿时间，在此领域， “量子效应将起作用，时间将不可能准确地测量出来，经典的引力和时空概念失效。”[3] [5]，也就是说，广义相对论到此就已失效。更不可能收缩到广义相对论中称之为现有物理定律所无法了解的“奇点”。[5] 同时，因为 $M_{bm}\approx10^{--5}$ g 整体是一个 10^{32} k 的宇宙中最高温的能量粒子，它内部因无引力发不出 m_{ss} 而无法再收缩，从而只能在最高温的辐射压力下爆炸粉碎消亡。

既然最小黑洞 $M_{bm}\approx10^{-5}$ g 的整体已是一个基本粒子，那么，它的整体温度就是 T_{bm}, $T_{bm} = 0.71\times10^{32}$k,因此，可以估算出它的热压力 P_{mb} 已达到，

$$P_{bm}=\rho_{bm}\kappa T_{bm}/M_{bm}=6.4\times10^{92}\times1.38\times10^{-16}\times0.71\times10^{32}/10^{-5}=6.36\times10^{113}=10^{107}\text{atm} \quad (6d)$$

【7】，物体的温度压力和结构（密度）对引力塌缩的对抗：在真实的物理世界，对抗物质引力塌缩的只有 2 种东西，一是物体内部结构所产生和保持的温度和压力，另一种是物体的稳定的结构即其一定的密度。

所有宇宙中独立存在的实体，特别是能够较长期存在的个体，其内部结构都存在对抗自己引力塌缩的机制，即其内部的引力与斥力，塌缩力与其对抗力能够达到较长期的平衡和稳定的结果，各种星体和黑洞也不例外。物体和各种能量粒子团的本性表明：在其体积收缩时所增强的热压力是引力如影随形的对抗力量，因此，只要能够保持其热量不流失和温度不降低，它就不会收缩。其次，物质的结构之间的结合力和其组成的粒子之间的不相容也对抗着引力的收缩，即以特定密度下结构对抗其收缩的引力。黑洞在宇宙中长期存在的事实就表明其内部斥力与引力达到了极好的平衡，所以能保持长期的稳定存在，这就否定了黑洞内部具有无法平衡的无穷大密度的物理量的“奇点”存在的可能。

质量小于 10^{15}g的物体中，其氢原子的数目$n_p < 10^{15}/1.67\times\mathbf{10^{-24} =10^{39}}$**.** 由于物质量小，所产生的引力往往能为该物体的外层电子结构（即化学结构）所承受，而形成不改变结构的热胀冷缩，因而可以没有一个较坚实的核心。

在宇宙中独立存在和运行的物体都有较大的质量。一个典型的慧星质量也有大约 10^{15}g.太阳的质量 $M_\theta =2\times10^{33}$g，这些大质量的星体为了阻止外层物质向中心的引力塌缩，用三种方式共同对抗外层物质向中心的引力塌缩。

1*。质量大于 10^{15}g，而小于 0.08 M_θ质量的行星：其中心都有密度较大温度较高的较坚实的核心。它一方面承受外围物质压力以对抗引力的塌缩，一方面又维持对外围物质的足够引力使其不会逃离出去，以保持该物体的整体的稳定性。这种气体或者固态行星的中心多为固态或液体的铁所形成较坚实核心以平衡和对抗外围物质的引力塌缩.

2*。质量大于 0.08 M_0 天体会成为恒星：这类恒星能够点燃其中心的核聚变，只要核聚变所提供的热能能够保持住中心的高温高压不下降，就能长期地对抗物质向其中心的引力塌缩，

太阳和正在其中心进行核聚变的所有恒星，都是用其中心核聚变所提供的高能量以维持其内部的高温高压，能量向外辐射的流失与核聚变供给的能量的平衡能长期地对抗其引力塌缩达到数亿年至百亿年之

久。最后，只有当氢被耗尽时，内核收缩，包层膨胀形成巨大红色星球--红巨星，再过几千年后，它们将坍缩成一个逐渐冷却的白矮星。

太阳内部稳定的状态使得我们能够估算出太阳中心的压力 **P_s:** 太阳中心密度 $\rho_s \approx \mathbf{10^2 g/cm^3}$**,** 太阳中心温度 $T_s \approx \mathbf{1.5}\times10^7$k,

$P_s = \rho_s\, \kappa T_s/m_p = 10^2\times\mathbf{1.38}\times10^{-16}\times\mathbf{1.5}\times10^{7}/1.67\times10^{-24} \approx 1.5\times10^{11}$ atm. （7a）

这就是说，太阳中心的压力 P_s 是地球表面压力的 1.5×10^{11} 倍。

3*。 不同质量的致密天体结构内，粒子之间的泡利不相容原理能够对抗其内部物质塌缩成为“奇点”：宇宙原始星云含有 3/4 氢，只要其质量 $M > 0.08\ M_0$, 它们就能靠自己引力的收缩达到大约高于 10^7k 的高温以点燃其中心核聚变, 从而长期对抗其引力收缩. 等到所有氢燃烧完毕时, 在通过红巨星或者新星超新星爆发之后, 它的余烬（星核）M_r 的塌缩根据其质量的大小会形成不同的结果: 白矮星, 中子星, 黑洞或成为一团尘埃. **大致上来说原始质量小于 3.5 M_0 的恒星，其余烬可能变成为白矮星[9]。质量在（3.5 ~ 8） M_0 之间的，可能成为“中子星”[9] 质量 大于 8 M_0 倍或更大的恒星，可能最终将塌缩成为“黑洞”。[9] 但还有多种不同的说法，尚无共识。**

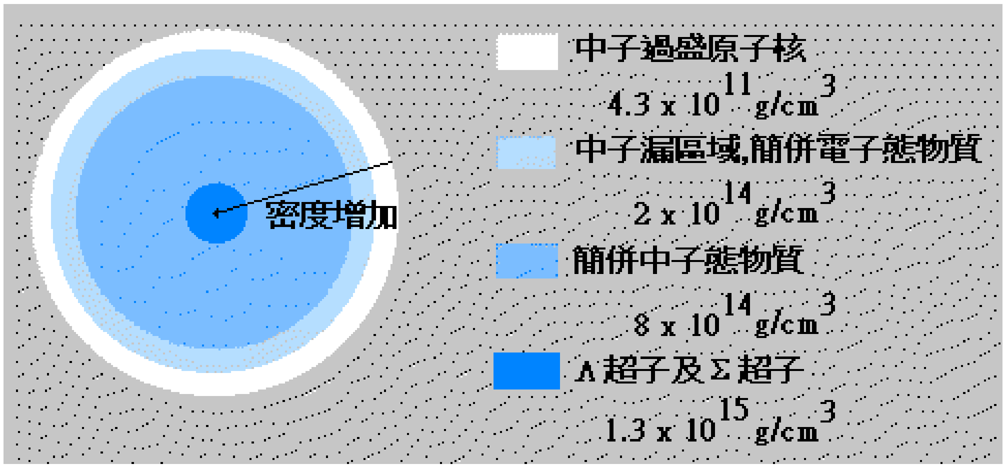
4*. 白矮星: 白矮星的质量M_w, 当老年原始恒星演变到最后阶段，它的余烬（星核）**$M_r < 1.44\ M_0$, ，会成为白矮星**.这就是**钱德拉塞卡极限**.

白矮星的表面温度T_w≈10000k。**M_w --**白矮星的质量；**ρ_w--**白矮星的核心密度；**d_w--**白矮星的核心质子之间的距离；**n_w--**白矮星核心 **每cm^3的质子数；**

$\rho_w \approx 10^6 g/cm^3$，$d_w \approx 1.2.\times10^{-10}$ cm, $n_w = 10^{30}$ 个/ cm^3. $M_w < 1.44M_0$ (7b)

原子核的直径d_a尺寸大约是10^{-13} cm，所以在白矮星内部，原子与原子之间尚有不小的空隙与距离，使电子脱离了原子轨道变为自由电子，这些空隙间成为充满电子的海洋。**由于电子间泡利不相容原理而产生的“斥力”能抗衡住核心外物质万有引力的塌缩,** 形成中心密度为$10^6 g/cm^3$ 左右的白矮星。但是白矮星是非常稳定的，释放能量以降低温度和冷却极其缓慢，经过数千亿年之后，白矮星才会冷却到无法发光，成为黑矮星。但是目前普遍认为宇宙的年龄（137亿年）不足以使任何白矮星演化到这一阶段。如白矮星有伴星而形成密近双星时，白矮星会从其伴星中吸取物质，**当白矮星的质量增大到1.44 M_0接近钱德拉塞卡质量极限时，会成为碳-氧白矮星通过聚变中心的碳和氧所引发的热核爆炸能产生Ia型超新星大爆炸，而可能将整个白矮星炸得粉碎而抛掷空中。**

5*. 中子星: 中子星质量M_n的下限$M_n > 0.1\ M_0$，M_n的上限M_n =（1.5~2）M_0，当超新星爆发之后，它的余烬（星核）**$M_r > 1.44\ M_0$而超过钱德拉塞卡极限，即M_r =（1.5 ~ 2）M_0时，会成为中子星。**由於中子星表面是固體,很有可能是固態鐵。中子星的构造分为4层，其密度由外层到中心核的密度大致是 **$\rho_n \approx 5\times10^{11}$~ 5×10^{15} g /cm^3**,相应地原子之间的距离d_n≈**1.2**×10^{-13} cm = 原子核的直径，**所以在中子星内，原子核是紧紧地挤在一起没有任何“真空”留下了。电子不再可以在原子核外活动，而是被挤进核内使质子变成为中子。特别是其核心的核子因能量的增高已成为超子的海洋，能够承受外层物质的引力塌缩。**最大中子星的直径大约为33公里。



中子星的结构图(圖: LKL Astro-Group) [13]

中子星**M_n**的一些状态参数如下：

$M_n = (1.5\sim2)M_0$, $\rho_n \approx 10^{14}\sim5\times10^{15} g/cm^3$, $d_n \approx 1.2\times10^{-13}$ cm, $n_n = 10^{39}$ 个/cm^3. (7c)

中子星的表面温度$T_n \approx 10^7$ k, 因此，其表面的热压力P_n估计大到：

$P_n = \rho_n T_n \kappa/m_p = \mathbf{10^{15}} \times 10^7 \times 1.38 \times 10^{-16}/1.67 \times 10^{-24} \approx 10^{24}$atm.

这就是说，超新星的爆炸力 $P_n \approx 10^{24}$atm一方面会压缩恒星的星核成为中子星，另一方面将其外壳以极高的速度炸飞而抛向外空。由于P_n过高造成的不稳定，使其高速旋转而快速释放能量-物质，快速降温变为冷星。 而1.3 M_θ ~2M_θ中子星不太可能自己塌缩成为黑洞，因为其外层温度非常高，旋转非常快，无法向内塌缩，而核心虽然密度高，但质量小，不可能在核心形成黑洞。**中子星只有在在吸收其大质量伴星的物质后，如果质量超过奥本海默-沃尔科夫极限，即$M_n \geq 3M_\theta$时, 中子间的“泡利斥力”顶不住万有引力的作用，将继续坍缩而成为夸克星，或者成为黑洞。**如果中子星外部没有伴星的物质可供吸收，就不会增大，而在快速降低温度后而成为一个黑星。

6*. $M_b \approx$（1.9 ~15~50）M_θ的恒星级黑洞的形成：

第一. 原始质量 ＞ 8 M_θ倍的恒星在超新星爆发之后，只有当它的余烬（星核）$M_r \geq 3M_\theta$ (奥本海默-沃尔科夫极限) 时，M_r才有可能会塌缩成为一个 ＞ $3M_\theta$的恒星级黑洞。 “伍德介紹，形成黑洞有兩種方式，一是質量非常大的恆星爆炸後產生黑洞，二是兩個中子星合並後形成黑洞。基本上可以認為有兩種不同類型的黑洞，一類是質量相當于太陽質量3～50倍的小黑洞，另一類是質量相當于太陽質量100萬～10萬億倍的大黑洞。”[11] “质量介于两者之间的黑洞是否存在，科学家们一直有争议。但近来美国密歇根大学的研究人员在《天体物理杂志通信》上发表论文说，位于双鱼座“梅西尔74”(M74)星系的一个黑洞，其质量可能相当于1万个太阳，远远大于恒星级的黑洞，但比“超级黑洞”小得多，符合中等质量黑洞的标准。

第二. 从理论的计算来看，**黑洞 $M_{bh} \approx 1.9\ M_\theta$ 是可能达到的恒星级最小黑洞，但它是极难出现和存在的：**从上面中子星的结构图可见，其核心已被压缩成为超子（另一种说法是固态中子）。只是由于这个核心的质量较小，而不能形成黑洞。取中子星核心的密度 $\rho_n \approx 5 \times 10^{15}$g/cm^3. 现求具有如此密度 $\rho_b > \rho_n \approx 5 \times 10^{15}$g/cm^3 的黑洞应当具有的质量 M_{bh}。按公式(1e)和(1f),

$$R_b = C[3/(8\pi G\rho_n)]^{1/2} = 0.189 \times 10^{-4}C， \quad \therefore M_{bh} \geqslant R_b C^2/2G \approx 3.8 \times 10^{33} \approx 1.9\ M_\theta, \qquad (7d)$$

“美宇航局戈达德太空飞行中心天文学家尼古拉·沙波什尼科夫及同事在加州洛杉矶举行的美国天文学会高能天体物理分会的会议上公布了这一发现。**这个“小”黑洞的代号为XTE J1650-500，现这个黑洞的质量仅仅是太阳质量的 3.8 倍**，比之前保持着最小质量记录的黑洞小了不少，它是太阳质量的 6.3 倍。那么最小黑洞的质量究竟有多少？按照天文学家估计，**应是太阳质量的 1.7 倍至 2.7 倍。**比这还小的天体只能是中子星了。找到迫近这一下限的黑洞，有助于物理学家更好地理解物质在这种极端环境下被碾碎时的表现.”[8]

第三. 恒星级黑洞$M_b \approx$（2 ~3）M_θ的形成：由于现在在宇宙中尚未观测到这种级别的恒星级黑洞，很难以判断其形成的机制。很有可能是大质量恒星在超新星爆炸后，形成双中子星或其它密近双星系统而后碰撞塌缩变成$M_b \approx$（2 ~3）M_θ的恒星级黑洞。

第四。夸克星：也许中子星在冷却后能逐渐吸收外界物质或与其伴星碰撞和降低温度后，可能先成为夸克星而后有可能再塌缩成为黑洞，现在已观测到在宇宙中或许存在着几个夸克星，如超高密度星 RX J1858–3754，但其寿命不会很长，这也许是在宇宙空间很难找到夸克星的原因。它一方面会吞噬外界能量-物质，另一方面，它也无足够大的引力禁锢其外层能量使其不致流失而保持温度。因此夸克星有可能会吞噬其伴星与外界能量-物质和降低温度而塌缩成为黑洞，当然也有可能在无外界能量-物质可被吞噬的情况下向外抛射能量-物质而最后消亡。

第五. 中子星与恒星级黑洞的比较:（a）。中子星和黑洞的重要不同之處,是中子星有一個固体表面，**核心是超子**。而黑洞則沒有固体表面. (b). 中子星的逃逸速度约为光速 0.8C。 而黑洞的逃逸速度为光速 C. (c).中子星的表面温度非常高，热压力非常大，旋转非常快，辐射 χ 射线、γ 射线和和可见光，黑洞的表面温度低，旋转慢。 (d). 中子星的典型质量为（1.5~ 2）**M_θ，恒星级黑洞的质量按照现有的观测从 3.8 M_θ~15 M_θ，有可能达到 50M_θ，因为最近发现了质量≈150 M_θ 的巨型恒星。**

1.75 M_θ 的中子星与黑洞的比较： “Strohmayer 所发现的中子星属于恒星系 EXO 0748-676 的一部分，坐落在南半球天空的飞鱼星座，离地球有 30000 光年的距离。这颗中子星的半径约为 7 英里（11.5 公里），质量约为太阳的 1.75 倍。”[12], 该中子星的质量 $\mathbf{M_{n1.75} = 1.75\ M_\theta = 3.5} \times 10^{33}$g，则其它的参数值计算是，

$$\mathbf{M_{n1.75} = 1.75\ M_\theta = 3.5} \times 10^{33}\text{g},\ R_{n1.75} = 11.5 \times 10^5\text{cm},\ \rho_{n\,1.75} = 5.5 \times 10^{14}\text{g/cm}^3, \qquad (7e)$$

设一个黑洞的质量 $\mathbf{M_{b1.75} = 1.75\ M_\theta = 3.5} \times 10^{33}$g，相应地各参数值计算是，

$$\mathbf{M_{b\,1.75} = 1.75\ M_\theta = 3.5} \times 10^{33}\text{g}，R_{b1.75} = 5.16 \times 10^5\text{cm}，\rho_{b1.75} = 5.75 \times 10^{15}\text{g/cm}^3， \qquad (7f)$$

由此可见，$\mathbf{R_{b1.75} = 1/2\ R_{n1.75},\quad \rho_{b1.75} = 10\ \rho_{n1.75}}$， (7 g)

7*。. 进一步的分析和结论，恒星级黑洞内部不可能出现“奇点”：

第一；在真实的宇宙物理界，宇宙本身就是一个宇宙黑洞。[18]无论是白矮星中子星和恒星级黑洞的形成都是由于恒星内部核聚变到最后，当氢燃烧耗尽时，所产生的爆炸或新星或超新星爆炸对其核心（余烬）产生巨大的内压力使其塌缩而成。这些致密星体形成和能长期稳定地存在本身，就表明靠巨大星云物质自然的引力塌缩后的新星或超新星爆炸只可能塌缩出现有宇宙中最大密度约为 $5 \times 10^{15} g/cm^3$ 的（3.8~50）M_θ的小恒星级黑洞。在这些恒星级黑洞内部，已经没有再产生核聚变的条件，不可能出现密度更高的更小黑洞，怎么可能再出现奇点呢？万一有我们尚不知道原因在其内部塌缩出小黑洞，因为它们有极长的寿命。所以只能吞噬其外界周围的能量-物质而膨胀和降低密度，最后与原黑洞合而为一。

第二；目前在宇宙中所观测到的恒星级黑洞的质量从（3.8 ~15）M_θ，其相对应的密度为从 $10^{15} g/cm^3$ ~ 8×10^{13} g/cm^3.这就是说，恒星级黑洞的密度与中子星的密度几乎是相同的，即内部都是超子。只不过比中子星稍大的黑洞内部的超子比中子星内多许多而已。因此，黑洞内部一定不会按照广义相对论的极端要求而产生“奇点”。中子星的核心的密度高到使核子已变成超子而无法塌缩成为黑洞，这证明超子之间的泡利不相容原理具有极其强大的对抗引力塌缩的能力，因为两个超子之间的距离小于 0.8×10^{-13}cm时核力表现为斥力。[17]。加上黑洞内在几乎不向外泄露辐射热能的条件下应比中子星能更有力地对抗其内部引力塌缩，没有什么力量使其塌缩成为奇点。由(7g)式可知，如果有 1.75 M_θ的黑洞存在，其密度也不过是等于中子星核心的密度$\rho_n \approx 5 \times 10^{15} g/cm^3$，而 1.75 M_θ的黑洞的寿命约为 10^{66}亿年，比中子星的寿命更长得多，这表明黑洞比中子星更加稳定. 中子星的核心是超子，而没有出现“奇点”，同样是更多有超子而更稳定更长寿命的黑洞内更不可能反而出现“奇点”。更何况现在在宇宙中找到的最小黑洞只是 3.8 M_θ，其平均密度比 1.75 M_θ的黑洞已经降低 4 倍而约为 $10^{15} g/cm^3$，就是说，其核心可能已不是超子而是中子和质子了，其内部更不可能出现奇点，而比 3.8M_θ更大的恒星级黑洞因其密度更低，就更无可能在其内部塌缩出来奇点.

第三.；既然黑洞在吞噬完外界能量-物质后，时刻都在因发射霍金辐射而收缩其视界半径，这说明黑洞内部空间不是如广义相对论所说的真空，不是内部空间的所有能量-物质都集中到其中心的“奇点”，而是充满能量-物质。只有这样，黑洞的视界半径收缩到任何尺寸时，才都会有霍金辐射发出。

第四；只要能够保持住物质物体的热能不损失，温度不下降，它就不会收缩。恒星级黑洞内部不可能出现“奇点”，是因为一个太阳级质量的黑洞，其寿命竟长达 10^{65} 年。具有如此长寿命的黑洞的内部是极其稳定的，不可能出现有无穷大密度的“奇点”存在， 因为黑洞有极强大的引力，而近似绝对黑体，连光都逃不出黑洞，所以有温度的粒子也逃不出黑洞，这样，黑洞内部就能保持其温度成为对抗引力的塌缩的主要力量，从而能够保持极长的寿命。但它还是会因霍金量子辐射而极其少量和缓慢地失去能量而收缩。大黑洞由于密度的大幅降低内部更加稳定而更难塌缩，其寿命能维持非常的长久，如一个太阳级质量的黑洞，$M_\theta = 2 \times 10^{33}g$ ，其寿命竟长达 10^{65} 年，而小黑洞由于辐射出高能量的霍金量子辐射，所以寿命变得很短。假如有一个小黑洞的质量M_b = 1000ton,其寿命就只有 1 秒。宇宙中一半以上的恒星都有伴星，成为双星系统，因此，各种恒星级黑洞在塌缩形成之后，就会马上吞噬其外界的能量-物质而膨胀以降低其密度，长成更大的黑洞。宇宙中也发现有几乎吞噬完其周围能量-物质后而孤独地在宇宙空间漂浮的黑洞(其外界并非绝对真空，只是能量-物质极其稀少而已)。

第五；在恒星所塌缩成的恒星级黑洞内，其中心所能达到的最高密度$\approx 5 \times 10^{15} g /cm^3$，即 1.75$M_\theta$黑洞由均匀的超子构成的中心的密度。比 1.75$M_\theta$黑洞更大黑洞，其中心的密度就更低。这表明宇宙中超新星爆炸时的极限压力对其余烬M_r的中心所能形成的最高密度不会高于 $5 \times 10^{15} g /cm^3$。所以，在恒星级黑洞内部不可能出现更小的黑洞，因为内部根本不可能再发生超新星爆炸和其它更剧烈的爆炸，更绝无可能塌缩出奇点。但是，各种大小不同黑洞形成的机制和过程现在还不清楚。普遍认为的是并非所有超新星爆炸都会形成中子星。而且当前的超新星爆发理论尚未完善，不能说明是否恒星的余烬（星核）M_r可能被直接压缩成为黑洞而不经过超新星爆发，是否有超新星形成的黑洞，以及恒星的初始质量和演化终点的准确关系。

【8】。恒星级黑洞的形成和存在在宇宙演化中的启示和意义。

1*. 从上面的(7g)式可以看出，无论是中子星或者最小的恒星级黑洞，其中心物质为超子，有人说是固态中子，其最大密度约为$\rho_n = 5 \times 10^{15} g / cm^3$，是由超新星爆炸所产生的宇宙中最大的压力压缩而成。

设d_n 是密度约为ρ_n 条件下2个中子之间的距离， N_n为cm^3内的中子数，

$$N_n = \rho_n / m_n = 5 \times 10^{15} / 1.67 \times 10^{-24} = 10^{39}$$

$$d_n = (1/ N_n)^{1/3} = 10^{-13} cm \qquad (8a)$$

从 (8a)可见, 中子之间的距离d_n 刚好等于中子或质子的直径。也就是说，在$\rho_n = 5 \times 10^{15} g / cm^3$下，中子或质子之间只是刚好挤在一起，只不过因有高温能量而成为超子 。质子的结构即其夸克链远未被破坏。

2*. 由于宇宙中没有 $< 2M_\theta$ 的黑洞，所以上述的密度 $\rho_n \approx 5\times10^{15}g/cm^3$ 就是宇宙中物质所具有的最高密度。因为宇宙中尚未有比超新星爆炸力更强的爆炸，所以密度 $\rho > 5\times10^{15}g/cm^3$ 的物质是不可能出现的。

3*. 既然恒星级黑洞来源于超新星爆炸，那么，在已经爆炸后的恒星级黑洞内部就绝无可能再发生超新星爆炸，也就不可能产生 $\rho > 5\times10^{15}g/cm^3$ 的物质。特别是 $>2M_\theta$ 恒星级黑洞，内部的密度开始降低，黑洞质量愈大，密度愈低。可见，恒星级黑洞形成后，内部连引力塌缩的条件都不存在，绝无可能出现奇点。

4*。既然在密度 $5\times10^{15}g/cm^3$ 的条件下，质子保存完好，未被破坏，那么在密度达到多大时（密度极限），质子才会被破坏而成为自由夸克呢？作者认为，这个密度极限应该是 $10^{53}g/cm^3$.

按照霍金的黑洞理论和公式，任何一个恒星在塌缩过程中，熵总是增加而信息量总是减少的。假设 Sm—恒星塌缩前的熵， S_b—塌缩后的熵， M_θ—太阳质量 $= 2\times10^{33}g$,

$$S_b/S_m = 10^{18}M_b/M_\theta \quad [2] \qquad (8a)$$

Jacob Bekinstein指出，在理想条件下，$S_b = S_m$, 就是说，熵在恒星塌缩的前后不变。这样，就从**(8a)**式得出一个黑洞 $M_{bo} = 10^{15}g$。这个黑洞就是宇宙的原初小黑洞 $= M_{bo}$ [1] [2]

$$M_{bo} = 10^{15}g \text{ 的密度 } \rho_{bo} = 0.7\times10^{53}g/cm^3;\ R_{bo} = 1.5\times10^{-13}cm;\ T_{bo} = 0.77\times10^{12}k;\ m_{sso} = 12\times10^{-24}g; \quad (8b)$$

5*. 从**Bekinstein**对恒星塌缩的前后不变的解释可以得出有非常重要意义的结论。**Bekinstein**对霍金公式**(8a)**只作了一个简单的数学处理，使其能够和谐地成立。但是没有给出其中的恰当的物理意义。作者认为，**(8a)** 应该用于解释恒星塌缩过程中的重要的物理含意。

首先，**(8a)** 表明在密度 $< 10^{53}g/cm^3$ 的塌缩过程中是不等熵的。这表示质子作为粒子在此过程中能够保持质子的结构没有被破坏或分解，所以质子才有热运动和熵的改变。质子变为超子 Λ 和 Σ 仅仅是质子具有高能量（高温）， 但它仍然由夸克组成。 其次, 既然密度从 $10^{53}g/cm^3$ 到 $10^{93}g/cm^3$ 的改变过程中, 不管是膨胀还是收缩，熵不能改变，就是理想过程。因此，质子必须解体而不能再作为粒子，也就是说，质子在此过程中只能变为自由夸克。换言之，夸克就是没有热运动和摩擦可在 $10^{53}g/cm^3$ 和 $10^{93}g/cm^3$ 之间转变.

最简单而重要的结论: 现在宇宙中所能产生的最强烈的爆炸是超新星爆炸，它们所能产生的最大压力只能将物质压缩成密度约 $5\times10^{15}g/cm^3$ 的中子星或最小的恒星级黑洞的核心，即超子 Λ 和 Σ 。从密度 $5\times10^{15}g/cm^3$ 到 $10^{53}g/cm^3$ 的塌缩或膨胀过程是非等熵过程，质子的结构未被破坏。这特性也许就是质子在宇宙中有 10^{30} 年的长寿命而难以被破坏的原因。密度从 $10^{53}g/cm^3$ 到为普朗克粒子 m_p 的 $10^{93}g/cm^3$ 的塌缩或膨胀过程是等熵的理性过程，质子已经解体成为自由夸克。既然自由夸克在过程中作等熵运动，表明自由夸克具有超导性，当密度达到 $10^{93}g/cm^3$ 时，即进到普朗克领域，时空变成不连续，广义相对论失效。这是人类认识尚远未达到的领域。

在爱因斯坦建立广义相对论的时代，他只知道引力和电磁力这 2 种长程力，在其作用下，物质所能达到的最大密度，是太阳中心的密度约为 $10^2g/cm^3$ 。那时，不知道还有核心密度为 $10^6g/cm^3$ 的白矮星和密度为 $10^{16}g/cm^3$ 的中子星。更不知道弱作用力和强作用力可以组成密度为 $10^{16}g/cm^3 \sim 10^{53}g/cm^3$ 的质子，和密度为 $10^{53}g/cm^3 \sim 10^{93}g/cm^3$ 的夸克。因此，那时爱因斯坦和其他的科学家们想当然的认为，物质粒子的引力可以自由而无休止地收缩。这是可以理解的。然而，现在主流的的科学家们固执的坚持物质粒子的引力可以收缩成为“奇点”，却是盲目而失去理智的。

【9】。微型黑洞 $M_{bo} \approx 10^{15}g$： 早在 1971 年，霍金首先提出了“微型黑洞”的概念，认为宇宙形成初期，一些小团块物质在“宇宙浴缸”的巨大压力下，会收缩成为不同尺度的黑洞，有的是由一座山收缩而成的，其体积仅相当现在的一颗基本粒子，在宇宙大爆炸发生之际，各种质量的黑洞都是有可能生成的；因此，宇宙空间里目前仍可能存在着“微型黑洞” 这也就是 “原初宇宙小黑洞 M_{bo}” 。

我们宇宙现今的年龄 $\tau_{b0} = 137$ 亿年，

霍金的任何一个黑洞的寿命 τ 的公式如下：

$$\tau \approx 10^{-27}M_b^3\ _{(s)} \quad [2] \qquad (9a)$$

如果霍金在 1971 年所提出的原初宇宙小黑洞 M_{bo}，现今尚能存在于宇宙中，其质量应该是：

$$M_{bo} \geq (10^{27}\times137\times10^8\times3.156\times10^7)^{1/3} = 0.756\times10^{15}g \qquad (9b)$$

在 70 年代，科学家们曾费力地力求在宇宙空间找到 M_{bo} **这种原初宇宙小黑洞，但一无所获。因为它们不可能存在于现今宇宙中**，相应的，该黑洞 M_{bo} 的其它参数如下，

$$R_{bo} \geq 1.12\times10^{-13}cm,\ \rho_{bo} \leq 0.1285\times10^{54}g/cm^3,\ T_{bo} \leq 10^{12}k.\ \tau_{b0} \geq 137 \text{ 亿年} \quad (9c)$$

从本文的下篇[18]可以查出或计算出，当宇宙的密度 $= \rho_{bo} \leq 0.1285\times10^{54}g/cm^3$ 时，宇宙的特征时间 t_{up} 是，

$$t_{up} = (3/8\pi\rho_{bo}G)^{1/2} = 0.37\times10^{--23}s \qquad (9d)$$

从宇宙大爆炸后的宇宙演变膨胀图可知[18]，$t_{up} = 0.37\times10^{-23}$s是处于宇宙的重子时代，即Hadron Era, 此时单个的强子不能存在，宇宙中大部分的物质形态是浓密的夸克和胶子的混合物，又称为夸克时代. **[2] [18]** 这就是说，此时的无数的质量为**M_{bo}的原初宇宙小黑洞是紧密地均匀地在当时宇宙内挤在一起的, 不可能独立的分开的存在**，随着时间的增加，许多小黑洞$\mathbf{M_{bo}}$ 就会碰撞和合并而变成更大的黑洞，因此，**在宇宙密度当时高达 10^{54}g/cm^3 的状态下，是不可能有原初宇宙小黑洞M_{bo}既不吞噬其外围的能量-物质又不与其邻近的小黑洞合并而孤立的残存到现今的宇宙空间的**。推而广之，宇宙膨胀到辐射时代（Radiation Era）结束之前[18]，此时宇宙的密度虽然已降低到≈10^{-20}g /cm^3，即在大爆炸后的 30~40 万年之前，但那时宇宙并不透明，仍然处在辐射为主的时代。宇宙由于原生的最小黑洞M_{bm} ≈10^{-5}g的合并仍然在不断地膨胀着，但在每一时刻，微波背景辐射的观测证实那时温度的差异仍然很小，也就是说，**宇宙还是几乎近于热平衡状态**。因此，**其内部密度在每一时刻都是相当均匀的**，不可能在以后密度降到远低于 10^{54}g/cm^3 的密度状态下又塌缩出$\mathbf{M_{bo}}$如此小的质量和如此高密度的原初宇宙小黑洞。

在宇宙膨胀到物质占统治地位的时代，即 Matter-dominated Era, 即在大爆炸 30 ~40 万年之后直到现在[18]，宇宙的能量-物质密度从≈10^{-20}g/cm^3 已经降低到现在的 10^{-30}g /cm^3. **只有在物质形成后，由于辐射能量与物质粒子能量之间的巨大差异而不能互换，辐射能量随着宇宙的膨胀而降低温度和流出星云或者物质团之外，才在宇宙的小范围内(1~3 亿光年内)造成物质密度的极大不均匀和物质团的引力收缩**。因而才出现星云星系和恒星，恒星只能在核聚变完成而死亡后通过新星或者超新星的爆炸，其残骸才能塌缩成为如前所述的质量大约为 10^{33}g 的恒星级黑洞，而不可能爆炸和塌缩出来质量≈10^{15}g 的原初宇宙小黑洞 $\mathbf{M_{bo}}$，因为其爆炸压力和温度都达不到 $\mathbf{M_{bo}}$所需要的密度 $\rho_{bo} \approx \mathbf{10^{53}g/cm^3}$。只能压缩使其成为中子星或恒星级黑洞中心的密度$\approx\mathbf{10^{16}g/cm^3}$

结论：1。根据１９８９年发射的ＣＯＢＥ卫星测量结果进行分析计算后发现，宇宙微波背景辐射与绝对温度２．７度黑体辐射非常吻合，另外微波背景辐射在不同方向上温度有着极其微小的差异，也就是说存在的各向异性非常小，因而在宇宙的辐射时代结束之前不可能使在宇宙早期所产生原初宇宙小黑洞 $\mathbf{M_{bo}}$ 孤独地保持到现在。而在宇宙的辐射时代之后一直到现在，即是物质占统治地位的时代，在此期间，只能产生恒星级黑洞。

2。如果从恒星级黑洞的质量大约为 6×10^{33}g（3Mθ）收缩到≈2×10^{15}g 的微小黑洞. **假设这个过程能够出现的话**，它只能是不停地发射霍金辐射而收缩的结果。这是唯一可能发生的过程，但这是一个时间极其漫长的过程。从大质量恒星级黑洞收缩到微型黑洞($\mathbf{M_{bo}}$)所需的时间是 = 恒星级黑洞的寿命-微型黑洞的寿命≈（10^{66}年 – 10^{11}年 ）。而**这个过程也完全不是理想的等熵过程，因为收缩的结果是向外发射了大量的无序的霍金量子辐射**，黑洞只是由一个质量 6×10^{33}g 恒星级黑洞缩小成 10^{15}g 的唯一一个微型黑洞，而不是收缩成为与原来黑洞等量又等熵的 N_{min}（$N_{min} = 6\times10^{33}/2\times10^{15} = 3\times10^{18}$）许多个 $\mathbf{M_{bo}}$微型黑洞。

【10】.（10^7 ~10^{12}）M_θ 超级大黑洞与类星体（Quasar）

在每个星系的中心都有一个超级大黑洞，其质量约为（10^7 ~10^{12}）M_θ不等。最近 “美国斯坦福大学的天文学研究小组在遥远的宇宙中发现了被称为Q0906+6930的黑洞。到目前为止堪称最庞大最古老的黑洞。其质量是太阳质量的100多亿倍，形成时间在127亿年前，即在宇宙的大爆炸之后大约10亿年”**[14]**。

设上述黑洞质量$M_q=10^{10}\mathbf{M_\theta=2}\times10^{43}$g, 则其$R_q = 2.96\times10^{15}$cm, $\rho_q=\mathbf{1.74}\times10^{-4}$g/cm^3.

而宇宙10亿年龄时的平均密度$\rho_{10} =3/(8\pi Gt^2) = 1.8\times10^{-24}$ g/cm^3.

再看中子星和恒星级黑洞的平均密度≈（10^{14} ~10^{16})g/cm^3，

“2008-09-05 报道，天文学家首次清晰观测到银河系中心黑洞”，该黑洞的史瓦西半径 R_y =1609 万公里，即 $R_y = 1.6\times10^{12}$cm，其质量 My ≈$\mathbf{10}^{6。5}$ M_θ, 平均密度$\rho_y = 3\times10^2$g/cm^3.

分析与推论：1*. 从上面的密度比较和分析后可见，质量愈大的超级黑洞，其密度愈小，可能愈易于从该超巨大星系的原始星云中直接收缩而成。所以在宇宙物质占统治时代的早期，在密度较大的状态下，较易形成超级大黑洞，即类星体。 2*. 超级黑洞外的剩余能量-物质愈多，则黑洞因吞噬能量-物质而向宇宙空间发射的辐射能量也愈多。在宇宙空间也就愈亮。银河系中心的超级黑洞外围的能量-物质较少，所以也较暗。 **3*.** 这些超级黑洞是否由其原始大星云在中心先塌缩成许多恒星级黑洞和致密天体，然后由他们碰撞合并而成呢？这种可能性不大。因大量致密天体被黑洞所吞噬而形成上述如此大的超级黑洞需要很长的时间，**特别是恒星级黑洞是需要在花费数亿到百亿年的时间完成核聚变之后才能形成的**。因此，超级黑洞的这种形成方式的可能性很小。也许小星系中心或者大星系中心外形成的10^5M_θ的中型大黑洞可能由这种方

式形成。 **4*.** 由此可见，应该是先有行星状星云的星系，然后其中在收缩成为各种星体各种黑洞和超级黑洞，而不可能先有黑洞再吸引宇宙空间的能量-物质形成行星状星系。

什么是类星体？类星体其实就是遥远的超级黑洞，也是上述超级黑洞的婴儿和青少年时期。现简单介绍何香涛教授在其“观测宇宙学”[3]中第8章的证明如下：

类星体的质量M_Q应该满足,

$$M_Q > L_Q M_\theta / 1.5\times10^{38} = 3.3\times10^8 M_\theta \tag{10a}$$

对于光变周期为1小时的类星体，其尺度D应该满足

$$D \le \mathbf{C\Delta t = 1.1}\times10^{14}\text{cm}, \tag{10b}$$

对于如此大小的一个史瓦西黑洞，其质量M_S应该是，

$$M_S = RC^2/2G = 1.9\times10^8\ M_\theta \tag{10c}$$

可见，$M_Q \approx M_S$，二者是极其接近的。(10a)式中之$L_Q = 5\times10^{46}$erg/s.

【11】. 对黑洞的论证再作进一步的分析和结论如下：

A. “两位英国学者, 剑桥大学的史蒂芬. 霍金和发明保角图的罗杰. 彭罗斯在 60 年代证明，“奇点”是广义相对论的一个必不可少的组成部分. 一个真实恒星的引力坍缩是否一定导致视界和黑洞的形成对此尚不明确，但是坍缩的结局是不可避免地成为奇点，这是确定无疑”. 这是“黑洞”一书作者约翰-皮尔. 卢米涅在 1995 年写的. [1] 按照广义相对论，任何一个黑洞将由三部分组成。第一，视界为其边界。第二，奇点在 R=0 的几何中心，在那里集中有无穷大的能量密度，时空弯曲成无穷大。第三, 在视界与“奇点”之间的空间为真空。这表示奇点成为黑洞存在的前提，广义相对论还指出，由于空间与时间在黑洞内互换，其中心 R=0 的点成为时间的终结, 以后就成为“时间之外”. [1][6]

广义相对论对“时间之外”无法解释。仅仅按照单独的广义相对论的数学方程的极端状态得出的上述解释是不适宜于研究黑洞内部状况的。**我们所熟知的物理定律失效的奇点[5] 只是广义相对论在许多错误假设下的数学推导的极端结果，而不是真实的物理世界的图像**。何况，广义相对论没有考虑温度和热压力如影随形地对引力的抗拒作用，没有考虑量子理论，它不能应用于普郎克量子领域。而“奇点”作为能量与密度为无限大的点，它不可能在真实的物理世界出现和存在。任何理论的数学方程都有其应用的极限, 广义相对论也不例外.因为数学方程的连续性通常不大可能统一地描述物态之间的极端（极限--相变及相变处的临界点）. 正如气体状态方程不能用于水的沸点一样，**在自然界既能找到长期存在的黑洞实体，就应当应用其它的观念或机理以代替用单独的广义相对论对黑洞内部无能为力的解释—“奇点”**。既然黑洞以被观测和证实为宇宙中长期存在的物质实体，那么，其内部必然存在着对抗引力塌缩的机制以维持其平衡和稳定。

B.本文前面是用 4 种不同经典理论的基本公式来解决黑洞内部不可能出现奇点。必须特别着重指出，**所有这些守恒公式仅仅实用于黑洞视界半径 R_b 上。至于黑洞内部各点的状态特别是各点的温度 T 的状态与上述守恒公式无关，也不影响上述守恒公式**。而 T_b 仅仅表示黑洞视界半径 R_b 上的霍金辐射量子的阀温。如果大黑洞内部有小黑洞，则该小黑洞视界半径 R_b 上也适用这组守恒公式。小黑洞在大黑洞吞噬大黑洞的能量-物质而快速增大，最后与大黑洞合二为一。

C. 由前面的论证可见，黑洞视界半径R_b的界面上实际上是黑洞能量位阶的最低界面。黑洞界面内外的能量-物质粒子只有通过界面才能交换和进出。**界面上的粒子能量只有达R_b的位阶，即其小于或等于阀值$m_{ss} \le \kappa T_{om}/C^2$ 时才可能逃出黑洞。**同样，**界面外附近的粒子能量只有达R_b的位阶，即其大于或等于阀值$m_{ss} \ge \kappa T_b/C^2$ 时才可能被吸入黑洞**。黑洞界面R_b上不停地能量-物质交换使得R_b上不停地震荡—扩大或者缩小。**当黑洞因不断地发射霍金量子辐射而内部空间一直缩小下去时，内部的能量物质也就一直不停地通过R_b向外辐射而后使R_b逐渐缩小和M_b减少，这就完全证明黑洞内部空间充满能量-物质，而在R_b逐渐缩小时其内部能随时供给能量-物质，从而证实其内部空间绝对不是真空。**因此，广义相对论所得出“黑洞内部除了奇点之外，所有空间都是真空”的结论是不符合黑洞的真实状况的。。

D. 恒星在死亡时的塌缩大爆炸中，恒星将抛射掉自己大部分的质量，同时释放出巨大的能量。这样，**在短短几天内，它的光度有可能将增加几十万倍，这样的星叫“新星”。如果恒星的爆发再猛烈些，它的光度增加甚至能超过 1000 万倍，这样的恒星叫做“超新星”**。这些剧烈的爆炸现在已能真实的被观测到。**设想如果所有的黑洞内均出现过“奇点”，那么每个奇点爆炸的剧烈程度将会比超新星的爆炸不知要大多少倍，似乎都会像广义相对论所设想的宇宙诞生的 “大爆炸”一样地剧烈。**从广义相对论的理论上讲，也许黑洞外面的人不能观察到黑洞内奇点大爆炸的图景。**但是”奇点”的爆炸必定会爆出来无法估量的能量-物质迫使其视界半径以光速不断地向外扩张**。**在我们银河系的中心区域有许多小黑洞和一个超级大黑洞，如果**

所有这些黑洞内都有“奇点”而爆炸的话，那么，距离银河系中心仅仅 2.6 万光年的太阳系早就被这些扩张的黑洞所吞噬了。因此，我们银河系内及外围空间许多被观测到的黑洞的长期真实地存在就证明所有黑洞内没有出现和存在过“奇点”和“奇点的爆炸”。也证明了我们的太阳系不在银河系的某个黑洞之内。可见，用广义相对论数学方程的极端处存在“奇点”以证明真实的黑洞内存在“奇点”是一种错误的推论和结论，正如用经典力学证明电子会失去能量而坠落到原子核中的错误是一样的。

E。作者的一个猜想，在大于10^3 M_0（此数为猜想，因为小于15 M_0的黑洞在形成之前，已产生核聚变）的中等黑洞内，由于形成之前没有产生核聚变，在黑洞形成之后可能在黑洞内的物质再收缩而产生核聚变，结果，会因不断地爆炸向黑洞外排出核聚变产生的能量-物质直到核聚变完成，这可能是黑洞不同于霍金辐射向外发射能量-物质的另一种方式。

F. 在前面已经证明的，所有黑洞的最后命运不是收缩成为奇点，而是收缩成为质量 $M_{bm} \approx 10^{-5}g$ 的最小引力黑洞在普郎克领域中强烈的爆炸消亡。既然所有黑洞的最后命运是如此，假设黑洞内部有可能发生这种极其强烈的引力收缩时，也必然而且只能是最后收缩成为质量 $M_{bm} \approx 10^{-5}g$ 的最小引力黑洞而在黑洞内部强烈的爆炸中消失后，其残渣就混入黑洞内的空间与能量-物质中。而实际上**恒星级黑洞或者由中子星所塌缩成的恒星级黑洞**是不可能发生这种情况的。

前面已经说过，现在宇宙中由新星和超新星爆炸所形成的恒星级黑洞或者由中子星所塌缩成的最小恒星级黑洞的质量大约是 3 M_0，其密度约为 5×10^{15} g/cm^3.**作者根据分析 (8a)式得出了重要的结论：密度从5×10^{15} g/cm^3 到 10^{53} g/cm^3 的膨胀或者收缩过程中，由于质子的结构未被破坏，会产生热运动和摩擦，是非理想的不等熵过程。密度从5×10^{53} g/cm^3 到 10^{93} g/cm^3 的膨胀或者收缩过程中，质子的结构已被破坏成为自由夸克，没有粒子热运动和摩擦，是理想的等熵过程。**

G. 前面的分析和论证表明，用单独的广义相对论无法解决黑洞内部的奇点问题。直到现在,尚未有一个单独的理论能描述黑洞内部. **在本质上, 广义相对论是一个无热力学效应而以四维时空代替引力作用的时空几何学。**因而, 在用单一的广义相对论方程式描述黑洞内部时, 没有热力作为对抗力, 均匀的能量-物质空间的引力的塌缩 (即时空收缩) 也就必然会产生“奇点”. 因此，**如果没有霍金的黑洞理论，就不可能找到在黑洞视界半径R_b上的 4 个守恒公式，**而正是这些守恒公式的存在才能了解恒星级史瓦西黑洞内部的能量−物质不可能塌缩成为奇点，而使黑洞能以极长期的寿命而真实地存在于宇宙中. **也正因有了霍金的黑洞理论，才有可能知道任何黑洞的寿命**, 才了解黑洞内部与外界的能量是如何交换的。结果，黑洞从过去存在于自然界的死而不化的物体变成为现在活的物体. 可见，**本文中运用霍金理论的公式才避免了广义相对论对“奇点”问题的危机**。同样的情况其实早已发生过，正如原子中的电子必需依从量子力学的测不准原理才不致落到原子核内，而稳定在原子核的外层运动。这才使得我们人类能出现和存在于现今美妙的世界里。

H. 黑洞视界半径上的参数的单一性和唯一性: 黑洞的所有物理状态参数 (M_b,T_b,R_b,ρ_b,τ_b,…)中,只要有一个被确定, 比如说 M_b被确定, 其它的所有参数都随着 M_b 的被确定而被唯一的确定了. 从这个观点来看, **黑洞又是自然界最简单的物体。这也就是说，同一个参数值的所有黑洞，在其视界半径R_b上的各种参数值是完全一样的。可见，具有同量M_b的所有黑洞，仅管它们内部状态各不相同，但是其黑洞的性质（视界半径上的性质）是完全一样的。黑洞内部的状态可以不相同，黑洞愈大，其内部的状态的差异也就愈大愈复杂。反之，所有的**$M_{bm} \approx 10^{-5}g$的最小引力黑洞都只是由一个粒子组成，而各种参数都一样，因此，**只有所有的$M_{bm} \approx 10^{-5}g = m_p$的最小引力黑洞内部状态才都是一样的，而达到这一状态时即爆炸解体消失于普朗克量子领域。**

I. 黑洞只有从外部吸取能量物质或与其它星体或黑洞碰撞才会膨胀增大尺寸, 而不停地向外所辐射的能量却极微, 1998 年由遥远的Ia型超新星的爆发而发现宇宙早期直到现在的加速膨胀。现在主流的科学家们都认为在宇宙早期出现了具有负能量或者排斥力的暗能量造成了宇宙加速膨胀，现在不少的科学家正努力想找到暗能量以求得到诺贝尔奖。**作者曾指出，由遥远的Ia型超新星的爆发而发现宇宙早期的加速膨胀是我们这个宇宙大黑洞在早期与另外一个宇宙大黑洞碰撞与合并所造成的结果。**[4]而这种合并似乎到现在尚未完全完成。因为合并一旦完成，两大黑洞的质量就会相加而成为新黑洞的质量，两个原来黑洞的视界半径就会相加而成为新黑洞的视界半径。这样，新黑洞因无外界能量物质可以吞噬而会停止膨胀。作者的上述解释是合乎宇宙的观测实况的。**因为只有两个宇宙黑洞在其早期碰撞而产生宇宙加速膨胀的上述解释才符合我们宇宙的平直性要求和当今较准确的观测值(Ω=1.02±0.02)。有排斥力的暗能量和所有其它理论都可能成为找不到的幽灵，因为它们都不符合此要求，解释不了我们宇宙的平直性[4].**

J. 两种不同的黑洞模式和两种不同的黑洞命运。

按照单独的广义相对论，黑洞中心有一个奇点，在视界半径与奇点之间的内部空间是真空。**黑洞永远不向外辐射任何能量-物质，在这种的条件下，黑洞将永远地存在于自然界。**这类黑洞只会从外界吸收能量-物质或其它天体而增加自己的质量和尺寸，但它永远是一个绝对的黑洞而不会消失，因此，在自然界已存在的黑洞和未来将出现的黑洞每一个都会有无限长的生命(这是时间的无限大)。这种可能性能存在吗？它符合自然界的根本规律吗？有许多确凿的证据已经证实我们宇宙就是一个巨无霸黑洞。[4] [18]作者在本文的下篇已经作了有力的证明。[18]在宇宙黑洞内，各种物质物体和人类的存在证明宇宙空间并不是真空，也没有观测到存在“奇点”的任何证据。而那些死抱着广义相对论方程里的极端的“奇点”结论不放的科学家们，其实他们也说不清“奇点”究竟奇到什么程度。这是即不符合理性也不符合宇宙的实际状况的。

黑洞的质量 M_b 愈大，其发射的霍金辐射 m_{ss} 小，黑洞的寿命愈长。广义相对论不承认黑洞发射 m_{ss}，即 $m_{ss} = 0$，所以黑洞应有无限长的寿命。仅由此观之，广义相对论可作为霍金黑洞理论极端的一个特例。

K.本文另开思路，独创地综合运用几种经典理论的基本公式，特别是应用霍金的黑洞辐射量子蒸发出能量的公式,证明**每个黑洞与宇宙中其它任何物体或者系统一样，都存在着对抗引力塌缩的机制，都合乎生长衰亡的法则**.在这种模式的大黑洞内部,各处和区域依据其不同的动静平衡条件而可以组成极不相同物体和系统。比如，在我们这个宇宙大黑洞内部，就可以在不同的地方存在着大小黑洞，恒星，行星，生物，人类和宇宙尘埃等等。但是，**可以明确地定论，我们宇宙任何地方绝对不可能出现高于 10^{32}k的高温，也绝对不可能出现小于 10^{-5} g的黑洞，永远不会找到“奇点”或者“奇点的大爆炸”.**

L. 关于人造黑洞：作者两年多前曾经论证过人类也许永远制造不出来任何大小的人造黑洞。请参看拙作"Mankind may be impossible to manufacture out any artificial real gravitational black holes forever"[16]。其实道理很简单明白，因为要想以小于 10^{19}GeV的能量制造出来小于 10^{-5}g的史瓦西黑洞，必然的，其相对应的温度 >10^{32}k，视界半径<10^{-33}cm，寿命<10^{-43}s，这些都是不可能达到的。而且这种<10^{-5}g的史瓦西黑洞已经深入到Planck Era 的量子时代，而广义相对论所得出的黑洞的概念和理论是完全不能适用于量子时代的。要想制造出>10^{-5}g的史瓦西黑洞，就要求能制造出来极大能量的对撞机，这也是人类无法能达到的。

M。作者最后的几句话：老子曰；“大道至简”。**本文独创的观点和论证方法是简单的，因为它只考虑黑洞视界半径上的平衡，而不管黑洞的内部状态。这就违反了以广义相对论为主流的学术界的观点和方法。但这种简化却达到了圆满的自洽的好效果。也会经得起观测的检验。**这也许不会受到大部分科学家与学者们或读者们的认可，因为本文缺乏新理论和复杂的数学公式，而这些东西都正是物理学界的主流学者们的本钱和终身引以为骄傲的。**但本文中的新的观念,新的论证方法与计算都来源于现代可靠的经典理论的基本原理和公式，并且和所有其它理论计算所得出的数据以及观测的数据相吻合**.而且容易被理解和接受.**本文的重要贡献就是找出了所有黑洞的最后命运是塌缩成为最小引力黑洞**$M_{bm} \approx$ **10^{-5}g后而在普郎克领域强烈的爆炸中消亡。这是由于本文推导出了新的公式(1f)，$m_{ss}\ M = hC/8\pi G= 1.187\times10^{-10}g^2$ 和 (1g)，$Rm_{ss} = h/(4\pi C)$而成。**本文用简单的方法以解决复杂问题的思路也许可以作为引玉之抛砖供给未来者作另类思考.

====全文完====

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The Complete Demonstrations To No Singularity
In Black Holes: New Edition
====Part 1：Black Holes==== May.-2010

《Black Holes: The Final Gravitational Collapse Of The Event Horizon Of Any BHs In Nature Would Only Contract To Planck Particle $m_p = M_{bm} = 10^{-5}$g And Disintegrate in Planck Era, But Impossibly Contract To Singularity Of Infinite Density.》

Dongsheng Zhang 张洞生 **Email: *ZhangDS12@hotmail.com***
Graduated in 1957 From Beijing University of Aeronautics and Astronautics. China.

【Abstract】: In this article, author doesn't propose any hypothesis and any supplementary condition, may derive out directly "the finally gravitational contraction of any black holes (BH) could impossibly become singularity, but Planck particles $m_p = M_{bm}$ and disappear in Planck Era". That result is got from Hawking laws about BH and other classical formulas together.

The superiority of author's method is to apply a group of formulas only to research the changes of physical parameters on the event horizon (EH) of any BHs, regardless of the complicated state and structure inside BHs. Thus, the final contracted result of EH of BHs could only become Planck particle $m_p = M_{bm}$ (minimum BH), but not singularity. Since the final collapse of EH of BH with its all mass (M_b) had to become m_p, if there were little BHs inside, it could certainly contract to m_p in advance.

The fundamental defect of the General Theory of Relativity Equation (EGTR) is that, any particles in EGTR has no thermodynamic action to resist the gravitational collapse, it would certainly lead to occurrence of singularity. On the contrary, Hawking formulas of BH were built on the foundation of thermodynamics and quantum mechanics, the heat pressure could resist the gravitational collapse forever.

According to above explanations and analyses, an important formula will be got as below:

$$m_{ss} M_b = hC/8\pi G = 1.187\times10^{-10} g^2 \qquad (1d)$$

In above formula (1d), m_{ss} is the mass of Hawking quantum radiation (HQR) on the EH, M_b is the mass of whole BH. $m_{ss}M_b$ is a constant. From (1d), in the real universe, $M_b \neq 0$, and, $m_{ss} \neq 0$, the smaller M_b is, the bigger m_{ss} can be. According to axiom of any part ≦the whole, at the limited condition, $m_{ss} = M_b = (1.187\times10^{-10}g^2)^{1/2}$. Thus, M_b is impossible become a singularity.

$$m_{ss} = M_b = M_{bm} = (hC/8\pi G)^{1/2} = m_p = 1.09 \times 10^{-5} g \qquad (1f)$$

Formula (1f) is the best important. correct and final conclusion in this article got by author. It clearly shows that, the final gravitational collapse of any BH would become Planck particle m_p, and explode in Planck Era, but not continuously go to singularity of infinite density.

Many new concepts and laws in this article are all the further developments to Hawking theory about BHs. In science, the simplest is the best. The demonstrations in this article is the simplest, whether it is good or bad will remain to reader's comments.

【Key words】。black holes (BH); singularity; star-formed Schwarzschild (gravitational) black holes: Planck particle--m_p; Planck Era; Hawking quantum radiation (HQR); General Theory of Relativity Equation (GTRE); minimum BH--M_{bm};

In this whole article, only Schwarzschild (= gravitational) BHs of no charges, no rotating and spherical symmetry will be studied as below.

【I】。Regardless of the states and structures in BHs, the final contraction of the event horizon (EH) and mass M_b of any BHs due to emit Hawking quantum radiations (HQR) could only become minimum BH (M_{bm}) equal to Planck particle (m_p), it could impossibly contract to singularity.

According to Hawking radiation law of BHs and Schwarzschild special solution to GTRE and other classical formulas, the relationship of many physical parameters on the event horizon (EH) of BHs can be got as below: M_b — mass of a BH, T_b --temperature on EH of BH, m_{ss} —mass of Hawking quantum radiation on BH, R_b --radius of EH of a BH, h—Planck constant = $6.63\times10^{--27}g_*cm^2/s$, , C --light speed =$3 \times 10^{10}$cm/s,, G --gravitational constant = $6.67\times10^{--8}cm^3/s^2{}_*g$, Bolzmann conseant $\kappa = 1.38\times10^{--16}g_*cm^2/s^2{}_*k$,
m_p -- Planck participle, L_p ---Planck length, T_p ---Planck temperature,

Applying Hawking law and other classical formulas to derive out the final gravitational collapse of EH of BH. Hawking temperature formula on EH of BH,

$T_b M_b = (C^3/4G) \times (h/2\pi\kappa) \approx 10^{27}$ [2] (1a)

Formula of energy transformation (i.e. gravitational energy transfer into radiation energy through valve temperature) on EH of BH,

$m_{ss} = \kappa T_b / C^2$ [1][2] (1b)

According to Schwarzschild special solution to GTRE,

$GM_b / R_b = C^2/2$ [1][2] (1c)

From (1a) and (1b), then,

$m_{ss} M_b = hC/8\pi G = 1.187\times10^{-10}g^2$ (1d)

Formulas (1a),(1b),(1c), (1d) are 4 general laws effective on any EH of BHs. In formulas (1a) and (1d), due to that, $T_b M_b$ = constant, $m_{ss} M_b$ = constant. So, m_{ss} , T_b and M_b is impossible ∞ or 0, then, m_{ss} , T_b and M_b all have its limit. Furthermore, according to axiom of any part ≦ the whole, m_{ss} is impossible > M_b, at the limited condition, the maximum m_{ss} = the minimum M_b-- M_{bm}, so,

$m_{ss} = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{-5}g$ [3] (1e)

Owing to $(hC/8\pi G)^{1/2} \equiv m_p$ [3] so,

$m_{ss} = M_{bm} = (hC/8\pi G)^{1/2} \equiv m_p \equiv 1.09\times 10^{-5}g.$ (1f)

$R_{bm} \equiv L_p$[3]$\equiv (Gh/2\pi C^3)^{1/2} \equiv 1.61\times 10^{-33}cm$ (1g)

$T_{bm} \equiv T_p$[3]$\equiv 0.71\times 10^{32}k$ (1h)

$R_{bm} m_{ss} = h/(4\pi C) = 1.0557\times10^{-37}cmg$ (1i)

Similarly, $m_{ss} \neq 0$, $R_{bm} \neq 0$, so, R_{bm} and m_{ss} all have its limit.

The best important conclusion: 1. From fotmulas (1b) , (1c), whether one of M_b , R_b , T_b , m_{ss} is 0 or ∞ can not be judged. That is reason why singularity could present in General Theory of Relativity Equation (GTRE). However, from formula (1a), (1d) and (1i), any one of M_b , R_b , T_b and m_{ss} can impossibly be "0 " or "∞", so, each of 4 has to its limit. That are results of Hawking theory about BHs to apply thermodynamics and quantum mechanics. 2。When a BH could get into the gravitational collapse because of emitting Hawking quantum radiations (HQR) after engulfing all energy-matters outside, it would continuously shrink its size R_b, increase in T_b, lose mass M_b and finally become $M_{bm} = m_{ss} \equiv m_p$. In addition, M_{bm}, R_{bm}, T_{bm}, m_{ss} form a perfect minimum BH, and perfectly and individually equal to m_p, L_p, T_p of Planck Era,

【2】. In the process of the gravitational contraction of any original nebula (matters), the principle of a particle m_s emitted to outside in nebula is the same mechanism with HQR emitted to outside from EH of a BH. They are all from high energy (temperature) flowing to low energy (temperature). The final result of both continuously contracted process are all the complete same, i.e. $M_{bm} = m_p = (hC/8\pi G)^{1/2} \equiv m_p \equiv 1.09 \times 10^{--5}g$. Thus, Hawking quantum radiations (HQR) are just the energy particles, which have the lower energy (temperature) than the valve temperature on EH and may flee out from the restraint of gravity of BHs to go to outside.

For examining the correctness of (1f); Suppose a particle m_s in nebula and on the boundary of R, if m_s is in the state of thermodynamic balance and locate at the end of R, then,

$dP/dR = -GM\rho/R^2$ [3] (2a)

$P = n\kappa T = \rho\kappa T/m_s$ (2b)

$M = 4\pi\rho R^3/3$ （2c）

Formula (2b) is the state equation of gas or particles, Formula (2c) is the formula of ball volume, P – pressure of R end, M –total mass in radius R, ρ – average density of R ball, T – temperature of R end,

Applying formulas(2a), (2b), （2c）, (1a), (1c) together. Formulas (1a), (1c) are right to physical parameters on EH of any BHs, so, the results of parameter values got from solving following equations are all on EH of BH. Thus, to any BHs, in reality, M, R are all completely equal to M_b, R_b as below.

From $P = \rho\kappa T/m_s = \kappa/m_s \times(3M/4\pi R^3)\times(C^3/4GM)\times(h/2\pi\kappa) = 3hC^3/(32\pi^2GR^3m_s)$,

$dP/dR = d[3hC^3/(32\pi GR^3m_s)]/dR = -(9hC^3)/(32\pi^2Gm_sR^4)$, ($\therefore dP/dR \propto R^{-4}$), （2d）

$-GM\rho/R^2 = -(GM/R^2)\times(3M/4\pi R^3) = -(3G/4\pi R^3)\times(M^2/R^2)$,

from (1c), $M_b/R_b = C^2/2G = M/R$.

$\therefore -GM\rho/R^2 = -3C^4/(16\pi GR^3)$, ($\propto R^{-3}$) （2e）

let（2d),（2e）into（2a）,

$--(9hC^3)/(32\pi^2Gm_sR^4) = -3C^4/(16\pi GR^3)$,

or $3h/(2\pi m_sR^4) = C/R^3$

$\therefore R = 3h/(2\pi Cm_s)$, or

$\therefore Rm_s = 3h/(2\pi C) = 1.0557\times10^{-37}$cmg （2f）

From（2f）and (1c), then,

$m_s M_b = 3hC/(4\pi G)$ （2g）

Comparing formulas (1d) and（2g）, (1i) and（2f）, only under the condition of $m_s = 6m_{ss}$, as the results, (1d) =（2g）, (1i) =（2f）. Why must $m_s = 6m_{ss}$? Because in deriving process from (2a) to (2g), density ρ and temperature T in formulas (2a), (2b) and (2c) used as the average values in a ball M of R, but not the real density and temperature on EH of BH, which < their average values, so, their combined effects let $m_s = 6m_{ss}$. Thus, under the condition of $m_s = 6m_{ss}$,

$\therefore m_s = 6m_{ss}$, (1d) ≡（2g）, (1i) ≡（2f） （2h）

Thus, the gravitational collapse and final destiny of any nebula (particles) is the perfectly same with the EH of a BH. Their final destinies are all $m_{ss} = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{--5}$g. In nature, any gravitational collapses of anybody are the certain results of discharging energy nonstop to outside.

Analyses and conclusions:

1*. Since formula（2h）accords with the real conditions, it is a circumstantial evidence to formulas (1d), (1f) and (1i). it shows that, the final collapse of EH of any BHs can reach to Planck Era, but not to singularity.

2*. Formula(2a) is really a simplified equation to Tolman-Oppenheimer-Volkoff equation. [7] Formula(2a) cancelled 3 complicated amended items from TOV equation. Thus, on the foundation of (2a), combined (1a), (1c) and (2b) as the boundary conditions, the correctness of (2f) and (2g) should be reliable.

3*. There are no essential distinctions for any BH or a star or a nebula to emit out or to attract in energy-matters. However, any BHs have very strong gravity, even light can't flee out from EH of BH. Owing to the very high density or big mass of current BHs, for example, a BH of $5M_\theta$, according to formula (1d), it could emit the extremely small energy of HQR equivalent to $m_{ss} = 1.187\times10^{-44}$g and absorb in any energy-matters > $m_{ss} = 1.187\times10^{-44}$g. A BH of mass $=10^{15}$g, its HQR = $m_{ss} = 1.66\times10^{--24}$g = mass of a proton. The current BHs in nature are all star BHs, so in people's mind, all BHs are rapaciously plundering energy-matters outside,

4*. How could HQR flee out from EH of BH? Just like a particle or quantum (energy or light) fleeing out from the boundary of a star or any body, once average energy of HQR < κT on EH, or its instant temperature < κT on EH duo to the heat motion and vibration, they could possibly flee out at a instant under the state of little lower temperature and energy.

【3】。No. 1 essential attribute of any BHs: Once a BH could be formed, it would be a BH forever until it finally become a Planck particle $m_p = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{-5}$g, no matter whether it's expansion because of engulfing energy-matter from outside or it's contraction because of emitting HQR to outside.

According to Schwarzschild solution to GTRE, from（1c）,

$R_b = 2GM_b/C^2$, (3a)

$\therefore C^2dR_b = 2GdM_b$

C^2 ($R_b\pm dR_b$） $= 2G(M_b\pm dM_b)$ (3b)

Suppose another BH M_{ba}, and,

$C^2R_{ba} = 2GM_{ba}$ (3c)

From (3a) +（3b）+ (3c)

$\therefore C^2$ ($R_b \pm R_{ba} \pm dR_b$） $= 2G$ ($M_b \pm M_{ba} \pm dM_b$) (3d)

Formula (3d) clearly shows that, any BH, no matter whether it would emit out or plunder in energy-matters, or collide with another BH, it could only be a BH of different mass forever.

In 1998, two groups of U.S.A. and Australia discovered the accelerating expansion of our universe (AEOU) through observations to the bursts of remote supernovas Ia, they pointed out, that remote galaxies are accelerating away from us. Most current scientists explained AEOU with "dark energy" of exclusive force in the universe. Author considered that, AEOU was due to the collision of our universal BH with other BHs in their early ages. Formula (3d) was proposed as the theoretical foundation for above hypothesis.

【4】。No. 2 essential attribute of any BHs: BHs are all the simplest bodies in nature. All physical parameters on the EH of BHs are only decided by mass of a BH, and have the same, sole, linear and single numerical value corresponding to mass M_b. In other words, any 2 physical parameters on the EH of all BHs have the same relationship of the sole, linear and single numerical value. Furthermore, no matter how structures and states inside different BHs, all EHs of BHs with the same mass M_b can have the completely same essential attributes. Therefore, there are not necessary for us for solving the complicated GTRE to study the structures and states inside BHs. Once knowing the mass of any BHs, then, knowing its all. This is Hawking's great contribution to the theory of BHs. From formulas (1a), (1b), (1c), (1d), it can be seen for any BHs, then,

$M_b \propto R_b \propto 1/T_b \propto 1/m_{ss}$ (4a)

【5】。No. 3 essential attribute of any BHs: Non-stop emitting HQRs to outside or engulfing in energy-matters from outside is other essential attribute of any BHs. Just like a star or a body to emit lights or infrared radiations, energy would always flow out naturally from high energy to low energy, no exception for any BHs to emit HQRs.

The EH of any BH is its boundary. The exchange of energy-matters must pass through EH. It can be seen from (2a), owing to that, HQR on EH would always be in the condition of heat motion, it could non-stop vibrate and have no an instant precise temperature, so, any HQR on EH could be in the unstable state and impossible to keep the thermodynamic balance at any instant. Thus, the exchange of energy-matters passed through EH would only lead to Event Horizon oscillated.

From formula (1b) $m_{ss}C^2 = \kappa T_b$, T_b is the valve temperature on EH, Really, EHs have become the switch of BHs to transfer energy-matters.

1*. Only in case κT_b of HQRs on or in BH, which instant temperature T_b is a little higher than outside, could flee out. After they fled out from EH. because of decrease in a little energy of BH, BH would contract a little size and increase in a little temperature, then, the energy distance would become bigger between EH and the fled HQR, which could impossibly return back into BH again. Thus, after losing a HQR, BH would continuously emit HQRs to outside, until finally become a Planck particle $m_p = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{-5}$g, and explode in Planck Era.

2*. Obviously, in case outside particle $m_o > m_{ss}$ or outside temperature $T_o > T_b$, m_o and radiation energy κT_o outside can be attracted into BH. Thus, BH can nonstop attract in all energy-matters outside with increase in mass M_b and decrease in T_b on EH. After that, BH will nonstop emit HQRs to outside, until M_b finally become a Planck particle $m_p = M_{bm} = (hC/8\pi G)^{1/2} = 1.09 \times 10^{-5}$g, and explode in Planck Era.

3*. In case $m_o = m_{ss}$ or $T_o = T_b$, generally, because the number of particles and T_o outside are more then those on EH of BH, so. BH can attract in more energy-matters than those fled out. After that, the process and result will be the same with above 2* section.

The character of any BH is always nonstop taking in all energy-matters from outside at first, then, emitting energy to outside until its final vanish in Planck Era, its Event Horizon would be oscillated nonstop.

According to Hawking's theory, the rate of radiating energy of a BH is:

$dE/dt \approx 10^{46}M^{-2}$ erg/s,<2> (5a)

Suppose $M = M_\theta = 2\times 10^{33}g = M_\theta$, $dE/dt \approx 10^{-20}$ erg/s, based on such extremely tiny rate, a BH of sun mass (M_θ) needs about 10^{65}years to radiate out all its energy-matters and explode in Planck Era.

Suppose $M = M_\theta = 2\times 10^{33}g$, its HQR = $m_{ss} = 1.187\times 10^{-10}/(2\times 10^{33}) = 6\times 10^{-44}g$. So, m_{ss} is too small. It shows that, mass of a BH equal to sun can almost absorb any tiny energy in the current space. If no energy outside, that sun BH can radiate HQR of $6\times 10^{-44}g$, It is much smaller than a proton mass of $1,66\times 10^{-24}g$.

It can be seen, Hawking theory and laws of BHs to emit HQRs are all right, but Hawking's explanations to emit HQRs are not correct and convincing. Normally, Hawking and the most modern scientists may explain HQRs with the concepts of vacuum energy. They recognized that a pair of virtual particles would be suddenly born out from vacuum, then annihilate and appear repeatedly. [1]. After negative particle on EH of BH being captured by positive virtual particle of vacuum and annihilating, then, the positive particle of BH would remain and appear outside BH and become a HQR fled out, Such explanations of them is a deliberate myth with the new physical concept. The energy value of HQR on EH of BH is certain, why could a pair of virtual particles appeared have the same energy value with HQR on EH and both could meet at the same time and same place? In addition, the explanation of so-called "virtual energy" has not a reliable and certain numerical value right now in any theory and may have no way to be observed and examined forever.

Right now, whether BHs would emit energy-matters or not with other ways except Hawking's radiations remains a question.

【6】。No. 4 essential attribute of any BHs: After plundering all energy-matters outside, any BH could only contract its size R_b, decrease in M_b, increase in T_b and m_{cc} because of emitting HQGs continuously. The final destiny of every BH could only become minimum BH (M_{bm}) equal to Planck particle (m_P), then, explode and vanish in Planck Era at once. See formula (1f),

$$m_{ssm} = M_{bm} = (hC/8\pi G)^{1/2} \equiv m_p \equiv 1.09\times 10^{-5}g$$

Why could M_{bm} be impossible to become < $\{(hC/8\pi G)^{1/2} \equiv m_p \equiv 1.09\times 10^{-5}g\}$ and continuous contraction? Surely impossible.

1*. Once $M_{bm} < 1.09\times 10^{-5}g$, its HQR ($m_{ss}$) $< 1.09\times 10^{-5}g$ too. Thus, $m_{ss} M_{bm} \ll ((hC/8\pi G)$. It violates formula (1d) of BHs.

2*. Once M_{bm} reach $1.09\times 10^{--5}g$, its gravitational energy = $M_{bm} C^2 = 10^{16}$erg, its radiation energy = $\kappa T_b = 1.38\times 10^{-16}\times 0.71\times 10^{32} = 10^{16}$erg too. . So,

$$M_{bm} C^2 = \kappa T_b = 10^{16}erg \qquad (6a)$$

It can be seen, the reason why BH can emit HQR is that the bigger BH has surplus gravitational energy to transfer to radiation energy of HQR. However, once M_{bm} reach $1.09\times 10^{-5}g$, the whole M_{bm} is a whole particle and has no surplus energy as HQR, it can only throughout explode, and wholly transfer $M_{bm} C^2$ to many and many small γ–rays of the highest energy of 10^{32}k.

3*. Owing to M_{bm} reach $1.09\times 10^{-5}g$, $M_{bm} C^2 = m_{ss}C^2$, it is said, the whole M_{bm} is a complete particle, no gravitational forces inside could continuously contract to resist the highest temperature of 10^{32}k inside the whole M_{bm}, thus, the whole M_{bm} must crushingly explode.

4*. According to Uncertainty Principle

$$\Delta E \times \Delta t \approx h/2\pi \qquad (6b)$$

To M_{bm}, $\Delta E = M_{bm} C^2 = \kappa T_b = 10^{16}erg$, Δt = Compton time = $R_{bm}/C = 1.61\times 10^{-33}/3\times 10^{10} = 0.537\times 10^{-43}$.

$\Delta E \times \Delta t = 10^{16}\times 0.537\times 10^{-43} = 0.537\times 10^{-27}$, but $h/2\pi = 6.63\times 10^{-27}/2\pi = 1.06\times 10^{-27}$,

Obviously, $\Delta E \times \Delta t < h/2\pi$, it violates Uncertainty Principle. Thus, M_{bm} could impossibly exist, but only disintegrate and vanish in Planck Era, so, it has no way to contract to singularity.

【7】。Various substantial structures just are the best and last mechanism to resist the gravitational contraction in nature. Bodies of no gravitational collapse in nature have always a solid and stable core.

From the process of formation of star BHs, the reasons why singularity can impossibly appear and exist in star BHs will be clearly known. In GTRE, the appearance of singularity is base on the hypotheses of that, a ball of definite energy-matters could free and infinitely contract its size with no resistance. However, in reality, the contracted process of anybody must at least overcome two resistances: the first is the heat pressure of its energy-matters, and the second is its substantial structure.

1*. Any body of mass $<10^{15}g$, its chemical structure can support its gravity, needs not a solid core. Mass of $10^{15}g$ has 10^{39} ($=10^{15}/1.67\times 10^{-24}$) protons. 10^{39} is a Dirac's large number.

2*. Planets of mass between 10^{15}g and 0.08 M_θ (1.6×10^{32}g) must need a core of liquid or solid irons to resist its gravitational collapse outside the core.

3*. Stars of mass > 0.08 M_θ (1.6×10^{32}g) : Owing to existence of the very high and stable pressure and temperature supplied by nuclear fusion, all stars cannot collapse in a long-term period, until nuclear fusion stopping in its core.

The pressure P_s in the core of sun is estimative about as below,

$P_s = \rho_s \kappa T_s/m_p = 10^2\times1.38\times10^{-16}\times1.5\times10^7/1.67\times10^{-24} \approx 1.5\times10^{11}$ atm. （7a）

4*, White dwarfs: It is generally estimated that, after finishing its nuclear fusion and through red giant star, the original star of mass < 3.5 M_θ could compress its remnant to become a white dwarfs of mass ≤1.44 M_θ. 1.44 M_θ is called Chandrasekhar's limit. It is said, after a white dwarf plundering energy-matters outside or colliding with another companion star, its mass might go beyond Chandrasekhar's limit >1.44 M_θ, and become a neutron star. White dwarf has a solid core of density about 10^6g/cm^3 and has very long lifetime. In the solid core, the distance between atomic nucleus is 10^{-12}cm, Electrons can freely flow and have the strong exclusive forces to resist the gravitational collapse outside the core. Once mass of a white dwarfs could approach 1.44 M_θ due to absorb matters outside, it would become a carbon-oxygen white dwarf and occur the strongest explosion of Ia supernova, and turn into powders scattered in space.

5*. Neutron stars: It is generally estimated that, after the original star of (3.5~8) M_θ finishing its nuclear fusion and after the strongest supernova explosion, its remnants might be contracted into neutron star of mass between(1.5~2) M_θ. It is said, mass of neutron stars may be (0.1~1.5~2) M_θ. Their density in core about 10^{14} ~5×10^{15}g/cm^3. Diameter of the biggest neutron star is 33km. The structural figure of neutron stars as below:

Parameters of neutron stars: mass of most M_n = (1.5~2) M_θ; density in core $\rho_n \approx 10^{14}\sim 10^{15.5}$g/cm^3; distance between neutrons, $d_n \approx 1.2\times10^{-13}$ cm; numbers of neutron in cm^3, $n_n = 10^{39}$ /cm^3; Λ and Σ are hyperons or solid neutrons in core.

Conclusions: 1. It shows clearly from above analyses and demonstrations that, before overcoming the very high density and crushing the extremely solid structure of its core formed by supernova explosion, any stars, no matter how great its mass is, can't continue or complete its gravitational collapse to compress matters to >10^{16}g/cm^3 in core.

2. From figure.1 below, the core of the density of neutron stars $\rho_n \approx 10^{14}\sim 10^{15.5}$g/cm^3. The formation of core of neutron star may be solid neutrons, or hyperons Λ and Σ.

3. If a neutron star could become a BH due to absorb energy-matters outside, only matters outside the core can be greatly compressed, the density in core can hardly increase any more, because the density between a little BH of 2M_θ and a neutron star of 2M_θ is almost the same, just their sizes have the great difference. Diameter of a neutron star of 2M_θ is about 33km, but diameter of little BH of 2M_θ is about 12km.

【8】。Star BHs: Singularity could be impossible to occur in star BHs. The formation of star BHs，Generally, the mass of star BHs may be between (3~10) M_θ.

How could star BHs be formed? It is said, after nuclear fusion having finished and through supernova explosion, the remnants of the original stars of mass > 8M_θ might become a star BH of mass≥3 M_θ. Besides, if a neutron star could engulf energy-matters outside or collide with its companion white dwarf (or another neutron star), it might become a star BH of mass ≥ 3M_θ. 3M_θ is so=called Oppenheimer-Volkoff limit. However, those two conditions are just the theoretical inference, but no real observations can be as evidences.

Parameters of a BH of mass = 3 M_θ: $M_{b3} = 3M_\theta = 6\times10^{33}$g, its $R_{b3} = 8.89\times10^5$cm≈9km, $T_{b3} = 1.3\times 10^{-7}$k, HQR--$m_{ss3} = 2\times 10^{-44}$g. $\rho_{b3} = 2\times 10^{15}$g/cm^3, [see formulas (1a), (1b), (1c), (1d), (2c)]

In 2006, a smallest star BH called XTE J1650-500 [6] was discovered, its mass = 3.8 M_θ. According to imagination and calculations by scientists, limit of mass of the smallest star BHs not still discovered in universal space might be (1.7~2.7) M_θ, then its density calculated is about $\rho_{b2} \approx 5\times10^{15}$g/cm^3.

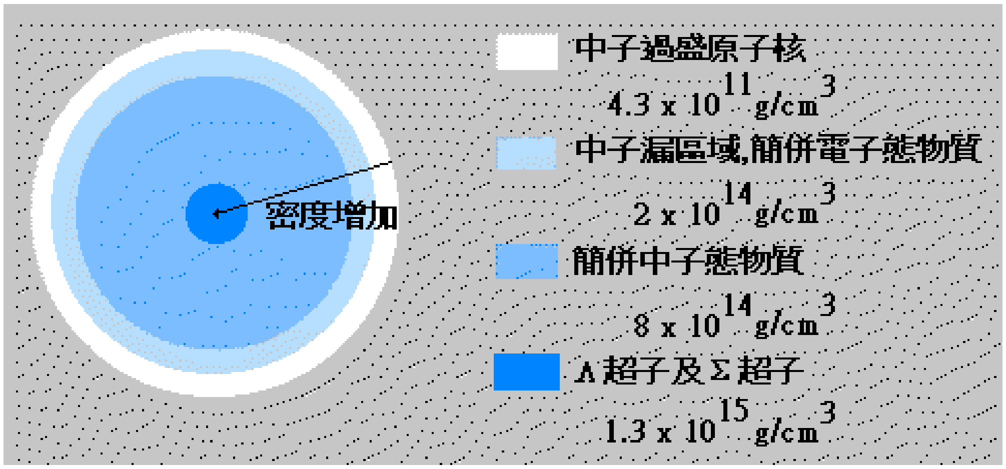

Figure. 1. Structural figure of neutron stars,
(Picture: LKL Astro-Group) [5] Hyperons Λ and Σ of 1.3×10^{15}g/cm^3 in blue little core.

Many important inferences and conclusions can be got from above calculations and analyses:

1*. Comparing the density of core between neutron star $\rho_n \approx 10^{14}\sim 10^{15.5}$g/cm^3 and density of the smallest star BH, their $\rho_{b3} = 2\times 10^{15}$g/cm^3 to $\rho_{b2} \approx 5\times10^{15}$g/cm^3, so, the core of small star BHs and neutron stars are the same thing, which may be all hyperons Λ and Σ. or solid neutrons. They have almost the same density, and are all originated from the explosion of supernovae.

The distance d_n between two adjacent neutrons in the core of neutron stars and star BHs,

$N_n = \rho_n /m_n = 5\times10^{15}/1.67\times 10^{-24} = 10^{39}$

$d_n = (1/ N_n)^{1/3} =10^{-13}$cm (8a)

From (8a), in the core of neutron stars and star BHs, The distance d_n between two adjacent neutrons is equal to diameter of a neutron or a proton. Thus, under the density of about 5×10^{15} g/cm^3, atomic nucleuses of neutrons or protons are just closely contacted together, but far away from break.

2*. Owing to no star BHs $< 2M_\theta$ existed in nature, the forces and pressures produced by the supernova explosions are the strongest forces in current universe and later. Thus, the matters of density $\rho >5\times10^{15}$g /cm^3 have impossible to appear and exist in nature afterwards, then, matters of density $\rho_n \approx 5\times10^{15}$g/cm^3 are the highest density in nature.

3*. Since star BHs are all originated from the superstar explosion, supernova explosion would impossibly occur inside any star BHs again. Thus, star BHs inside would impossibly continue its gravitational collapse, so, it have impossibility of appearance of singularity.

4*. Owing to that, the bigger a star BH is, the lower its density can be. Thus, all BHs (> star BH of 10 M_θ) inside can be more impossible to produce > density of 10^{16}g/cm^3, so, absolutely impossible to produce singularity inside.

5*. Since matters of density $\approx 5\times10^{15}$g/cm^3 in star BHs are hyperons or solid neutrons, it shows that, protons having become hyperons are not broken or disintegrated, and still keep their own quark chains, i.e. keep their proton formation. Maybe it is reason why protons have so long lifetime of about 10^{30} years.

6*。Since protons can keep their particle formation at about density 5×10^{15}g/cm^3, how great density may let protons disintegrated into quarks? Author consider that, protons may be disintegrated in density about 10^{53}g/cm^3.

According to Hawking's theory of BH, in the collapsing process of any star, its entropy always increased and its information capacity always decreased. Suppose Sm--original entropy before the collapse of a star, S_b--the entropy after collapsing, M_θ--mass of sun = 2×10^{33}g,

$S_b/S_m= 10^{18}M_b/M_\theta$ [2] (8b)

Jacob Bekinstein pointed out at the ideal conditions, $S_b = S_m$, or, the entropy did not change before and behind the collapse of a star. From formula (8b), M_b will be 10^{15}g, and M_b = original mini BH = M_{bo} [1] [2]

Density of (M_{bo} =10^{15}g) is ρ_{bo} =0.7×10^{53}g/cm^3; R_{bo} = 1.5×10^{-13}cm; T_{bo} = 0.77×10^{12}k’; m_{sso} = 12×10^{-24}g;

7*. The best important conclusions: Bekinstein only did a well mathematical arrangement to formula (8b), but neglected the profound physical implications of (8b). Author think, (8b) should be applied to explain some significant physical process.

Firstly, the gravitational collapse under the condition of density < 10^{53}g/cm^3, the collapsed process should not be equal entropy. It clearly tell us that, protons can keep its particle formation, and not be disintegrated, so, protons as particles must have heat motions and frictions, and can change entropy more or less.. Hyperons Λ and Σ are only protons of high temperature, and still formed from quarks.

Secondly, however, since in the changed process of density from 10^{53}g/cm^3 to 10^{93}g/cm^3, entropy can impossibly change, it shows that, protons must be disintegrated, and become into quarks. It also shows that, quarks might only be changed in the ideal state between density region from 10^{53}g/cm^3 to 10^{93}g/cm^3, no matter whether they were in expansive or contractive process, which were all the ideal process of equal entropy. In other words, quarks might have no heat motion and frictions changed between 10^{53}g/cm^3 and 10^{93}g/cm^3.

The best important conclusion: The strongest pressure in present universe produced from the supernova can only compress matters into density of about 5×10^{15}g/cm^3, what could be the most powerful force in nature to compress matters to density of 10^{53}g/cm^3, even finally to 10^{93}g/cm^3 of Planck particle (m_p)? The most powerful force is only the contracted force of very small BHs (<< star BH) due to radiating HQRs continuously, it can let BHs (mass <10^{15}g) to contract nonstop to Planck particles. It obviously shows that, BHs only radiating nonstop its HQRs outside can nonstop go on its gravitational contraction until becoming to minimum BH-- M_{bm} =$(hC/8\pi G)^{1/2}$ ≡ m_p and disappearing in Planck Era.

【9】。Original mini BH = M_{bo} ≈10^{15}g, Could those M_{bo} be found in the universe at present? In nature, the great significance of M_{bo} is its density of 10^{53}g/cm^3, only substantial density > 10^{53}g/cm^3, protons can be broken and disintegrated. That may be an important reason why protons have so long lifetime of 10^{30}years,

From formula (8b), the mass of original mini BHs = M_{bo} ≈10^{15}g. Its other parameters are:

R_{bo} = 1.5×10^{-13}cm; ρ_{bo} =0.7×10^{53}g/cm^3; T_{bo} = 0.77×10^{12}k’; m_{sso} = 12×10^{-24}g

From formula (6b), lifetime of M_{bo}, $\tau_{bo} \approx 10^{-27} M_b^3$ (s) = 10^{18}/ 3.156×10^7s ≈ 3×10^{10}yrs.

Compton time t_{bo} = R_{bo}/C = 5×10^{-24}s,

Numbers of proton: n_{bo} = $M_{bo}/1.66\times10^{-24}$ = 10^{39}, n_{bo} is other Dirac’s large number.

According to calculations above, the lifetime τ_{bo} of original mini BH=M_{bo} ≈ 10^{15}g , τ_{bo}≈ 3×10^{10}yrs. The age of our universe is 1.37×10^{10}yrs, which is the same scale with τ_{bo}. In 1971, Hawking proposed, M_{bo} might exist in our universal space, if some of them could be survivals from the newborn time of our universe. However, in 1970s, many scientists attempted to observe and find out such original mini BHs in universal space, but their efforts about 10 years were all in vain. It clearly shows that, no such M_{bo} could remain to the present.

In the newborn time of our universe, at least before the end of Hardron Era, i.e. the expansion of our universe from density 10^{93}g/cm^3 to 10^{53}g/cm^3 could have perfect homogeneity, because that expansive process would be completely equal entropy known from above paragraph. The numerical values of 3 main parameters ρ_{bo}, T_{bo} and t_{bo} of M_{bo} are all in Hadron Era of universal evolution. At that time, all M_{bo} in universe were closely and evenly linked together into a whole, and had no way to exist single. With their expansion later, they could only combine each others and become bigger and bigger. In other words, in the universal expansive process, any original BHs of high density could not exist single at all, no matter how great they were, because BHs linked together could only combine and expand, but have no way to exist independently. Only after Radiation Era of universal evolution, because radiations separated from matters and led to lower temperature in matters, then, matters could do a renew contraction. As a result, the nebulas could have a great gravitational contraction to become the compact stars or a BHs through supernova explosion.

【10】。The super great BHs of（10^7 ~10^{12}）M_0 and Quasars.

In the center of every galaxy and star cluster, there is a super great BH, its mass can reach to （$10^7 \sim 10^{12}$） M_θ. Recently, a super giant BH called Q0906+6930 discovered by an astronomy group of Stanford University in the remote center of our universe. Its mass more than 10^{10} M_θ, and it formed 127×10^8 years ago. i.e. after 10^9 years of the birth of our universe. [9]

Let that BH be $M_{bs} = 10^{10}$ $M_\theta = 2\times10^{43}$g, so, its $R_{bs} = 2.96\times10^{15}$cm, its $\rho_{bs} = 1.74\times10^{-4}$g/cm^3.

The simple calculations to Quasars in the 8th chapter of Prof, He Xiangtao's book "Observation Cosmology" [3] are as follows:

The mass of a Quasar must be satisfied by the following formula,

$$M_Q > L_Q M_\theta/1.5\times10^{38} = 3.3\times10^8 M_\theta \qquad (10a)$$

In above formula (10a), $L_Q = 5\times10^{46}$erg/s.

If the light period of a Quasar is 1 hour, its scale D should be:

$$D \le C\Delta t = 1.1\times10^{14}\text{cm}, \qquad (10b)$$

For a Schwarzschild's BH of the same size , its mass M_S should be:

$$M_S = RC^2/2G = 1.9\times10^8\ M_\theta \qquad (10c)$$

It can be seen, $M_Q \approx M_S$，the numerical values of both are very close.

Conclusion: Really, Quasars should be the predecessor and the childhood of super great BHs, which might all come from the evolution of Quasars.

There has been an important problem in astronomers and cosmologists: Was BHs formed before as a core to contract its outside energy-matters to compose galaxy and star cluster, or substantial particles contract to form nebula at first, and then ignite the nuclear fusion in the core to form BH through supernova explosion? Author think, the later can accord with the real circumstance in nature, because forming a galaxy needed time is << forming a BH needed time.

【11】。The simple summations, further analyses and important conclusions as bellow:

A: No matter whether the EH of any BHs or a large ball of matters (mass of a nebula 5 M_θ ~8 M_θ) would be, their finally contracted destinies could be the perfectly same, i.e. $m_{ss} = M_b = M_{bm} = (hC/8\pi G)^{1/2} = m_p = 1.09 \times 10^{-5}$g, but impossible to contract to singularity of infinite density. It proved that, Hawking laws about HQR, Schwarzschild solution to GTRE, uncertain principle and other classical dynamic laws are completely harmonious and identical, No singularity shows that, General Theory of Relativity Equation (GTRE) has had the fatal weakness.

B: The fatal weaknesses of GTRE are to neglect the thermodynamic effects to resist the gravitational contraction of matter particles. For simplifying the difficulties to solve GTRE, the most scholars proposed two bad hypotheses which violate thermodynamics, i.e. the contraction of equal matters and the "universal model of zero (constant) pressure". Just those two bad hypotheses lead gravitational contraction to singularity in GTRE. Of course, GTRE may have other important defects, such as, permitting the infinite contraction of participles of point structure. In addition, GTRE is hardly to be solved. The hypothesis of inertial mass equal to gravitational mass has no reliable evidences, etc.

Particles of point structure, which may be infinite contraction in GTRE, must have a limit. It is just Planck Era, in which time and space are not continuous, [8] and it certainly leads GTRE lose effect.

C: Hawking theory and some important laws about BHs based on quantum mechanics and thermodynamics are very correct and effective, they avoid and overcome the important defects of appearance of singularity in GTRE, just as quantum mechanics could demonstrate that, electrons could not fall into atomic nucleus in the past. Similarly, Hawking theory and laws about BHs demonstrated that, GTRE lost effectiveness in Planck Era, just as GTRE demonstrated that, Newton mechanics had lost effectiveness in the movements of near light speed.

However, the explanations of Hawking and modern physicists to HQRs with the concept of "a pair of virtual particles would be suddenly born out from vacuum" may be a deliberately mystifying with the new physical concept. HQRs flow out from the EH of BH to outside, just as energy or matters naturally flow down from high position to low position, or from high temperature to low temperature.

D: Through studying star BHs, the conclusion is that, singularity could have no possibility to occur in BHs. After the Big Bang, the strongest explosions in nature have been the supernova explosions, which explosive forces can only compress matters to density about 10^{16}g/cm^3, i.e. the

density of core of neutron stars, in such level of density, protons cannot be broken yet. Only the substantial density reaches to 10^{53}g/cm^3 of original mini BH (M_{bo}), protons can be destroyed. Protons are the most stable and solid particles, and have the longest lifetime of 10^{30} years. The forces to destroy protons have not appeared in nature as yet. Of course, no more powerful forces can compress matters to the density 10^{93}g/cm^3 of Planck particles ($m_p = M_{bm}$), except the contraction of BHs < 10^{15}g due to emitting HQRs.

On the contrary, if there were singularity or smaller BH in BHs, certainly, singularity could explode at once and change into rays of extremely high energy in BHs. At the same time, the smaller BH could absorb energy-matters of its outside, finally, the event horizon (EH) of smaller BH could enlarge to combine with the EH of BH together.

E。Here author makes a guess: In BHs of >10^3 M_θ, （10^3 M_θ is guessed by author, because nuclear fusion had finished before any star BHs of <15 M_θ was formed.）owing to no nuclear fusion occurred before BHs forming, so, nuclear fusion might occur in BHs because of the contraction of matter particles. Thus, energy-matters would discharge outside BHs until nuclear fusion finished.

F: Only the contracted forces of mini BH，which mass ($M_{bo} = 10^{15}$g) due to radiate HQRs, could compress protons disintegrated into quarks. After that, the contracted forces of mini BHs of mass $M_{bmi} < (M_{bo} = 10^{15}$g) due to radiate HQRs could raise the density of M_{bmi} and decrease in distance between quarks in M_{bmi}. The finally contracted results of M_{bmi} would just become to ($m_p = M_{bm}$), and explode and disappear in Planck Era.

G: A few words out of this article about the destiny of our universe, if the current mass M_u of our universe is about 10^{56}g, and no energy-matters outside can be absorbed. Thus, our universe can only nonstop emit HQRs to contract its size up to become $m_p = M_{bm} = 10^{--5}$g, and explode and vanish in Planck Era. The lifetime of M_u will be (= $10^{-27}M_u^3$) about 10^{132}years.

The problem is to judge whether energy-matters have or no outside our current universe. Author think, if the real lifetimes of some bodies in nature measured by scientists, such as some celestial bodies or aerolites, are the same with Compton time of our current universe (UBH), and Hubble constant has a certainly reliable value as normal, it may shows that, there might still be energy-matters outside our universe. Correspondingly, our universe will plunder all energy-matters outside, after that, it can nonstop contract its size with emitting HQRs until become $m_p = M_{bm} = 10^{-5}$g, and explode and vanish in Planck Era. Thus, its lifetime will prolong to >>10^{132}years. If the real lifetimes of some bodies in nature > Compton time of our UBH, and Hubble constant = 0, it shows no energy-matters outside our UBH.

However, if a insolated star BH of $3M_\theta$ had no energy-matters outside to be engulfed, it could only contract its size to $m_p = M_{bm} = 10^{-5}$g, then, explode and vanish in Planck Era too. Its lifetime = $10^{-27}(3M_\theta)^3 \approx 10^{67}$years is too long. It is much longer than lifetime = 10^{30}years of protons.

H: Author's few words: Author may only forge ahead a little step from Hawking theory about BHs with simple explanations and calculations to BHs in this article, and get many important and basic conclusions. It may help people to understand many fundamental and principal concepts to BHs from profound theories and complicated mathematical equations of modern scientists.

====The End====

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Author: Dongsheng Zhang, graduated in 1957 from Beijing University of Aeronautics and Astronautics of China, retired now. Permanent Address: Seventeen Pontiac Road, West Hartford, CT 06117-2129. Email: zhangds12@hotmail.com.

马博士：请您在 New York Science Journal ,2009,2(2) 上 删去旧文，贴上此新文。然后在 content 页的最后加上下面的英文题目: **The Complete Demonstrations To No Singularity In Black Holes: ====Part 1：Black Holes====**

《No Singularity in BHs, The Final Gravitational Collapse of BHs would be minimum BHs equal to Planck particles, i. e, $M_{bm} = m_p$. 》

Dongsheng Zhang 张洞生

马博士：我已将原中文缩短，加上现在英文全文，页数还少 1 页。自认为新文当然比旧文好得多，论证更有力。Header and Footer 已经改正，但是 page number 我无能为力。请帮忙。谢谢。

张洞生 拜托

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对广义相对论方程和当代科学界一些主流的新观念的理解和质疑

====对广义相对论与许多近代物理学新观念的质疑，比如，奇点，黑洞，霍金辐射，宇宙起源，普朗克领域，宇宙黑洞，真空能，宇宙常数====

张 洞 生 **Dongsheng Zhang** **新 1212 1/24/2010**

1957 年毕业于北京航空学院,即现在的北京航天航空大学
E-mail: ZhangDS12@hotmail.com

【内容摘要】：现在爱因斯坦的广义相对论方程几乎与所有当代的物理学的新观念联系在一起。比如，宇宙起源，奇点，黑洞，零点能，真空能，N维空间等等。然而，已经观测到的物理真实往往证实这些与广义相对论方程相结合的新观念的虚幻性和谬误。其中最明显而困惑科学家们数十年的“奇点”问题就是其中之一。宇宙中根本没有具有无穷大密度“奇点”存在的任何迹象。再如，按照J. Wheeler等估算出真空的能量密度可高达$10^{95}g/cm^3$。[9] 这些都是不可思议的。在本文中，作者改采用霍金的黑洞量子辐射理论和公式，**只研究黑洞在其视界半径上的收缩和膨胀，而不研究黑洞的内部状态。**结果，**黑洞只能收缩成为普朗克粒子m_p,**而在普朗克领域爆炸消失，不可能最后收缩成为“奇点”。作者并由此证实许多新观点和结论比现代故弄玄虚的科学新观念显得更为可信可靠。[Academia Arena, 2010;2(7):64-95] (ISSN 1553-992X).

【关键词】：广义相对论，黑洞；奇点；宇宙黑洞；黑洞的霍金辐射；宇宙起源；宇宙监督原理；普朗克领域；零点能；真空能；宇宙常数；N 维空间；宇宙加速膨胀；多宇宙；

【前言】：广义相对论方程的根本缺陷是没有热力学效应，既无热力对抗引力

《1》. 科学研究的结论和结果取决于研究方法。

不同的研究方法会得出不同的结果和结论。但是不同理论的结论的正确与否只能根据是否符合观测和实验的数据予以确证。本文是将宇宙产生的膨胀和收缩都用霍金的黑洞理论和予以论证。当黑洞在其视界半径(Event Horizon)上因发射霍金辐射 (Hawking Radiation)而收缩或者因吞噬外界能量-物质而膨胀时，**其视界半径上各种物理量（参数）的变化，与其内部结构和物质密度的分布无关，而只与黑洞质量M_b有关。从而证明：黑洞的视界半径最后只能因不停地发射霍金辐射而收缩成为最小黑洞$M_{bm} = (hC/8\pi G)^{1/2} = 10^{-5} g = m_p$，即普朗克粒子时，就在普朗克领域爆炸消失。因此，黑洞就不可能在其视界内部的中心出现“奇点”**。作者这种简单而有力的证明方法无需解复杂的广义相对论方程，**避免了该方程中因单纯的引力收缩而最终产生“奇点”的荒谬结论**。（附注：本文只分析广义相对论方程与真实物理世界差异所产生的问题，不涉及诸如惯性质量与引力质量等同性和所有参照系的等效性之类的抽象原理。）

《2》。现在爱因斯坦的广义相对论方程几乎与所有当代的物理学的新观念联系在一起。比如，宇宙起源，奇点，黑洞，零点能，真空能，暗能量，N维空间等等。或者说，所有这些新观念都被新潮的物理学者塞进广义相对论方程以便能披上一件合乎主流理论的外衣。然而，已经观测到的物理真实往往证实这些与广义相对论方程相结合的新观念的虚幻性和谬误。其中最明显而困惑科学家们数十年的“奇点”问题就是其中之一。**宇宙中根本没有具有无穷大密度“奇点”存在的任何迹象**。然而，近四十年前，R·彭罗斯和霍金发现广义相对论存在空时失去意义的“奇性”；星系演化经过黑洞终结于奇点，宇宙开端有奇性。甚至可能存在“裸奇性”，**于是不得不提出“宇宙监督原理”（hypothesis of cosmic**

censorship）来，以规避理论的错误。奇性，这一理论病态的发现是理论研究的重要进展，却又与等效原理不协调。[17]再如，按照J. Wheeler等估算出真空的能量密度可高达 10^{95} g/cm3。[9] 这些都是不可思议的。

《3》。既然由推导广义相对论方程得出“奇点”的结论不符合物理世界的真实性，这证明广义相对论方程本身有无法克服的缺陷。广义相对论方程是爱因斯坦头脑中的产物，不是建立在坚实可靠的实验基础上的。从哲学上来讲，**广义相对论方程中只有物质引力而无对抗引力的斥力是先天不足的。是无法解出物体内部粒子的运动状态的，因为宇宙中任何物体的稳定存在都是其内部物质的引力与斥力相平衡的结果**。而后来从外部加进出的具有排斥力的宇宙常数Λ也是后天失调的。爱因斯坦于 1915 年建立了广义相对论。尽管他的假说甚至有错误，但是**广义相对论方程将时空结合的宇宙观却有划时代的哲学和科学意义**，仍是划时代理论。按照爱因斯坦通俗的解释，如同钢球会把绷紧的橡皮膜压弯，太阳会使其周围的空间时间弯曲。由此，他说明了牛顿引力无法解释的水星近日点的剩余进动，预言经过太阳附近的光线会偏折等。牛顿体系是一个没有完成的理论体系。爱因斯坦以狭义相对论为基础，发展到广义相对论，进而建立相对论性宇宙论的相对论体系，包含了牛顿体系的合理内容，克服了牛顿体系的一些重大疑难。爱因斯坦之后，有关广义相对论和宇宙论的研究也取得了一些进展。但是，**这个体系也是一个没有完成的伟大体系。**[17] **晚年的爱因斯坦写道：**“大家都认为，当我回顾自己一生的工作时。会感到坦然和满意。但事实恰恰相反。**在我提出的概念中，没有一个我确信能坚如磐石**，我也没有把握自己总体上是否处于正确的轨道。”这位创造了奇迹，取得划时代伟大成功的科学巨匠，以他的辉煌，谦虚地陈述着一个真理。[17]

《4》. 广义相对论方程本身的根本问题和无法克服的缺陷是没有与热力学联系在一起，也就是说没有时间方向。因此得出一团物质粒子自身的引力收缩会成为“奇点”的荒谬结论。霍金黑洞理论的优越性就在于将黑洞视界半径 R_b 上的物理状态始终与热力学联系在一起，从而证实我们宇宙的生长衰亡规律符合黑洞的理论和规律。热力学定律是宇宙中最根本的规律，是因果律在物理学中的化身，**任何普遍（适）性的理论如果不与热力学结合在一起，必然难以成功。现有的广义相对论方程的各种解都有 2 个最主要的假设前提：一是质量守恒。二是零压（恒压）宇宙模型，即不考虑温度变化而产生的热压力改变。正是这 2 个假设违反了热力学定律，而最终导致用广义相对论方程解出一团物质的自然收缩到会成为违反热力学定律“奇点”**。律的。

假设有一大团定量物质粒子 M 收缩时，

1*。当M在绝热条件下由状态 1 改变到状态 2 时，根据热力学第二定律，热量Q，熵S和温度T的关系为 $\int TdS = C + Q_2 - Q_1$。在 $Q_2 - Q_1 = 0$ 时，因为熵总是增加的，所以温度T必然降低。这就是说，**假设有一大团定量物质粒子M在自由绝热状态下改变其状态时，只能降温膨胀，绝对不可能靠其粒子的自身的引力产生收缩**。

2*。在 $M = M_1 + M_2$ 时，根据热力学定律，如M在绝热过程中，当其中 M_1 部分收缩而使得其温度增高和熵减少时，必然使其另一部分 M_2 的熵的更多的增加。这就是说，M_2 必须作为能量或物质从 M_1 中抛射出去，才能使 M_1 收缩和提高温度减少熵。如能继续收缩，结果就是 M_1 会愈变愈少，而发射出去的 M_2 愈来愈多。这就是宇宙中一团物质（包括黑洞）符合热力学定律的实际，在收缩过程中的普遍规律。**即当物体中的热量无法排出或有外界供给足够的热量时，物体是不可能收缩的。**

3*。当 M_1 因发射能量-物质而收缩到史瓦西条件时，即 $M_1 = C^2 R_1/2G$ 时，M_1 就成为黑洞。其视界半径将能量-物质 M_1 都禁锢在黑洞内，并吞噬外界的能量物质。当外界没有能量-物质可被黑洞吞噬时，黑洞只能不停地逐个的发射霍金辐射量子。使 M_1 收缩变小的

极限就是**最后成为最小黑洞 $M_{bm} = (hC/8\pi G)^{1/2} = 10^{-5}$ g 时，在普朗克领域爆炸消失。**可见，**彭罗斯和霍金是假定在质量守恒和零压宇宙模型的条件下而得出广义相对论方程会出现“奇点”的结论的。这是违反实际过程中的热力学定律的。**

《5》. 在真实的宇宙或者一团定量的 M 物质粒子中，状态和温度的改变是如何影响粒子 m_s 在外部和内部的运动的？假设有质量为 M 的物质粒子在半径为 R 的橡皮球内，温度为 T。设橡皮球的弹力忽略不计。

1*。当 m_s 在 R 的外面，距离球中心为 R_s，因此 m_s 受 M 的引力作用在 M 外作测地线运动，R_s 的曲率半径为 K_s.当 M 绝热膨胀到 T_1 时，半径增大为 R_1，即 $R_1 > R$，这表明 M 距离 m_s 更加近了，引力也加大了，所以此时在 M 外面的 m_s 运动 的曲率半径变成为 K_{s1}，于是 $K_{s1} > K_s$。

2*。当 M 因排热收缩到 T_2 时，半径减小为 R_2，即 $R_2 < R$，这表明 M 距离 m_s 更加远了，引力减弱了，所以此时 m_s 运动的曲率半径变成为 K_{s2}，于是 $K_{s2} < K_s$。

3*。如果 m_s 在M内部，当M膨胀或收缩时，由于R的增大或减小，m_s 的位置和其运动的测地线也会随着改变。可见，解广义相对论方程所假设的“零压宇宙模型”是与真实的物理世界不相符的。**温度对物质粒子在外部和内部运动的影响在任何情况下都存在，而且是不可以忽略的，忽略就会出现“奇点”**。其实，这就是定性的将宇宙常数Λ引进广义相对论方程中的能量-动量张量内部进行分析的结果，这相当于引进一种能量密度为 $\rho_\Lambda = \Lambda/8\pi G$， 压强为 $p_\Lambda = -\Lambda/8\pi G$ 的能量动量分布，问题还在于这种 ρ_Λ 与 p_Λ 不仅与温度有关，而且与一定温度下的物质结构有关。因此所有解该方程的学者们不得不简化和加进许多限制条件以求解出方程。但是自由绝热状态下的物质粒子团只会增加熵而降温膨胀，**这表明任何时候物质粒子的热压力都超过其引力。只有当其内部的剩余热量流出到外界后，该团物质才会收缩。因此，假设任何一团物质粒子会收缩本身就是一个与物理真实相违背的伪命题。该团物质粒子能够收缩成为“奇点”的充分必要条件必须是该团物质在任何条件下都能将内部热量排除除去，而这是不可能的。特别是物质团被压缩成为黑洞后，因无法向外排出热量，黑洞内部的物质就更无可能靠其自身的引力继续收缩，更绝无可能收缩为“奇点”。所以“奇点”是广义相对论学者们在解方程时违背热力学规律的假设所造成的荒谬恶果。**

《6》。我们宇宙本身和其内部任何物质物体的结构的稳定存在都是在一定温度的条件下，其内部的引力和斥力相对平衡的结果。所以广义相对论方程中只有引力而无斥力是违反我们宇宙和其内部物体物质结构稳定存在的普遍规律的，也就是违反热力学定律和因果律的。

第一；宇宙中任何小于 10^{15} 克的物体，其中心不一定有一个较坚实的核心，因为该物体本身的化学结构就可以对抗自身的引力塌缩。但是质量大于 10^{15} 克的行星，恒星，致密天体，星团，星系等等，其中心一定存在着对抗其自身引力塌缩的较**坚实的核心**。地球和行星的中心有坚实的铁质流体或固体。太阳和恒星的中心有提供高温的核聚变坚实中心对抗中心外的物质的引力塌缩。白矮星的中心有密度约 $10^6 g/cm^3$ 的电子简并的坚固核心。中子星的中心有密度约 $10^{16} g/cm^3$ 的中子简并的坚固核心。每个星系的中心都有密度较大的巨型黑洞。

第二；在我们宇宙内，最实际的关键问题是，现在我们宇宙中所能产生的最大压力是强烈的超新星爆炸。而这种压力也只能将物质粒子压缩到约 $10^{16} g/cm^3$ 的高密度，而形成恒星级黑洞，但还不能破坏质子中子的结构，将其压垮。估计物质粒子的密度达到 $10^{53} g/cm^3$ 才能压垮中子（质子），而压垮夸克的物质密度估计应达到 $10^{93} g/cm^3$。**宇宙中恒星级黑洞的内部因无可能再产生超新星爆炸，靠黑洞内部物质本身的引力收缩不可能克**

服质子和夸克的泡利不相容斥力的对抗。因此，更绝无可能塌缩出无穷大密度的“奇点”。

第三；因为爱因斯坦建立广义相对论方程时，只知道 4 种作用力中的 2 种，即引力和电磁力，而不知道尚有弱作用力和强作用力（核力）。**当大量的物质粒子因引力收缩而密度增大时，它们的弱力，电力和核力所构成的物质结构对引力收缩的对抗作用会随着密度的增大而显现出来。**这就是上面所说的靠大量物质自身的引力收缩是不能逐一压垮这些力所构成的物体的坚实结构的。

《7》。原先只有 2 项的广义相对论方程实际上是一个动力学方程，它在什么样的条件下能够得出较准确的结果？即其有效的适用范围是什么？为什么水星近日点的进动，光线在太阳引力场中的偏转会成为广义相对论方程较准确的验证？一个不加任何限制条件的广义相对论方程能解出来吗？

如果用广义相对论方程研究我们宇宙视界范围以内的宇宙或者宇宙中的某一足够大的区域或定量物体M时（在忽略其内部温度改变的条件下），这应该能够得出**其外部较远的物体或粒子m_s所作的较准确的沿测地线的运动轨迹。**因为在这一定量物质场M的能量-动量张量的作用下，可以看作与其内部为恒温（然而在实际上，M内部的温度会影响其外围尺寸R的大小，从而影响m_s运动的曲率半径），因此，在描述M外的较远的粒子m_s沿爱因斯坦张量的时空几何特性作测地线运动时，而能得出比牛顿力学较准确的结果。

1*。比如，当解决水星近日点的进动时，广义相对论方程之所以能够得出比牛顿力学较准确的计算数值，是因为牛顿力学将太阳质量 M_θ 当作集中于中心一点来处理的。而广义相对论是将 M_θ 的质量当作分布在其太阳半径 R_θ 的转动球体内的。这就使得同等的 M_θ 对水星引力产生差异。这就是广义相对论方程对牛顿力学的修正，和比牛顿力学较准确的原因。

2*。当光线在太阳附近的引力场外运动发射偏转时，**因为已经按照狭义相对论，规定了光子没有引力质量，而将太阳作为恒温定直径球体**，所以光线只能按照广义相对论的解释，在太阳外围作较准确测地线运动。这是牛顿力学无法解决的问题。**但是，如果不按照狭义相对论的观点，而假设光子也有相当的引力质量，用牛顿力学解决光线在太阳外围附近的偏转运动也是有可能的**。

结论：广义相对论对以上 **2 个问题的解决之所以能够得出较正确的结果，主要原因在于；1*。水星和光线都是在太阳 M_θ 的外面运动，因此，在解方程时可以将 M_θ 当作恒温的状态（即不是正在收缩或膨胀的状态）来处理， 2*。既然 M_θ 是在一定（恒温，表明 M_θ 中的粒子此时并未向奇点塌缩）温度下（核聚变供热）的稳定状态，就可以忽略温度改变对 M_θ 本身所能造成的影响和改变。这就使得水星和光线在太阳 M_θ 的外面能有较准确的测地线运动。**

《8》. 如果限定我们宇宙视界内的 M_u 质量温度恒定不膨胀，就可用广义相对论方程研究我们宇宙视界外的物质粒子 m_s 沿测地线的运动，但因我们无法观测到宇宙视界之外的物体运动，所以这对我们毫无意义。

《9》. 当用广义相对论方程研究宇宙内部或者宇宙内部分区域或物体的（比如星系或者星体）内部运动状况时，因为假设只有纯粹的物质引力，而无内部斥力（这些斥力包括有引力收缩时所产生的物质分子的热抗力，物体的结构抗力，核聚变的高温热抗力和物质粒子间的泡利不相容斥力等）与其引力相对抗，即所谓的**“零、恒压宇宙模型”。所以任何物体或者粒子团在其内部只有引力收缩的条件下，就只能一直塌缩成为荒谬的**“奇点”。这就是 **R·彭罗斯和霍金必然会得出的结论。因此，将无宇宙常数的广义相对论方程应用于**

研究宇宙内部和物体内部各处粒子的运动状况时，其内部任何一点的粒子的测地线运动都是很难从方程中解出来的。这是因为物体内部物质粒子在单纯的引力作用下，都处于正在向“奇点”塌缩的不稳定的运动状态过程中。而爱因斯坦 1917 年在忽略温度（实际上是恒温条件）影响的条件下，就其场方程给出了一个稳定态宇宙的解(1b)和(1c)，其实也是处在不稳定的在向“奇点”的塌缩过程中。

《**10**》**.** 因此，**如果要想使广义相对论方程可以用于解决宇宙或其中的某物体内部的运动状态，就必须要在方程的能量-动量张量项内部引入与引力如影随形的斥力，即热力**。同时还要在物体的中心加入某温度下足够大的坚实核心作为附加条件．即一方面要将热力学与其能量-动量张量紧密的结合在一起，使每一个有引力的物质粒子同时具有上述的内部斥力，另一方面还要知道在不同半径上的温度分布和密度分布（不同的质量），即引力和斥力平衡所形成的物质结构，这样才有可能正确地从方程中解出物体结构（核心）外的各处粒子的的真实运动状况，并且避免其内部“奇点”的产生。但如此一来，**这方程就会变得极其复杂而现在完全不可能解出来。反之，如果已经知道了物质团的内部的温度分布（斥力）和其核心的结构状况，就不需要广义相对论方程方程了**。这就是广义相对论方程到现在为止，除了作为一种宇宙观之外，而没有得出许多具有普遍性的科学结论的根本原因。**由于解方程时的简化，反而得出许多的谬论，如“奇点”**。

《**11**》。广义相对论方程中本无斥力，所以无法解释宇宙膨胀。而有排斥力的宇宙常数Λ是爱因斯坦后来加进方程中去的。**Λ是加在具有引力物质粒子的外部，而不是能量-动量张量的内部，**所以Λ的作用在本质上只能引起该物体的外在运动，而难以从广义相对论方程解出物体内部质点的运动轨迹，即测地线。因此，**从理论上讲，只有Λ进入能量-动量张量项的内部，使其内部的每一个粒子具有确定的引力和斥力，才能从该方程中解出物体内部各处粒子的测地线运动。但这种广义相对论完整体系的数学方程尚未建立．**

《12》。本文的下面就是要运用霍金的黑洞量子辐射理论研究黑洞视界的收缩，从而避免了上述广义相对论单纯的引力收缩而导致“奇点”的缺陷的谬误。

霍金的公式(3b)，$T_b = (C^3/4GM_b) \times (h/2\pi\kappa) \approx 0.4\times10^{-6} M_\theta / M_b \approx 10^{27}/ M_b$ [2] 是黑洞量子辐射理论的最大成就。作者在此基础上只前进了一小步，就得出来任何黑洞质量 M_b 与其视界半径 R_b 上量子辐射粒子 m_{ss} 的普遍公式(3d)，**$m_{ss} M_b = hC/8\pi G = 1.187\times10^{-10} g^2$** [1] [6]，再根据部分不可能大于整体的公理，在极限的条件下，只能是 $m_{ss} = M_b$。**因此得出 (3e)式，即 $M_{bm} = m_{ss} = (hC/8\pi G)^{1/2} = 10^{-5}g = m_p$** [1] [6]。**由此证明了黑洞因发射霍金辐射只能收缩成为普朗克粒子 m_p 而在普朗克领域爆炸解体消亡。**在第【五】节中，用粒子 m_{ss} 在视界半径上的热动力学的平衡佐证了(3d)式的正确性。

由于霍金的黑洞量子辐射理论不需要宇宙学原理，恒量物质的引力收缩和零压宇宙模型等许多假设，所以霍金理论比广义相对论简洁正确，不会出现“奇点”。并进而能得出符合宇宙真实性和近代天文观测数据的许多重大的正确的科学结论。

《13》。因为黑洞在其视界半径R_b上的状态参数（M_b， R_b，T_b，m_{ss}）只与黑洞质量M_b有关，而M_b的量是与黑洞内部的状态和结构无关的。因此，在解决黑洞本身的生长衰亡问题时，就无需用广义相对论方程解决黑洞内部结构、状态参数的分布、粒子的运动等问题。而这些黑洞的内部问题只能用牛顿力学、热力学和结构力学等分别予以解决。实力上，**解广义相对论方程的过程，也就是将广义相对论方程分解、简化、还原为牛顿力学、热力学和结构力学等的过程。所以，广义相对论方程除了作为时空统一观有重大的意义外，它没有什么特别重大的功能，也就是说，它既不能将牛顿力学、热力学、结构力学和**

量子力学等综合统一起来，也解决不了分别为牛顿力学、热力学、结构力学和量子力学等所无法解决的问题。所以，实际上广义相对论方程是近代科学上的一个花瓶工程，好看不管用，因为它对物体物质的结构和状态及其转变过程没有提出什么新的观点和变化方程。反而使人们在解方程时，为简化而提出许多违反热力学和真实世界的假设，造成出现“奇点”的重大谬误。

【一】。下面具体分析为什么由广义相对论方程会推导出“奇点”的错误结论。

因为在最早解广义相对论方程时，所得出的弗里德曼(Freidmann)方程，R-W 度规（Robertson-Walker 度规）和史瓦西度规等加入了许多的附加条件，而造成了对宇宙和黑洞的解释都与物理世界的真实状况不相符合。由于本文题目中所有的近代的科学新观点都与广义相对论有关，因此，下面先从广义相对论方程谈起。以**论证绝无可能塌缩出无穷大密度的“奇点”**。

$$\mathbf{G\mu\nu + \chi T\mu\nu + \Lambda\, g\mu\nu = 0} \quad \text{[3]} \qquad \mathbf{(1a)}$$

上面(1a) 式就是爱因斯坦广义相对论方程，该方程原来只有左边的 2 项。引力场方程是非线性的，很难精确求解。Gμν是描述时空几何特性的爱因斯坦张量.。Tμν 是物质场的能量-动量张量，其中 **χ= 8π**G/C⁴.。gμν 是度规张量。不幸的是， 这样的模型与广义相对论的初衷却是不相容的。 这一点从物理上讲很容易理解， 因为普通物质间的引力是一种纯粹的相互吸引的中心力， **而在纯粹吸引作用下的物质分布是不可能达到静态平衡的，只能向其中心收缩**。为了维护整个宇宙的 “宁静”， Einstein 后来不得不忍痛对自己心爱的广义相对论场方程作了修改， 增添了一个所谓的 “宇宙学项”Λgμν，其中 Λ 被誉为宇宙学常数.。Λgμν 具有排斥力，它是爱因斯坦为了保持我们宇宙中引力和斥力的平衡后来才加进去的.[3]

1917 年爱因斯坦就其场方程给出了一个稳定态宇宙的解，**即宇宙半径 R 不随时间的变化，Λ 可以取为** $\mathbf{\Lambda_c = 64\pi^2/(9\chi^2M^2)}$□ **[3]** (1b)

而 $R_c = \Lambda_c^{--1/2}$ [3] (1c)

$4\pi R^3\rho/3 = M = \mathrm{Const} > 0$ [3] (1d)

$(dR/dt)^2 = 2GM/R + \Lambda R^2/3 - KC^2$ [3] (1e)

从(1e)可看出，当Λ= 0 时，只要给出的R受到任何的微扰，即dR/dt一旦不为零，它就会随着时间的改变，宇宙或者膨胀，或者收缩，**总是处在加速或减速运动的状态中**。

《1》。弗里德曼(Freidmann)方程--符合宇宙学原理的“零压宇宙”模型（无热力学效应），无法解释□Ω□**为什么会非常接近于 1。在宇宙学原理和零压宇宙模型下得到的R-W 度规（Robertson-Walker度规）**如下。

$$\mathbf{ds^2 = C^2dt^2 - dl^2}$$
$$\mathbf{= C^2dt^2 - R^2(t)[dr^2/(1-Kr^2) + r^2(d\theta^2 + \sin\square\square\square^2\square\theta\, d\phi^2)]} \quad \text{[3]} \qquad \mathbf{(11)}$$

上面(11)中，R(t)仅仅是时间的函数，与坐标无关，在一定的意义下，R(t)可以理解为“宇宙的半径”，决定宇宙究竟是膨胀还是收缩，K是空间曲率，决定于究竟是有限还是无限。(11)中，r所表示的只是测量距离l与尺度因子R的比，所以r并不是观察者（r = 0）到天体的距离l，而是所谓的径向共动距离坐标。[3]-在(1e)式中当Λ = 0 时，就得到，

$(dR/dt)^2 - 8\pi G\rho R^2/3 = -KC^2$ [3] (11a)

$d^2R/dt^2 = --4\pi G\rho/(3R^2)$ (11aa)

$(dR/dt)^2/R^2 + 2(d^2R/d^2t)/R = -KC^2/R^2$ [3] (11b)

式(11a)是关于R(t)的最基本的方程式。这是一个典型的微分方程。对应于方程中常数项的不同取值，便得到R(t)的不同形式的解。这些解分别对应于不同的宇宙模型。**在推导该方程时，是忽略了宇宙中压力项的影响的**。因此，**由该方程给出的宇宙模型都属于“零**

压宇宙”模型，而且都要符合宇宙学原理。[3] (11b) 就是弗里德曼(Freidmann)方程，是弗里德曼直接从爱因斯坦场方程得到的。(11a)和(11b)两式是完全一致的。(11a)可以改写为，

$$\rho = 3\,[(dR/dt)^2 + KC^2]/(8\pi GR^2) \quad \square\square^{[3]} \qquad (11ab)$$

从(11ab)可以看出，在R(0) = 0 时，$\rho \to \infty$。所以R(0) = 0 是空间“奇点”，无论K为何值，该点的空间曲率和密度都是∞。这就是广义相对论得出的宇宙产生于无限大密度的“奇点”结论的根源。

由(1e)和(11b)式，可以得到，在宇宙总物质 M 不变的条件下，即符合(1d)式时, 即 $M = 4\pi$□$R^3/3 = \text{const}$, □□

$$\rho = -\,(d^2R/d^2t)/\,4\pi G\,R = 3\,H^2q/4\pi G \quad \square\square^{[3]} \qquad (11c)$$

上式(11c)通常将宇宙的物质密度ρ用哈勃常数 H 和减速因子 q 来表示。定义一个宇宙的临界密度ρ_c，令,

$$\rho_c \equiv 3H_o^{\,2}/8\pi G \quad \square\square^{[3]} \qquad (11d)$$

设宇宙目前的密度值为ρ_o，H_o是宇宙目前的哈勃常数，q_o是目前宇宙的减速因子。

$$\rho_o = 3q_oH_o^{\,2}/4\pi G \quad \square\square^{[3]} \qquad (11e)$$

相应地定义一个密度参数值□□□，

$$\Omega \equiv \square\ \rho_o\square\square/\rho_c \quad \square\square^{[3]} \qquad (11f)$$

广义相对论就是用□□的值来判断宇宙的最终命运的。当$\Omega > 1$，即□,□ ρ_o□□$/\rho_c > 1$时，宇宙是闭宇宙，闭宇宙是有限的。当□□$\Omega < 1$, 即,□ $\rho_o/$□□ρ□$_c<1$ 时,宇宙是开宇宙。开宇宙是无限的，没有有限半径。当Ω □=1□，即□,□ ρ_o□□$/\rho_c = 1$时, 是临界情形，宇宙是平直的无限宇宙。由于q_o和H_o的实际准确值很难测定，而Ω的值又非常非常地接近于 1，所以用广义相对论的这种方法很难判断出宇宙是封闭还是开放。

上述的标准宇宙模型，即FLRW(Freidmann -Lemaitre-Robertson-Walker)模型，也就是弗里德曼(Freidmann)模型，[3] 这是一个没有考虑**热压力**(零压宇宙模型)的**定质量**的**纯引力**收缩模型。它无法解释宇宙为什么会膨胀。因此，它用□ $\Omega \equiv$□ ρ_o□□$/\rho_c$去判别宇宙是封闭还是开放实质上是一个**伪命题**。**下面作者将以黑洞宇宙模型完满地解释我们宇宙的生长衰亡规律。并得出结论：**□ $\Omega \equiv$□ ρ_o□□$/\rho_c$ **= 1 是黑洞宇宙的本质属性**。当今较准确的观测值是：($\Omega = 1.02 \pm 0.02$)，这完全证实了黑洞宇宙观念和理论的正确性。

《**2**》。.约四十年前，彭罗斯和霍金发现广义相对论方程存在空-时失去意义的“奇点”。**霍金写道：“罗杰·彭罗斯和我（霍金）在 1965 年和 1970 年之间的研究指出，根据广义相对论，在黑洞中必然存在无限大密度和空间—时间曲率的奇点。这和时间开端时的大爆炸相当类似”**[8]。**所以“奇点”成为爱因斯坦的广义相对论一个必不可少的组成部分**。[7] 因为普通物质间的引力是一种纯粹的相互吸引， 而在纯粹吸引作用下的物质分布是不可能达到静态平衡的。**广义相对论认为星系演化经过黑洞最后还会塌缩成为“奇点”，宇宙开端有“奇点”。甚至可能存在“裸奇点“**。爱因斯坦自己写了一篇论文，宣布恒星的体积不会收缩为零。**所以罗杰·彭罗斯和霍金在爱因斯坦死后对“奇点”的证明是违反爱因斯坦的初衷的。**事实上，**在真实的宇宙中和物理世界，没有发现“奇点”存在的蛛丝马迹**。为了避免理论与实际矛盾的尴尬，**彭罗斯于是不得不提出“宇宙监督原理”来加以避免。这和牛顿的“第一推动力”的错误思想如出一辙**。“奇点”，这一理论病态的发现是理论研究的重要进展，却又与等效原理不协调。

从上面的分析和论证可见，广义相对论方程得出“奇点”的必然结论是基于几个假设：第一。引力塌缩时的质量守恒。**第二**。忽略了引力收缩时所产生的热压力和辐射压力的对抗作用。**第三**。忽略了物质结构及其物质粒子间的不相容对引力收缩的对抗，和物体中心所形成的坚实的核心对其引力的对抗。因此，在该方程中，恒定量（即使是一块石头）的物质的纯引力收缩必然会一路毫无对抗地在收缩形成黑洞后再直接收缩达到“奇点”。这就

是彭罗斯和霍金在从广义相对论方程推演出“奇点”的过程中必须遵循的前提条件。如前言中所述，**这些假设条件使广义相对论方程所描述的收缩过程违反了热力学定律。**

《**3**》。广义相对论是只假设恒质量M物质的引力收缩，而没有考虑引力收缩时所引起的热压力的对抗。所以当一定质量的M收缩到史瓦西解成为黑洞时，即达到$M = M_b = C^2R_b/2G$时（附注：在后面的第【2】节中，还要证明，恒量的M物质不可能收缩成为$M = M_b = C^2R_b/2G$的黑洞，更不可能收缩成为“奇点”），M仍然会一带而过地变成继续在黑洞内部收缩，**而且按照彭罗斯和霍金的解释，在黑洞形成后的瞬间，黑洞内部突然变成时空颠倒，所有黑洞内的能量-物质一下收缩到中心成为密度无限大的“奇点”，并使黑洞内部空间成为真空**。这就是罗杰•彭罗斯和霍金证明后的结论。其解释的根据是史瓦西度规，这个度规也是零压宇宙模型并符合宇宙学原理的，即，

$$\mathbf{ds^2 = (1- r_b/r)dt^2 - dr^2/(1- r_b/r) - r^2d\theta^2 -{}^{\square}\square\, r^2\sin^2\theta d\varphi^2}\ ^{[4]} \qquad \mathbf{(12a)}$$

A**。下面从第一 到第四是近代的广义相对论学者们对**(12a)**式的解释，在该式中，$\mathbf{r_b =2GM_b/C^2}$**, $\mathbf{r_b}$是质量$\mathbf{M_b}$的引力半径或史瓦西半径。对于太阳，$\mathbf{r_{bs} = 295cm}$,** 对于地球，$r_{be} = 4.33mm$.[4]

第一．当 $r_b < r$ 时，即从黑洞外面观察黑洞对外界物质或物体的引力作用时，(12a)式是正常的。广义相对论的解释是可以被接受的。也就是说，黑洞的质量 M_b 与具有相同质量的物体所产生的中心力对外界所产生的引力场没有什么本质地不同，实际上是将 M_b 当作为中心力来看待的。

第二．当$r_b = r$ 时，按照广义相对论对(12a)式的解释，称为坐标奇点。它可以通过坐标变换而去掉。尽管如此，它**还有许多异乎寻常的性质**。当$r_b= r$ 时，(12a)式变为$ds^2 = 0\times dt^2 - \infty\times dr^2$，这就是说，在黑洞的视界半径$r_b$上，一个事件无论经过多么长时间dt，事件的信息也传不出去，**因为光在$\mathbf{r_b}$上被禁锢**，不能逃出r_b之外。广义相对论的这种解释可以认为是正确的。

第三．按照霍金等对广义相对论的**史瓦西度规**对(12a)式的解释，**因为他们假设，当$\mathbf{r = 0}$ 时，成为内禀奇点。全部质量集中于此点，密度为无穷大，时空曲率无穷大，物理定律失效。**这只是他们按照(12a)式的数学方程而作出的一种无可奈何的假设性的错误解释，也就是一种曲解。**他们是假设黑洞内的物质在没有任何对抗力的条件下，按照单纯的引力收缩必定成为“奇点”而得出的结论**。按照他们的这种假设，黑洞外的物质的引力收缩的条件也应该是同样的，也可以收缩为奇点。由此推而广之，就可以得出结论，**凡是有物质存在的地方，都会塌缩出来“奇点”**。这是把“奇点”当作事实上已经存在于黑洞中心后所作出的错误解释。

第四．当$r_b > r$ 时，按照霍金等对广义相对论的解释，(12a)式变为$ds^2 = -(r_b/r-1)dt^2 + dr^2/(r_b/r-1) - \mathbf{r^2d\theta^2 -{}^{\square}\square\, r^2\sin^2\theta d\varphi^2}$，**因为式中$\mathbf{dt^2}$为“–”而$\mathbf{dr^2}$为“＋”，所以得出黑洞内时空颠倒的结论**，以便进一步得出黑洞内所有物质塌缩集中到其中心成为“奇点”的荒谬结论。

上面第三，第四中，按照霍金等对广义相对论的史瓦西度规对(12a)式的解释，**就得出了黑洞中心出现“奇点”，时空颠倒，内部真空的结论。但是其解释的理由是错误的。**

B。作者认为他们对(12a)式的解释和推理是不对的，理由如下**。首先必须指出的是广义相对论学者们解释的 2 个根本的错误前提：第一；他们对黑洞的定义是以错误的假设作为先决条件的，他们说：“由视界包围的，含有奇点的封闭时空区域叫黑洞”[4]。而在真实宇宙中，黑洞内外都无奇点。第二；在(12a)式中，因为所规定的r_b与 r都决定于其内所包含的物质量m，而广义相对论学者们在解释(12a)式时，故意混淆其中r_b/r的含（定）义。在**黑洞内**，如果按照他们的说法，**物质都已经全部集中于中心成为奇点，那么，$\mathbf{r_b}$与r内的质**

量就是同样的M_b，即$r_b/r = 1$，而不是如他们所说的$r_b/r > 1$。所以他们按$r_b/r > 1$得出黑洞内时空颠倒的结论是他们自相矛盾的结果，是根本不可能出现的。也就是说，他们的结论是在用循环假设来循环论证而得出的错误结论。他们是在假设黑洞内能量-物质的引力已无对抗力而塌缩成为“奇点” 的条件下，来证明黑洞内部的“奇性”。

1#。按照霍金等对广义相对论的史瓦西度规(12a)式的解释，即当$r_b< r$时或者$r_b= r$时，即对上面A***节第一，第二项的解释之所以能较正确的符合真实情况，是因为他们假定r_b内的质量M_b和r内的质量m符合真实情况，即此时$m \geq M_b$, 所以$r \geq r_b$。**而且此时他们故意含糊在r_b的中心是否存在“奇点”，只承认r_b内的质量为M_b，他们实际上并未将M_b当作已经塌缩成为“奇点”来看待**。因为黑洞内的**M_b是塌缩成为“奇点”，还是分别在r_b内，其引力的效果对于大于r_b的r来说是同样的**。

其次，如果按照霍金等所强调的，r_b 的中心也已经有密度为无穷大的“奇点”出现，而因为“奇点”不可能稳定的长时期的存在，**r_b 内的质量在变成“奇点”后是否会增长爆炸到大于 M_b 呢**？若果如此，在第一，第二项的某些情况下，(12a)式中也会出现 $r_b> r$ 的情况而变成与第三，第四中的状况完全一样，形成时空颠倒。**霍金等从未谈到会出现这种情况**。可见，霍金等此时是在作有利于他们结论的有选择性的解释。

2#。如果仅从数学观点来分析(12a)式，也可以作如下解释：在r = 0 时，因**ds只能在r_b内**，此时，$ds^2 = -\infty \times dt^2$，首先的直接的结论应该是$ds^2$为负，是虚数，是无意义。即在 0 点，无论dr 或者dt是“—”或“+”，都与ds无关，即永远隔绝，所以在r = 0 点的物质质量也只能看作为 0。{因为从(12a)式可见，在r_b / r 中，既然$r_b = 2GM_b/C^2$，就是说，r_b中包含有M_b，则r 中就一定包含有m。所以在r = 0 点，应该是m = 0。} 而不必看成是广义相对论所述的∞。所以没有引力对ds产生影响。再者，如果按照他们的假设，M_b已经在r = 0 点处成为“奇点”，则$r_b/r=1$.因此，**广义相对论认为在r = 0 处 “密度为无穷大，时空曲率无穷大”的解释是先入为主的相互矛盾的假设**，是为他们先假设“**在r = 0 处存在奇点的先决条件下**”作补充循环论证。或者说，他们的解释比作者的解释至少更为不合理。

3#。上面霍金等 A***节第三，第四项中对公式(12a)解释的**根本错误**在于：**当将(12a)式用于黑洞内部时，他们没有按照具体情况正确地分析究竟 r_b 和 r 代表什么？意味着什么？r_b 内的质量和 r 内的质量是什么**？。

在实际上，当黑洞形成之后，如果还要对黑洞内部状况用(12a)式加以运用和解释的话，就只能出现以下几种状况：

{a}。假设黑洞内部中心再出现 1 个小黑洞，其史瓦西半径为r_{bo}，然后将(12a)式全部用于黑洞内，(12a)式中的r_b/r现在就会变成为r_{bo}/r_b或者r_{bo}/r，此时$r_b > r > r_{bo}$，即将ds也放在r_b内，这样，对于用(12a)式的解释就回归到A***节中第一，第二的真实情况。此时黑洞内除了小黑洞r_{bo}之外，其余的空间并不是黑的。

{b}。在黑洞形成以后，一方面，内部密度大大的增加了，此时不能再作为零压模型来考虑，而黑洞又将所有能量物质禁锢在黑洞内。另一方面，密度的增加又使得粒子间的泡利不相容的排斥力增加。这些对抗力和增高的温度一起完全能够对抗原有物质引力的继续收缩，而在一定的条件下达到平衡，**并在黑洞中心出现一个能够对抗 M_b 的引力塌缩的坚实核心**。设其核心的引力半径为 **r_o**，则应用(12a)式中的情况与{a}段中相似。只不过r_o 内的质量与密度小于 r_{bo} 内的质量和密度而已。此时黑洞内就并不黑。

{c}。按照宇宙学原理和伯克荷夫 (G.B.birkhoff) 定律，物质自身的引力是中心力。一大团均匀和各向同性的物质的引力塌缩只决定于物质粒子在所规定的周边处的势能，即GM/r。因此，在均匀和各向同性的宇宙（黑洞）内部某一大尺寸区域是 $4\pi\rho r^3 = 3m$，在$\rho =$ □const时，**m是以r^3 在急剧地减少**，所以在该区域的各处$r_o = 0$ 处，只能是m = 0，因此，在该区域内，不可能出现“奇点”。

对于我们宇宙（黑洞）内某处如果塌缩出来的一黑洞 r_b，其中心一定存在着一个较高温高密度的核心 r_{bb} 能对抗住 r_b 内物质的引力塌缩。所以除了在 r_{bb} 的中心 r = 0 处，只能有 m = 0，不可能出现□为∞ 的“奇点”。

{d}。如果按照彭罗斯和霍金的解释，黑洞内部除了中心集中所有能量-物质的奇点之外，其余的空间全是真空。**那么在能量-物质绝对真空内应用公式(12a)，就只能得出 ds，r_b，r 等根本不可能发生任何联系，是完全隔绝的结论。而且因奇点集中黑洞内所有的能量-物质，所以只能是 r_b/r =1，即(12a)不适用于黑洞内部的结论**。而所谓黑洞内部“时空颠倒”就是毫无根据和毫无意义的。可见，黑洞中心存在“奇点”根本就是一个假设性的相互矛盾的**伪命题，**是用等质量物质在无热力对抗条件下引力可以无限塌缩的结果。

{e}。如果按照霍金等对广义相对论的解释，**黑洞中心已经成为“奇点”，这个无限大密度的“奇点”为什么不即刻大爆炸呢？**这种大爆炸如果能破坏黑洞的视界，黑洞就解体消失了，会变成另外的宇宙了。如果这种大爆炸不能破坏黑洞的视界，就表示黑洞仍然牢不可破，“奇点”在大爆炸后的物质又会按照广义相对论的解释，重新塌缩到中心再次成为“奇点” 。这样，**黑洞内部就会不停地产生反复的“奇点”大爆炸，永远没完没了，真实的物理世界是这样吗？**

4#。结论：综合上面所述，**可以得出如下结论。在黑洞形成过程中，质量并不守恒更非零压。当黑洞形成之后，黑洞的视界将其内外分隔成 2 个不同性质和状态的区域。这 2 个区域是不均匀的和各向不同性的。黑洞内更不符合零压宇宙模型。因此，就不能按照广义相对论学者们那样，直接将公式(12a)从黑洞外搬进黑洞内运用，而造成黑洞内出现“奇点”，时空颠倒和内部真空的错误结论。因此，如要公式(12a)用于黑洞内部，就必须**a。，只能将(12a)中在外面所用的 r_b/r 改成为在黑洞内部用的 r/r_b。b，承认黑洞内一定存在对抗其引力塌缩的坚实核心。3，将 r_b/r 与其内所包含的质量和密度联系在一起考虑。

《5》. 下面具体的分析一下由广义相对论推导出来的“奇点”不可能在真实的物理世界出现和存在的原因：

1*. 宇宙中稳定的物质结构是在不同的温度下构成不同的物质层次的。当物质结构从某一层次转变为另一层次时，会发生“相变”，两层次的结合处是“临界点”。适合于某一物质结构层次的数学方程达到其“临界点”后就会失效，正如流体力学方程不适用于其“沸点”和“冰点”一样，也只能用于流体，而不能用于气体和固体。作者在下面将会证明，当黑洞只能因发送霍金辐射而收缩到密度≈10^{93}g/cm^3 时，就达到了宇宙的最高极限温度，即 10^{32}k，即达到时空不连续的普朗克领域 (Planck Era)，这就是“临界点”。此时广义相对论就失去了作用。因此，黑洞不可能再继续收缩和增高密度，而达到无限大密度的“奇点”。

2*. (12a)式是在“等质量和零压宇宙模型”的条件下从爱因斯坦的场方程中得出的。即没有考虑引力收缩时的热压力的增加，**在真实的物理世界，宇宙中的温度不可能达到无限高**，当热压力增加到某种程度时，是完全能够对抗引力的继续收缩的。能量-物质密度的增加会造成的热压力的增加。所以，**温度是对抗引力收缩的如影随形巨大力量，任何一团定量物质不可能绝热收缩，在不散热的高密度高温度下的热抗力更是不能忽略的。当黑洞因发射霍金辐射而收缩到宇宙的极限高温度时（10^{32}k），物质粒子都变成普朗克粒子 m_p，必然在普朗克领域消亡**。实际上宇宙学项中的排斥作用就应当包括引力收缩时所产生的高温压力增高的排斥对抗作用。

现代宇宙学中通常把宇宙学项并入能量动量张量，这相当于引进一种能量密度为 $\rho_\Lambda=\Lambda/8\pi G$， 压强为 $p_\Lambda= -\Lambda/8\pi G$ 的能量动量分布，这样的广义相对论方程应该比原来的方程正确得多，但为了得出近似解，又不得不加进一些简化假设。 这是一种十分奇特的能量动量分布， 因为在广义相对论中，当能量密度与压强之间满足 $\rho+3p<0$ 时， 能量动量分布所产生的 “引力” 实际上具有排斥的作用。 因此在一个宇宙学常数 $\Lambda > 0$ 的宇宙学模型

中存在一种排斥作用，这种排斥作用与普通物质间的引力相平衡使得 Einstein 成功地构造出了一个静态宇宙学模型，其宇宙半径为 $R=\Lambda^{-1/2}$，即公式（1c）。**这说明宇宙膨胀到密度很小的情况下，温度的斥力也还是不可忽略的。考虑了温度的斥力，就可能得出较符合实际情况的结论。** 虽说静态宇宙模型的构造是如愿以偿了， 但 Einstein 对所付出的代价却很耿耿于怀， 他在那年给好友 Ehrenfest 的信中说自己对广义相对论作这样的修改 “有被送进疯人院的危险”。 几年后， 在给 Weyl 的一张明信片中他又写道： “如果宇宙不是准静态的， 那就不需要宇宙学项”。**可见爱因斯坦为了他的理论的完美，是宁可不接受实验的检验和纠正的。**

但是，必需指出，这种（$\rho_\Lambda=\Lambda/8\pi G$， 压强为 $p_\Lambda= -\Lambda/8\pi G$ ）的能量动量分布的假设只能勉强用于黑洞外的物质粒子的收缩，而不能用于发射霍金量子辐射的黑洞视界半径。**更不能将同一广义相对论方程无条件地连续地直接用于黑洞视界半径的外部和内部。**

3*．(1a) 是一个等式，从因果关系来看，应该是无限大的物质密度才能产生无限大时空曲率的“奇点”。但是，现在我们银河系，无数恒星级黑洞和星系中心的巨型黑洞已被观测所证实，而且我们的宇宙就是一个巨无霸黑洞。**在宇宙黑洞内，我们没有感受到“奇点”大爆炸的威胁，和感受被“奇点”吞噬的危险。**这说明彭罗斯和霍金根据爱因斯坦广义相对论方程得出的有关“奇点”的结论是一个违背实况的虚构怪物。

4*．**排除“奇点”的广义相对论有什么不好**？现代科学家的头脑中都有一个怪物，就是终极理论 T.O.E. 由此可见，科学家们的病态不在于他们的数学理论，而在于他们的思维方式和认识论。他们是在把自己掌握的数学方程当作自己的上帝来信仰的。他们宁可迷信和服从自己的的数学方程，也不相信不符合其数学方程的真实的物理世界。科学家们不应该抱残守拙，用一些不合实际和不合逻辑的稀奇古怪的新观念去修补其数学方程中的缺陷。**特别是许多科学家坚持认为宇宙和黑洞内存在“奇点”的事实，只是因为他们的事业，荣誉和权威就是建立在这个理论上的，为此我感到很困惑。**更特别玄乎的是他们首先将广义相对论方程推崇为具有无限的和绝对的正确性，而又隐瞒他们在解方程时的假定条件，然后以自己的新观念符合该方程为荣以证明自己的正确性。

5*．由此可见，**本身只有物质的引力广义相对论方程是有根本缺陷的。**在真实的物理世界，如果没有对抗引力收缩的各种排斥力，一块铁，一个人，一池水，以座山，地球等等都完全可以靠其自身的引力收缩成为“奇点”，这是多么荒谬的结论。物理学是建立在实验的基础上的，其结论应该符合物理世界的真实性和热力学定律，**而不应该顺从有许多假设条件的数学方程的荒谬解释。**广义相对论的学者们用“宇宙监督原理”以解释宇宙中不存在“奇点”的事实表明他们是很无能和很无奈的。**宇宙中物质粒子的引力和及其如影随形的温度斥力是一对永不分离的矛盾体，它们在各种不同条件下的平衡就构成宇宙中不同的稳定存在物体和天体。**

【二】。宇宙中真实存在的恒星级黑洞的形成的过程：

所有的恒星级黑洞都是是靠大量物质的引力收缩到引发核聚变完成后，通过超新星的强烈爆炸而形成的。靠恒质量物质的自身引力不可能收缩成为同等能量－物质质量的黑洞。在恒星级黑洞内部因绝无可能再产生超新星爆炸和在热量无法向外散去的情况下，根本不可能靠其自身引力直接塌缩成为更小的黑洞，更不可能塌缩出无穷大密度的“奇点”。

《1》.宇宙中一团原始星云为什么会在其引力的作用下收缩？物质的热压力(温度)和引力是一对永不分离的矛盾体，如影随形。在宇宙的持续膨胀过程中，物质密度偏高的星云团内辐射成分比例的相对下降和热量向外流散造成了温度降低，造成了物质团块引力收缩。

$$R \propto 1/T_r \qquad\qquad R \propto 1/T_m^2 \qquad\qquad (21a)$$

上面(21a)式中，R是宇宙尺度，T_r 是宇宙的辐射温度，T_m是宇宙中物质的温度。从(21a)式中可以看出，在宇宙膨胀时，物质的温度T_m的降低比R的膨胀要快一些。这就是说，星云膨胀中物质温度较快的降低(排温)是引起物质粒子引力收缩的主要原因。反过来，**当星云中的物质粒子收缩即R,减少时，由于粒子收缩的位能转变为热能后不停地向外辐射造成R,的继续收缩，温度T_m的持续上升**。当R,收缩到一定程度，使星云中心的温度T_m达到约 2×10^7k时，就达到了产生核聚变的温度。在星云内一定尺度的中心就点燃了核爆炸，于是一颗恒星就诞生了。恒星中心核聚变的热能所产生的持续的高温高压就成了维持其外层物质引力塌缩的对抗力量，使恒星能够在数亿 ~ 数百亿年内维持稳定，不会塌缩。直到中心的核燃料耗尽，不再能够产生高温高压以对抗其引力塌缩时，**恒星中心的残核按照其质量的大小分别可以塌缩成为稳定的长寿命的白矮星，中子星或者黑洞**，也可能白矮星经过吸收外界能量-物质而达到钱德勒塞卡极限产生激烈的Ia型超新星大爆炸将残骸全部爆炸成为微粒子而喷发散布到宇宙空间。

物质结构和其内部物质粒子在不同温度和尺寸范围内都有不相容的斥力能对抗引力收缩。白矮星内的电子简并压力，中子星内的中子简并压力都能有效地对抗其本身物质引力的收缩。许多学者认为，当恒星内部核聚变完成后，其中心残骸变成为铁时，就无力对抗引力塌缩而收缩成为黑洞了。[4] 这种看法是不对的。我们知道，中子星的核心密度约达到5×10^{15}g/cm^3，而且外壳所形成的铁层比普通铁的密度要大上亿倍。在如此高的密度下，**中子星中心的物质粒子已经变成为超子或固态中子，其内部质子和夸克之间的不相容还能承受更高密度的引力**。而（1.5~2）M□$_\theta$质量的中子星不能塌缩成为黑洞不是因为其核心密度不够高，而是因为其高密度核心的质量较小，其所产生的引力还无法使其内部的超子或固态中子核心外的物质继续收缩。所以一旦中子星吸收其伴星和其外围的物质，质量增加到超过奥本海默极限而达到（2.5~3）M_θ质量时，变大的 5×10^{15}g/cm^3 高密度核心的引力增大到使其视界半径R上辐射能量无法逃出R时，就成为恒星级黑洞了。

一旦恒星级黑洞形成，由于它就会吸收存在于外界的能量-物质而扩大视界半径，并同时降低其密度了。所以恒星级黑洞内的最高密度可能就是约为(5×10^{15} ~ 10^{16}) g/cm^{3}了。而比 3M_θ质量更大的黑洞，其密度就比(5×10^{15} ~ 10^{16}) g/cm^{3}更低了。因为黑洞的形成是在其核聚变彻底完成后，靠超新星爆炸的巨大的内压力使其残骸塌缩而成，或者是中子星吸收其伴星物质超过奥本海默极限塌缩而成。**无论是由哪一种情况所形成的恒星级黑洞，其内部都不可能再产生比核爆炸或者超新星爆炸的更加巨大压力。更因为黑洞内的热能无法外泄，恒星级黑洞内的密度又高，因此，在达到某种温度时，热压力就能对抗其内部自身物质引力的继续收缩而达到平衡，正如恒星内核聚变的高温阻止其物质引力塌缩的道理一样，其内部连出现更小的黑洞都无可能，更绝无可能塌缩成为无限大密度的“奇点”。**

《2》. 从上面可以大致了解到恒星级黑洞的形成过程。关键问题在于：我们必须重新考虑真实世界与其所描述的广义相对论数学方程之间的不同关系，**了解到在某些假定条件下物理方程的解并不一定存在于真实世界中，而只是一种数学游戏。**因此就要如何正确认识广义相对论与黑洞和“奇点”3 者之间的关系。

第一；罗杰•彭罗斯和霍金根据广义相对论场方程证明黑洞内能够塌缩出“奇点”的前提条件是：1*。在质量守恒和其自身纯引力作用下收缩。**2***。要符合宇宙学原理(密度均匀和各向同性)。**3***。零压力宇宙模型，即物质收缩时，温度升高所产生的热压力可以忽略不计，即收缩时引力位能所转变成的热能要全部辐射到外界。**4***。忽略了核聚变的高温对引力塌缩的对抗力。**5***。忽略物质结构及其内部粒子不相容所产生的巨大排斥力完全能够对抗其自身的引力收缩。**6*.** 即使宇宙中最强烈的超新星爆炸所产生的内压力也只能压缩成密度约 10^{16}g/cm^3 的中子星核心或恒星级黑洞的核心，即成为超子或者固态中子，这

是宇宙现实中密度最大、温度最高的物质粒子团。而这还离压垮质子所需的高密度约 10^{53}g/cm^3 和高温度相差的非常之大。

由此可见，**宇宙中真实的最高密度的物质团是恒星级黑洞，其真实的形成过程完全不符合罗杰•彭罗斯和霍金解广义相对论场方程时规定的前提条件，从而使他们得出“物体引力塌缩最终形成奇点”的谬论.**

第二；从纯粹的数学观点看，广义相对论方程不仅可以用于宇宙，按照罗杰•彭罗斯和霍金根据广义相对论场方程的论证，任何一团大小的物体或物质粒子都可以在其自身物质的引力作用下，毫无阻碍地可以收缩成为“奇点”。这就是彭罗斯和霍金关于“任何物体受到引力塌缩必须最终形成一个奇点”的定理。**然而真实的物理世界却完全否定了罗杰•彭罗斯和霍金的推理和论证。一块石头，一个人，一座山的分子结构，地球铁质核心，太阳和恒星中心的核聚变所产生的高温，白矮星的电子简并斥力等等都能对抗其引力收缩。恒星级黑洞内部的高温度高密度和中子星靠中子的简并斥力都能够更加有效地对抗其引力收缩**。而大黑洞和巨型黑洞的内部密度反而是大大地降低了，其物质粒子本身的稳定和原子分子结构就能承受其全部物质的引力。这也就是说，**由广义相对论数学方程所描述的给定的一团物质在其自身的引力作用下能够塌缩成为一个黑洞是一个伪命题，更不可能塌缩成为“奇点”。**只要考察一下宇宙中众多的白矮星的状况就可以知道，由于白矮星极难向空间散发出其内部的热量，释放能量以降低温度和冷却的速度极其缓慢，所以白矮星是非常稳定的，经过数千亿年之后，白矮星才会冷却到无法发光，而成为黑矮星。因此，现在宇宙中尚无一颗黑矮星。

第三；最近天文学家借助于“钱德拉”X射线观测望远镜在位于天坛星座的年轻的Westerlund 1 星团中，发现了这样的星。Westerlund 1 星团拥有几颗巨大恒星,它们的质量超过太阳 40 倍。根据现有的恒星演变理论，巨大恒星在密实星团中的碰撞会导致“中等”黑洞的形成。**但是在Westerlund 1 星团中没有找到任何“中等”黑洞，而是出现了一颗中子星**，其正式编号为J164710.2-455216。天文学家根据中子星的特性可以确定生成它的原始恒星的参数：它的质量至少超过太阳质量 **40 倍。也就是说,它属于非常巨大的恒星。这说明无论多大的恒星的超新星爆炸所产生的巨大的内压力最多也只能产生一个（1.4~2） M_θ 的中子星，**而几乎不可能产生比中子星密度更大的一个（1.4~2）M_θ的小黑洞。**因为其爆炸力只能压缩物质粒子成为密度约 10^{16}g/cm^3 的中子星核心，即超子。**

“美宇航局戈达德太空飞行中心天文学家尼古拉·沙波什尼科夫及同事在加州洛杉矶举行的美国天文学会高能天体物理分会的会议上公布了这一发现。所发现的这个“小”黑洞的代号为XTE J1650-500，**现这个黑洞的质量仅仅是太阳质量的 3.8 倍（附注：其密度约为 10^{16}g/cm^3）**，比之前保持着最小质量记录的黑洞小了不少，它是太阳质量的 6.3 倍。那么最小黑洞的质量究竟有多少？**按照天文学家估计，应是太阳质量的 1.7 倍至 2.7 倍。比这还小的天体只能是中子星了。**找到追近这一下限的黑洞，有助于物理学家更好地理解物质在这种极端环境下被碾碎时的表现.”[14]

《3》. 结论：1*。在我们现在和遥远将来的真实宇宙中，无论是极强烈的超新星爆炸所形成的（1.4~2） M_θ的中子星或者（2~3 ）M_θ的恒星级黑洞内部，**其爆炸所产生的最大的内压力也只能压缩成密度约为 10^{16}g/cm^3 的超子物质（浆团），或者是形成固态的中子核心**，或者是形成中子流体中的 π 介子凝聚。而不可能产生密度更高的核心物质，所以在宇宙中不可能出现比恒星级黑洞更小的黑洞。

2*。可见，**现在宇宙中还没有一种力量可以破坏质子，这个就是质子的寿命能够长过 10^{31} 年的原因**。因此，**密度约为 10^{16}g/cm^3 的超子或者固态中子就是我们现在宇宙中最高密度的物质，它们只能存在于中子星或者恒星级黑洞内部。**恒星级黑洞以及比其更大得多的巨型黑洞是宇宙中真实存在的实体。一定质量黑洞M_b在宇宙中的形成并不是靠其同等质

量M_b自身的引力，而是靠比M_b大得多M(即$M \gg M_b$)的物质引力的收缩，最后再加上核聚变完成后所产生的超新星爆炸的极大压力而形成中子星，再由中子星吸收其伴星和周围的的物质，长大到超过奥本海默极限而变成恒星级黑洞。

3*。在恒星级黑洞内部，因为再无可能发生超新星爆炸，而热能又极难外泄，质子远未被压垮。压垮质子的密度可能约 10^{53}g/cm^3。即使质子被压垮了，还有更强的夸克之间的泡利不相容斥力，其密度会达到 10^{93}g/cm^3。无穷大密度的“奇点”只有在压垮密度10^{93}g/cm^3 的夸克后，才有一点可能出现。可见，恒星级黑洞内部连出现更小的黑洞都不可能，怎么可能靠其物质自身的引力塌缩出无穷大密度的“奇点”呢？黑洞的质量愈大，其密度反而愈小。所以大于 3 M_θ的黑洞内就更无可能出现“奇点”了。

在爱因斯坦建立广义相对论的时代，他只知道引力和电磁力这 2 种长程力，在其作用下，物质所能达到的最大密度，是太阳中心的密度约为10^2g/cm^3 。那时，不知道还有核心密度为10^6g/cm^3 的白矮星和密度为 10^{16}g/cm^3 的中子星。更不知道弱作用力和强作用力可以组成密度为10^{16}g/cm^3 ~10^{53}g/cm^3 的质子，和密度为 10^{53}g/cm^3 ~10^{93}g/cm^3 的夸克。因此，那时爱因斯坦和其他的科学家们想当然的认为，物质粒子的引力可以自由而无休止地收缩。这是可以理解的。然而，现在主流的的科学家们固执的坚持物质粒子的引力可以收缩成为“奇点”，却是盲目而失去理智的。

4*.所有宇宙中星系中心几乎都存在着（10^5 ~ 10^7）M_θ巨型黑洞或者（10^9 ~10^{12}）M_θ超级黑洞，它们都是在宇宙早期形成的，是由巨大的类星体或者星云在庞大的外围物质的引力作用下由其相对较小的中心核塌缩而成，而不是由中心核自身的引力可以塌缩而成的。但是在其中心还是可能形成恒星级黑洞的。由于它是在大黑洞内的小黑洞，我们是无法观测到的。宇宙中，包括我们地球上的重原子，如铁铀等都是强烈的超新星爆炸形（合）成的。

5*. 宇宙中最强烈的引力收缩是黑洞不停地向外发射霍金辐射而产生的收缩。因此所有黑洞的最后命运都是收缩成为最小黑洞 $\mathbf{M_{bm}}$，即普朗克粒子 $m_p = \mathbf{M_{bm}}$，而在普朗克领域(Planck Era)爆炸解体消亡，而不是收缩成为密度无限大的“奇点”，**这说明由于量子效应，奇异性会消失**。也同时表明：宇宙中物质结构的“相变”会阻止“奇点”的产生，而不是什么“宇宙监督原理”阻止了“奇点”的出现。

6*。罗杰•彭罗斯和霍金根据广义相对论场方程证明，一定量的均匀和各向同性的物质（质量守恒）在其自身引力的作用下，必然会塌缩成为“奇点”，而不是黑洞。所以“奇点”是广义相对论方程的必不可少组成部分。这是霍金和彭罗斯在错误假设的条件下从数学中推导出的的证明和贡献。但真实的宇宙中找不到“奇点”的踪影。宇宙中真实的恒星级黑洞的形成过程是与罗杰•彭罗斯和霍金解广义相对论场方程时所假设的条件完全不相符合的．因此，罗杰•彭罗斯和霍金的“奇点”只是高超的数学游戏的结果．

7*。所谓“裸奇点”，“宇宙监督原理”都不过是忽悠人们的一些观念，是不可能是宇宙中真实存在的实体。虽然在 1990 年代早期，物理学家开始考虑气体压力的效应。以色列技术学院的欧瑞(Amos Ori)与耶路撒冷希伯来大学的皮兰(Tsvi Piran)进行数值模拟，证实了具备真实密度与压力关系的恒星，是能够塌缩成“裸奇点”的。约莫同时，意大利米兰理工大学的马格利(Giulio Magli)与日本大阪市立大学的中尾健一的两支团队，都将塌缩的恒星内由粒子旋转所产生的一种特殊型态的压力加入计算，也显示了在许多情况下，模拟的坍塌都会产生“裸奇点”。

问题在于：（A）。他们的计算模拟模型无法考虑到宇宙中物质结构的“相变”及其内部粒子间的泡利不相容的排斥力，**他们没有考虑到恒星引力的收缩力不可能压垮质子和夸克**，宇宙中最强烈的超新星爆炸所产生的内压力也只能将物质压缩成密度约 10^{16}g/cm^3 的中子星或恒星级黑洞的核心，即超子或者固态中子。而且当物质收缩到密度达到 10^{93}g/cm^{3}时，**物质就进入了时空不连续的量子化的普朗克领域，它只能解体**，而不可能在继续塌缩

以增高密度达到数学中的“奇点”。（B）。**但是，必需指出，这种只考虑**（$\rho_\Lambda=\Lambda/8\pi G$， 压强为 $p_\Lambda= --\Lambda/8\pi G$ ）的能量动量分布的假设，只能勉强用于黑洞外的物质粒子的收缩，而不能用于发射霍金量子辐射的黑洞视界半径R_b的收缩。就是说，“裸奇点”的出现是由于上述模拟试验者，**错误的假定“黑洞内外的收缩可以运用一组相同的公式连续的通过黑洞的视界半径R_b”的结果。而且，按照爱因斯坦曾说过，他的广义相对论方程完美到无法在加入任何东西。**

8*。为什么许多科学家忙于论证和迷信虚无缥缈的“奇点”的存在？因为他们可以从“奇点”的存在进而推论或者幻想出“白洞”“虫洞”等许多迷人的幻想。

9*。我们宇宙的物质世界之所以如此丰富多彩和千姿百态，就在于物质物体内部有较完好的对称平衡，宇宙中不存在一种无敌的超强而没有与之相对抗相平衡力量，爱因斯坦的广义相对论方程的先天不足就在于只有一种物质的引力，而无与引力相对称平衡而又如影随形的热压力和在不同温度下的物质结构所产生的对抗力。后来虽然爱因斯坦加入了一个有排斥力的宇宙常数□□，但是这个后加入的**Λ**不能与物体内每一个物质粒子所产生的微引力相抗衡。加入的**Λ**是一种后天失调的补救措施，只能对外界粒子的运动起作用。这就是将广义相对论方程用于宇宙学和其它方面得出许多不合真实物理世界情况的根本原因。

【三】。在黑洞已经形成之后：黑洞视界半径 R_b上的霍金辐射。

黑洞内部不可能出现“奇点”，这是由霍金量子辐射理论可以直接推导得出的结论。因为黑洞在其视界半径R_b上的状态参数（M_b， R_b，T_b，m_{ss}）只与黑洞质量M_b有关，而M_b的量是与黑洞内部的状态和结构无关的。因此，在解决黑洞本身的生长衰亡问题时，就无需用广义相对论方程来解决黑洞内部结构、状态参数的分布、粒子的运动等问题。下面只证明黑洞M_b因发射霍金辐射而造成其视界半径R_b的收缩状况。无论黑洞内部的能量-物质是何种状态和分布规律，它都不可能影响视界半径R_b上的状态，也不可能从R_b逃出外界。因此，在现实的宇宙中，任何黑洞都是在吞噬外界的能量-物质而膨胀，只有外界无能量-物质可被吞噬时，才只能因发射霍金辐射使R_b收缩，其最后命运就是M_b收缩成为 2 个$M_{bm} = (hC/8\pi G)^{1/2} = 10^{-5}\ g = m_p$的最小黑洞在普朗克领域(Planck Era)爆炸解体消亡。

黑洞在其视界半径上的各种物理量的守恒公式。按照罗杰•彭罗斯和约翰•惠勒的观点和论证，任何非旋转的恒星，不管其形状和内部结构如何复杂，在引力塌缩之后，都将终结于一个完美的球形黑洞。其大小仅依赖于它的质量。[8] 这就是史瓦西Schwarzchild对广义相对论方程的特解的意义。见公式(12a)。**从而得出了球对称，无旋转，无电荷黑洞的史瓦西公式如下，**M_b是任一黑洞的质量，R_b 是黑洞M_b的视界半径，G是引力常数，C是光速，h是普朗克常数，κ是玻尔兹曼常数。下面是史瓦西黑洞M_b和视界半径 **R_b的公式，**
恒

$$GM_b/R_b = C^2/2 \quad [1][10] \qquad (3a)$$

霍金的黑洞 M_b 在其视界半径 R_b 上的温度 T_b 的公式如下，

$$T_b = (C^3/4GM_b) \times (h/2\pi\kappa) \approx 0.4\times10^{-6}\ M_\theta/M_b \approx 10^{27}/M_b, \quad [2] \qquad (3b)$$

设黑洞在其视界半径上 R_b 所发射的霍金粒子的质量为由 m_{ss}，根据能量在视界半径上 R_b 转换的阀温公式可得出，

$$m_{ss} = \kappa T_b/C^2 \qquad (3c)$$

此时，由以上的(3b)和(3c)个公式，可得出，

$$m_{ss}M_b = hC/8\pi G = 1.187\times10^{-10} g^2 \quad [1][6] \qquad (3d)$$

(3d)式是任何一个黑洞的质量M_b和在其视界半径R_b上发射的霍金辐射粒子质量m_{ss}必须遵守的普遍公式。而且，黑洞M_b所发射的霍金粒子的质量m_{ss}是不可能大于M_b的，这是根据部分不可能大于整体的公理所得出的正确结论。因此，**在极限的情况下，只能是最大的**

m_{ss} = 最小的M_b = M_{bm}，这就是说，当黑洞发射霍金辐射而收缩到最后极限时，只能分裂成一对宇宙中的最小黑洞M_{bm}而爆炸解体消失在普朗克领域。此时，由 (3d)得出，

$M_{bm} = m_{ss} = (hC/8\pi G)^{1/2} = 10^{-5}g = m_p$ [1] [6] **(3e)**

根据以上结果，可以求出最小黑洞 M_{bm} 在其视界半径 R_b 上的其它的物理量如下。m_p 是 普朗克粒子。

由(3c)，$T_{bm} = m_{ss}C^2/\kappa$ = **$(hC^5/8\pi\kappa^2G)^{1/2} = 0.652\times10^{32}k$,** (3fa)

由(3a)，R_{bm} = **$(hG/2\pi C^3)^{1/2} = 1.61\times10^{-33}cm$,** (3fb)

由球体公式求最小黑洞 M_{bm} 的密度□ρ_{bm}，

M_{bm} **$= 4\pi$□$\rho_{bm} R_{bm}^3/3$**

$\rho_{bm} = 3M_{bm}/4\pi R_{bm}^3 = 0.57\times10^{93}$**$g/cm^3$** (3fc)

光穿过黑洞 R_{bm} 的时间 $t_{bm} = R_{bm}/C$,

$t_{bm} = (hG/2\pi C^5)^{1/2} = 5.39\times10^{-44}s$ (3g)

$m_{ss}R_b = h/4\pi C$ **(3h)**

结论：**(3d)，(3e) 和(3h)式是作者直接从霍金黑洞辐射公式和史瓦西公式推导出来的。既然任何黑洞的视界半径因发射霍金辐射而最后收缩成为 2 个宇宙中的最小黑洞M_{bm}而爆炸解体消失在普朗克领域，那就不可能如广义相对论方程所推导的，在黑洞内部出现“奇点”。**假设黑洞M_b内出现小黑洞M_{bo}的话，M_{bo}的寿命必定小于M_b，所以M_{bo}也只能最后收缩成为 2 个宇宙中的最小黑洞M_{bm}而先消失在黑洞M_b内部。最后M_b会同样以收缩成为 2 个宇宙中的最小黑洞M_{bm}爆炸消失在普朗克领域。

用广义相对论的方法研究黑洞与采用作者用霍金的黑洞究竟有什么不同？广义相对论场方程没有热辐射和热力学定律，所以就没有在视界半径R_b上的霍金辐射。因此，一旦宇宙中出现一个黑洞，它就永远是一个顽冥不化的黑洞怪物。这是不符合我们宇宙的普遍规律和因果律的。而在霍金提出黑洞的霍金辐射之后，黑洞才与宇宙中其它任何物体的变化一样，符合热力学定律。具有生长衰亡的普遍规律。这又是本文下面将要证明的。

【四】。最小黑洞 M_{bm} ≡ m_p =普朗克粒子。本节的计算完全来自参考文献[3]。

量子引力论是将量子力学中的测不准原理引入到引力理论中，由测不准原理给出，[3]

$\Delta E \bullet \Delta t \approx h/2\pi$ [3] (4a)

将上式用于两个基本粒子的反应过程，

$\Delta E = 2\ mC^2$ [3] (4b)

则产生或湮灭两个基本粒子的时间量级为，

$\Delta t = t_c = h/4\pi mC^2$ [3] (4c)

t_c称为康普顿时间(Compton time),光穿过质量为 m 的基本粒子的史瓦西半径的时间为，

$t_s = 2Gm/C^3$ [3] (4d)

t_s称为史瓦西时间，一般来说，$t_c < t_s$, 当 $t_c = t_s$时，对应的质量为，

$m_p = (hC/8\pi G)^{1/2} = 10^{-5}g$ [3] (4e)

m_p称为普朗克质量。由测不准原理，与普朗克质量对应的时间为

$t_p = (Gh/2\pi C^5)^{1/2} = 5.39\times10^{-44}s$ [3] (4f)

t_p称为普朗克时间，相应地长度 L_p为普朗克长度

$L_p = (Gh/2\pi C^3)^{1/2} = 1.61\times10^{-33}cm$ [3] (4g)

宇宙在普朗克时间时，温度达到了 $T_p = 10^{32}k$，粒子的平均能量为 10^{19}GeV. [3]

最小黑洞M_{bm}的物理量与普朗克领域粒子m_p物理量的比较和结论如下。

从上面【三】节可见，当任何一个黑洞因为发射霍金辐射而逐渐损失质量和收缩其视界半径时，收缩到最后极限是分裂成一对宇宙中**$M_{bm} = 10^{-5}g$**的最小黑洞。而**$M_{bm} = 10^{-5}g$**的最小黑洞完全等于普朗克质量**m_p**，**即 (4e) = (3e)，(4h) = (3h)**，

$$\mathbf{M_{bm} = m_p = (hC/8\pi G)^{1/2} = 10^{-5}g}$$

$$T_p = m_{ss}C^2/\kappa = (hC^5/8\pi\kappa^2G)^{1/2} = 0.652\times10^{32}k, \qquad (4i)$$

$$\rho_{bm} = \rho_p = 3M_{bm}/4\pi R_{bm}^3 = 0.57\times10^{93}\mathbf{g/cm^3} \qquad (4j)$$

$$\mathbf{m_p L_p = h/4\pi C} \qquad \mathbf{(4h)}$$

$\rho_{bm} = \rho_p$为普朗克密度。从上面可以清楚地看到，**$M_{bm} = 10^{-5}g$的最小黑洞的各种物理量与普朗克领域的各项公式和数值完全相等。即证明M_{bm}已经完全进入到普朗克领域，最小黑洞M_{bm}就是普朗克粒子m_p。**

【五】。黑洞的霍金辐射是如何从其视界半径 R_b 上发射到外界的？

用牛顿力学和热力学求解黑洞霍金辐射粒子m_{ss}在黑洞M_b的视界半径上R_b的平衡和发射。霍金辐射粒子m_{ss}在 R_b上的热动力平衡，其最后结果同样会收缩成为$M_{bn} \equiv m_p \equiv 10^{-5}g$的最小黑洞，即普朗克粒子。只有用经典力学才能正确地解释霍金辐射，证明霍金辐射就是直接从黑洞视界半径上跑出来的辐射粒子。这说明霍金的黑洞理论和公式虽然正确，但是霍金用真空能量的虚粒子对解释黑洞的霍金辐射是在故弄玄虚。并再次确证了(3d)式$m_{ss} M_b = hC/8\pi G = m_p = 1.187\times10^{-10}g^2$ [1] [6] 的正确性。

《1》。先来看 Tolman-Oppenheimen-Volkoff 方程，简称 T-O-V 方程如下，

$$\mathbf{-R^2dP/dR = GM(R)\rho(R)[1+ P(R)/\rho(R)][1+ 4\pi R^3\rho (R)/ M(R)][1-2G M(R)/R]^{-1}} \text{ [4]} \qquad \mathbf{(5)}$$

上面(5)式，即T-O-V方程，来源于解爱因斯坦场方程。是在假定恒星内部是静态球对称理想流体的状态下得出的。**(5)式右端 3 个方括号因子是广义相对论对牛顿力学的修正**。用它讨论恒星的内部结构时，恒星内部的压力P与密度ρ，比熵s（每个核子平均的熵）及化学成分有关。**如果不考虑(5)式右端 3 个方括号因子的修正，使其均 = 1，则T-O-V方程还原为牛顿方程**，即下面的(5a)式。但要解出(5)式，需要作出许多简化假设条件，以便近似的求出P(R)，ρ(R)，M(R)的分布，是很不容易的。因此，**(5)式仍然是在零压模型状态下导出来的**。如果在解出(5)式时，用气体的状态方程以考虑温度的横向抗力，要解出(5)式就更加困难了。

《2》。下面我们干脆用牛顿力学与热力学只解出黑洞M_b的各个物理参数在视界半径R_b上的平衡，而不管黑洞内部的状态，因为黑洞内部的任何状态都不可能超出其视界半径或改变视界半径的状态，而只有M_b的量与视界半径上的参数有关。因此，只研究黑洞视界半径的收缩或膨胀，问题就变得极其简单而易于解决了。

当黑洞M_b收缩或者膨胀时，在其视界半径R_b上的粒子m_s所受的力的作用与宇宙中原始星际星云的收缩过程中粒子所受到的作用力是相同的，**即m_s粒子在视界半径R_b上处于热动力平衡状态，**下面的(5a)式正确地规范了辐射粒子的压强P与其在同一处的引力F相平衡。如将**(5a)**用于规范粒子在史瓦西黑洞M_b视界半径R_b上的平衡也应该是适合的，根据牛顿方程和热力学;

$$\mathbf{dP/dR = -GM\rho/ R^2} \text{ [1] [3]} \qquad \mathbf{(5a)}$$

$$\mathbf{P = n\kappa T = \rho\kappa T/ m_s} \qquad \mathbf{(5b)}$$

$$M = 4\pi\rho R^3/3 \qquad (5c)$$

其实，(5a)式与前面的(5)式中去掉了右边 3 项修正项后的结果是完完全全一样的。上式中，M为R内的质量，ρ为M在R上的密度；m_s为粒子在R上的质量；T为对应于R处的温

度；波尔兹曼常数$\kappa = 1.38\times10^{-16} g_* cm^2/s^2{}_* k$；引力常数$G = 6.67\times10^{-8} cm^3/s^2{}_* g$,；**光速**$C = 3 \times 10^{10} cm/s$,；普郎克常数$h = 6.63\times10^{-27} g_* cm^2/s$； n = 单位体积内的粒子数。**(5a)， (5b) 和(5c)** 式也可用于黑洞内任意半径上**R**上的各处。

史瓦西对广义相对论方程的特解，得出了球对称，无旋转，无电荷的黑洞公式如下，

$GM_b/ R_b = C^2/2$ [1][10] (3a)

霍金的黑洞在其视界半径上的温度 T_b 的公式，

$T_b = (C^3/4GM_b) \times (h /2\pi\kappa) \approx 10^{27}/ M_b$, [2] (3b)

将(3a) 和(3b)式代入(5a)后，并将(5b), (5c)代入，求解的结果得出的就是各个参数在黑洞视界半径R_b上的守恒公式。

$P = \rho\kappa T/m_s = \kappa/m_s \times(3M/4\pi R^3)\times(C^3/4GM)\times(h/2\pi\kappa) = 3hC^3/(32\pi^2 GR^3 m_s)$,

$dP/dR = d[3hC^3/(32\pi GR^3 m_s)]/dR = -(9hC^3)/(32\pi^2 Gm_s R^4)$, ($\therefore dP/dR$ 正比例于 R^{-4}), （5aa）

$-GM\rho/R^2 = -(GM/R^2)\times(3M/4\pi R^3) = -(3G/4\pi R^3)\times(M^2/R^2)$,

由 (1c), $M_b /R_b = C^2/2G = M/R$. 故

$-GM \rho/R^2 = -3C^4/(16\pi GR^3)$, (正比例于 R^{-3}) （5ab）

将（2a),（12b）代入（1a），

$-(9hC^3)/(32\pi^2 Gm_s R^4) = -3C^4/(16\pi GR^3)$,

或 $3h/(2\pi m_s R^4) = C/R^3$

$\mathbf{R_b = 3h/(2\pi Cm_s)}$, **或者** $\mathbf{R_b m_s = 3h/(2\pi C)}$ [1] **（5d）**

将（5d）式$R_b m_s = 3h/(2\pi C)$与(3h)式$m_{ss} R_b = h/4\pi C$和(4h)式$m_p L_p = h/4\pi C$向比较，可以得出，

$m_s = 6 m_{ss}$ (5e)

为什么$m_s = 6m_{ss}$？是（**5d**）正确还是**(3h)，(4h)**式正确？**当然是(3h)，(4h)是正确。**因为在推导(3h)式时，所有运用的公式都是在R_b上，而(4h)式则来源于量子引力论。在推导出（5d）时，所用公式(5a) ,(5b)和 (5c)中的密度ρ和温度T是M_b 在R_b内平均密度**ρ**，而不是R_b 上的密度ρ_{br} 和T_b。**而$\rho_{br} < \rho$，$T_b < T$** (黑洞内的平均温度)。**.ρ 和T的综合效应使得m_s就会成为$m_s/6$**，这样，（5d）就变成与(3h)式完全一样了。

根据(5a)式，**可见是m_{ss}在黑洞视界半径R_b上达到了引力与其热压力瞬时的平衡**.。由于m_{ss}是黑洞M_b的霍金辐射粒子，m_{ss}必须符合视界半径 R_b上温度T_b**作为阀温，而与**(3c)**式相一致。因此，**

$m_{ss} = \kappa T_b/C^2$ (5f)

《3》。m_{ss} 作为是黑洞 M_b 的霍金辐射粒子是怎么能从 R_b 上逃出黑洞呢？T_b 是黑洞视界半径 R_b上的温度，

第一．当黑洞外界附近的温度$T_w < T_b$，或者如果外界粒子的质量m_{ssw}均小于m_{ss}时，此时外界的能量-物质不能被吞噬进入黑洞内部。而**在R_b上面的黑洞辐射能量和m_{ss}粒子，根据热力学的观点，它们是围绕在R_b内外附近来回地震荡，因而会很自然地脱离R_b，**由高温逃向外界的低温，由高能奔向低能，而以霍金辐射的形式逃出黑洞的R_b进入外界（而$>T_b$的辐射能量和$>m_{ss}$的粒子只能留在黑洞的R_b之内）。而后，黑洞由于失去m_{ss}而相应地缩小了R_b和提高R_b上阀值温度T_b，这样，先前逃出黑洞的那个m_{ss}的能级就更低于新T_b的能级，能级差距的增大使得m_{ss}无法再回到黑洞，m_{ss}就这样成为逃出黑洞的霍金辐射。此后，黑洞就一直不停地向外界发射霍金辐射，收缩体积和提高温度和密度，直到最后收缩成为 2 个质量m_{ss}= $\mathbf{M_{bm}}$ **=** $m_p \approx 10^{-5}$g的最小引力黑洞，即普朗克粒子，在强烈的爆炸中消亡于普郎克领域。

第二．当黑洞外界附近的温度$T_w > T_b$时，或者如果外界粒子的质量m_{ssw}均大于m_{ss}，此时外界的高能量-物质就会流进低能量的黑洞内，而被黑洞吞噬。黑洞M_b会因此增加质量

和扩大R_b，并相应地降低温度T_b。由于与外界温度差距的增大，黑洞会继续吞噬外界能量-物质，直到所有外界能量-物质被吞噬完为止。然后，黑洞才能向外不停地发射霍金辐射，减少质量和收缩其视界半径，直到最后收缩成为 2 个最小的黑洞$m_{ss}= M_{bm} = m_p= 10^{-5}g$而爆炸消亡在普朗克领域。

第三．当黑洞外界附近的温度$T_w = T_b$，或者如果外界粒子的质量$m_{ssw} = m_{ss}$时，因为m_{ssw}与m_{ss}在黑洞R_b上可互相来回进出于（震荡）R_b内外。**黑洞R_b上的温度T_b只对应一个确定值m_{ss}。就是说，在一个确定的时间，黑洞只发射一个确定的m_{ss}，但是外界的m_{ssw}却可能存在许多个**。因此，黑洞M_b会因吞噬更多的m_{ssw}而增加质量和扩大R_b，并相应地降低温度T_b。于是与外界温度差距的增大，**变成黑洞外界附近的温度$T_w > T_b$的状况，回归到上面第二的状况。**

第四．霍金和所有现在的科学家们都用高深莫测的“真空海中的虚粒子对”的瞬间的产生和湮灭来解释黑洞发射霍金辐射。他们认为：“由于能量涨落而躁动的真空就成了所谓的狄拉克海，其中偏布着自发出现而又很快湮灭的正-负粒子对。，，量子真空会被微型黑洞周围的强引力场所极化。在狄拉克海里，虚粒子对不断地产生和消失，一个粒子和它的反粒子会分离一段很短的时间，于是就有可能使正-负粒子对中的负粒子与黑洞R_b的相等的能量的正粒子湮灭，使黑洞减少了 1 个正粒子。而原来在黑洞外面的虚粒子对中残留的那个正粒子就成为黑洞向外界发射的霍金辐射。[7] **但是这种曲折的怪异的解释既无法自圆其说也无法观测到的**。所以是不能成立的。因为**不同质量M_b的黑洞有不同的R_b和不同质量的m_{ss}，并且m_{ss}相差极大。真空中怎么能有如此大量的不同质量的虚粒子对随时都存在于各处而等待着与黑洞视界半径上的具有确定温度的粒子去配对呢？再说，只有微小黑洞才有能力激化附近的真空，而大黑洞的视界半径处的能量极其微弱，如果无能力激化其附近的区域，那就不能发射霍金辐射了，这不就违反黑洞的普遍规律了吗？**

【六】。我们宇宙起源于普朗克领域，而不是起源于无限大密度的“奇点”。

广义相对论方程根本不能解释宇宙的膨胀。本文用在普朗克领域的大量最小黑洞 $M_{bm} = m_p$的碰撞和合并成大黑洞来解释我们宇宙的膨胀，认为这种膨胀是黑洞的本性，是自然而然的事。

1。** 约翰•格里宾：“我们宇宙可能就是从这样一个粒子（普朗克粒子m_p）起源的”[5]，“普朗克密度ρ_p是对应着普朗克时代的密度，实际上就是宇宙创生时所处的状态”。[5] **约翰•格里宾的猜测实际上是对的**。作者在《对宇宙起源的新观念和新的完整论证:宇宙不可能诞生于奇点（下篇）》[6]一文中，**充分有力地证明了我们现在的宇宙诞生于前辈宇宙在普郎克领域Planck Era有一次大塌缩，而不是诞生于“奇点”或“奇点的大爆炸”**．我们现在的宇宙就是起源于大量的这种原初最小黑洞($M_{bm}\approx10^{-5}$ g)的碰撞和合并，它们所造成的膨胀形成了我们现在宇宙的原初暴涨和宇宙现在的膨胀。[6] **我们宇宙黑洞 [6] 在吞噬完外界能量**－物质后，就发射霍金辐射而收缩，其最后命运就是收缩成为无数的原初最小黑洞($M_{bm}\approx10^{-5}$ g)，即普朗克粒子m_p而消亡。**这就是我们现在宇宙黑洞的生长衰亡规律。**

2。** 作者在《对宇宙起源的新观念和新的完整论证:宇宙不可能诞生于奇点（下篇）》[6]一文中，根据时间对称原理，由于前辈宇宙发生的一场大塌缩，**根据作者推导出来的公式，原文章中的公式是（3b），即 $t \le T(2G\kappa)/(C^5)$,** [6]当前辈宇宙塌缩到$t = -0.5563\times10^{-43}s$ [6]时，形成了 3 种状态，即达到了粒子间的引力断链状态，而这些粒子又完全 = 最小的$M_{bm} = 10^{-5}g$ = 普朗克粒子$m_p = (hC/8\pi G)^{1/2}$。这 3 种状态相对应的参数值完全相等。[6]**正是这 3 种状态共同阻止了前辈宇宙塌缩到“奇点”，而止于普朗克领域**。并在普朗克领域转变成无数新的最小黑洞$M_{bm} = 10^{-5}g$ ，它们之间的碰撞和合并所造成的膨胀就形成了我们现在膨胀的宇宙。[6]

3**。按照爱因斯坦最初的广义相对论方程，是没有宇宙常数项Λ的，他最初认为宇宙是稳恒态而不膨胀的。只是哈勃在 1929 年发现宇宙膨胀之后，爱因斯坦为了达到宇宙的平衡，才在场方程中加入宇宙常数项Λ，后来他后悔，认为这是他一生中最大的错误。这说明最初的广义相对论方程根本不能解释宇宙的膨胀，而只能加入一个有排斥力的Λ才能描述宇宙的膨胀。这也说明用广义相对论方程定量的描述宇宙内部的运动状态就显得先天不足。而场方程又极其复杂难解，所以弗里德曼和史瓦西等只能用零压模型求解。如果将气体的热压力和辐射压力作为有排斥力的Λ加进场方程中的能量-动量张量中，其复杂的程度恐怕就无人能解了。**根据爱因斯坦的说法，他的广义相对论方程完美到不可能再加进入任何东西的（大意）**。本文上面用许多最小黑洞的碰撞和合并成大黑洞来解释我们宇宙的膨胀就成为符合宇宙的真实状态。

4**。**“奇点”只是将广义相对论方程推演到极点所出现的虚拟的数学“符号”**。数学方程（公式）中的参数往往都可以从 0 →∞，或者从-∞→+∞。但是，这不符合物理世界的真实性。因此，**物理世界总是要求其数学方程在一定的区域性内有解**。在真实的有限的物理世界和现实宇宙中，绝对不可能出现和存在能量-物质密度为无限大的“奇点”。而且，宇宙中的物质结构是分层次的，特定的数学方程只适用于某些特定的物质结构层次。正如流体力学方程不适用于固体一样。广义相对论方程也不例外，它在普朗克领域就失效了。**所以黑洞塌缩到普朗克领域时，就不能再继续塌缩了，黑洞的物理概念本身也失效了。**

“奇点”本身就是违反因果律和能量守恒等一系列定律，所以不可能在真实的物理世界出现：按照广义相对论方程（即假设质量守恒，纯引力而无热压力）得出的“奇点“是极不稳定的。如果考虑到“奇点”会有极高的密度和温度，那么，**“奇点”一旦形成，就会造成一种宇宙大爆炸，或者会产生一个新宇宙，而一个小黑洞就可以生出一个大宇宙来了。在我们宇宙中有无数个黑洞，如果按照广义相对论的论证，每个黑洞的中心都产生过“奇点”，则我们宇宙中早已又生出了无数个宇宙了。**

5**。我们宇宙本身就是一个巨无霸黑洞，[6] 各种黑洞内如有“奇点”的大爆炸，为什么我们没有感受到和观测到呢？这说明我们宇宙中和黑洞中根本就没有出现过“奇点”，因为“奇点” 的出现会违反因果律和能量质量等一系列不可动摇的宇宙的普遍规律。

【七】。黑洞的本质属性。史瓦西特解对黑洞的真实意义。宇宙黑洞。

我们现在的宇宙就是一个巨无霸黑洞，它生长衰亡的规律与黑洞完全一致。因此，用广义相对论 $\Omega \equiv \rho_o/\rho_c = 1$ 的观点判断宇宙最后是闭合收缩还是开放膨胀就显得既无意义也不适用。只有用黑洞的规律才能判断宇宙的最后命运。一个封闭的黑洞是膨胀还是收缩只取决于它是吞噬外界能量-物质还是发射霍金辐射，与其内部的密度毫无关系。哈勃定律就是描述我们宇宙吞噬其视界外的能量-物质而产生膨胀的规律。[6]

《1》。一旦一个黑洞形成之后，无论他是吞噬外界能量-物质而膨胀，还是发射霍金辐射而收缩，在它最后收缩成为 2 个最小黑洞($M_{bm} \approx 10^{-5}$ g) 而爆炸消亡之前，它会永远是一个黑洞，

假设已经形成了一个黑洞 M_b，按照史瓦西公式, R_b 为 M_b 的视界半径，

$$2GM_b = C^2 R_b \qquad (71a)$$

如果该黑洞 M_b 在吞噬外界能量-物质或者发射霍金辐射的质量增减与其视界半径增减的关系如下，

$$2\,GdM_b = C^2\, dR_b \qquad (71b)$$

假设有另外一个黑洞 M_{bo}，其视界半径 R_{bo}，当 M_{bo} 与 M_b 发射碰撞而合并时，

$$2GM_{bo} = C^2 R_{bo} \qquad (71c)$$

于是，$2G（M_b + M_{bo} \pm dM_b）= C^2(R_b + R_{bo} \pm dR_b)$ (71d)

(71d)式表明，当一个黑洞形成之后，无论它是向外发射霍金辐射，还是吞噬外界的能量-物质，还是与其他的黑洞碰撞合并，直到它因发射霍金辐射最后收缩成为 2 个最小黑洞(M_{bm}≈10^{-5} g) 而爆炸消亡之前为止，它将永远是一个黑洞。这就是史瓦西特解对黑洞的真实物理意义。

《2》. 我们宇宙是一个真正的巨无霸宇宙黑洞。哈勃定律就是我们宇宙黑洞吞噬其视界外的能量-物质时的膨胀规律。

现将哈勃定律用于宇宙因吞噬外界能量-物质而膨胀的球体 M_u, t_u为宇宙年龄，R_u为宇宙的视界半径，

$$\mathbf{M_u} = 4\pi\rho_o R_u^3/3 = 4\pi(3H_0^2/8\pi G)C^3 t_u^3/3 = 4\pi(3H_0^2/8\pi G)C^3 t_u/3H_0^2 = \mathbf{C^3\ t_u/2G}$$
$$= \mathbf{C^2}\ R_u\ \mathbf{/2\ G} \qquad (72a)$$

再从史瓦西对广义相对论（GTR）的球对称黑洞的解可得，$C^2/2 = GM_b/R_b$, 这是黑洞存在的必要条件。因为 $R_b = C\ \mathbf{t_u} = R_u$, 于是，

$$\mathbf{M_b} = R_bC^2/2\ G = \mathbf{C^3\ t_u/2G} = R_uC^2/2\ G \qquad (72b)$$

结论：上面由黑洞推导出的 (72b)式与由哈勃定律推导出的(72a) 式是完全相等的。因为宇宙的年龄与黑洞宇宙的年龄是一样的。

我们宇宙既诞生于大量的原初最小黑洞(M_{bm}≈10^{-5} g) 碰撞和合并，它就会永远是一个黑洞，**哈勃定律所描述的宇宙膨胀规律就是我们宇宙在吞噬其视界外的能量-物质时的膨胀规律**。[6] 因此，**我们宇宙这个巨无霸黑洞的密度就只能有一个**。如果实际密度ρ_o 测量得准确的话，它就应该完全与计算密度ρ_c相等。所以，**我们宇宙作为一个巨无霸黑洞，其Ω □≡ ρ_o/□□ρ_c □≡ 1 是宇宙黑洞的本性，是必然的结果**。[6] 只有宇宙黑洞才符合我们宇宙的平直性要求，即符合现在实际测定的 Ω ≡□ ρ_o□□/ρ_c □□ = 1± 0.02。[6]

作为一个宇宙黑洞来说，它的收缩或者开放（膨胀）只取决于它是在发射霍金辐射呢还是外界仍然有能量-物质在被吞噬。可见，现在主流的科学家们几十年来仍然用广义相对论的观点Ω □≡ ρ_o/□□ρ_c ≠ 1 去判断我们宇宙是闭合还是开放是一种自欺欺人的伪命题。科学家们几十年来为证明Ω □≡ ρ_o/□□ρ_c =1 的努力是毫无意义的。

《3》. 下面是黑洞因发射霍金辐射而收缩的寿命公式，

τ □$_b = 10^{-27}M_b^3$ [2][1] (73a)

现在我们黑洞宇宙的总质量大约为 10^{56}g。如果现在宇宙视界外是空空于也，即无能量-物质可被吞噬，我们宇宙将逐渐不断地发射霍金辐射而收缩，直到约 10^{134} 年之后，收缩成为 2 个 M_{bm}≈10^{-5} g 的最小黑洞在普朗克领域爆炸成一簇高能量的γ射线。如果现在宇宙视界外还有能量-物质可被吞噬，我们宇宙就还会因吞噬外界能量-物质而继续增加质量和膨胀体积，直到吞噬完所有外界能量-物质后，再向外界不断地发射霍金辐射而逐渐收缩，直到最后收缩成为 2 个 M_{bm}≈10^{-5} g 的最小黑洞在普朗克领域爆炸成一簇高能量的γ射线。但是其最后的年龄就会>>10^{134}年.

结论：黑洞的生长衰亡规律：既然我们宇宙本身就是一个巨无霸黑洞，[6] 那么，它的诞生，生长（膨胀），衰落（发射霍金辐射）和死亡也就应当完全与黑洞的生长衰亡一样。作者在上面已经论证了我们宇宙诞生于前辈宇宙在普郎克领域Planck Era有一次大塌缩，从而造成了无数的原初最小黑洞(M_{bm}≈10^{-5} g)，大量的这种原初最小黑洞(M_{bm}≈10^{-5} g)的碰撞和合并所造成的膨胀形成了我们现在膨胀的宇宙黑洞。我们宇宙的膨胀就是最小黑的之间的合并和吞食外界能量-物质所造成的，黑洞的收缩只能是由于黑洞在吞噬完所有外界能量-物质后，发射霍金辐射而损失能量-物质所造成的。黑洞最后的死亡也只能是由于它收缩到最后形成最小黑洞(M_{bm}≈10^{-5} g)时，再无任何霍金辐射可以发射，而爆炸解体成为一

簇高能量的γ 射线。

【八】。用霍金的黑洞理论对黑洞内部不可能出现“奇点”的再分析和结论：

当任何一个黑洞因为发射霍金辐射收缩到最后极限分裂成一对宇宙中 $M_{bm} = 10^{-5}$g 的最小黑洞后还能再继续收缩成为“奇点”吗？答曰：M_{bm}绝对不可能再收缩，只能爆炸消亡。

《1》。霍金已经明确地指出 M_{bm}只能爆炸成一簇强烈的γ □□射线。

第一：因为M_{bm}已经进入普朗克量子领域，所以必须服从测不准原理，就是$\Delta E \bullet \Delta t \approx h/2\pi$，现在普朗克粒子$m_p$ 的 $\Delta E = M_{bm}C^2 = 10^{-5}\times9\times10^{20} = 9\times10^{15}$。$\Delta t = 5.39\times10^{-44}$s , $\Delta E \bullet \Delta t = 9\times5.39\times10^{-29} = 0.48\times10^{-27}$. 而$h/2\pi = 6.63\times10^{-27}/2\pi = 10^{-27}$。如果$M_{bm}$再继续收缩，必然造成, $\Delta E = M_{bm}C^2$ 和Δt都缩小，从而造成, $\Delta E \bullet \Delta t < h/2\pi$，这就违反了测不准原理。

第二：由于黑洞有温度，那么它必定会辐射。每一个辐射粒子的能量为 κT。当黑洞最后收缩成为 $M_{bm}= 10^{-5}$g 的最小黑洞时，整个黑洞的粒子数为 $N_{bm} =1$，

$$N_{bm} = M_{bm}C^2/\kappa T_{bm} = 10^{-5}\times9\times10^{20}/(1.38\times10^{-16}\times0.652\times10^{32}) = 1 \qquad (8a)$$

当 1 个黑洞内有许多个粒子时，它们之间的引力会形成向中心的收缩力。但由(8a)式可见，$M_{bm}= 10^{-5}$ g最小黑洞整体就是 1 个 10^{32}k的极高温能量的孤立子，没有任何其它的粒子与之产生引力而造成收缩。1个将自己全部的引力能（$M_{bm}C^2 = \kappa T$）转变为宇宙最高温度的热能和辐射能的孤立粒子不可能自己再收缩的，而只能将整个粒子变成霍金辐射发射出去而剧烈地爆炸后解体消亡。因此，它只能在 10^{32}k的温度下爆炸解体，使 1 个M_{bm}爆炸分成许多个粒子n，每个粒子n都是降低了温度的γ□□射线。

第三：根据霍金的黑洞寿命公式，黑洞的寿命τ□$_b$与质量M_b的关系如下

$$\boldsymbol{\tau\square_{b\square} \approx 10^{-27} M_b^{3}}\ [2] \qquad \textbf{(8b)}$$

当 $M_{bm}= 10^{-5}$g 是最小黑洞时。其寿命τ□$_{bm} \approx 10^{-42}$s。可见τ_{bm} 与前面的 $t_{bm} = t_p = 5.39\times10^{-44}$s 在同一个数量级，这就是说，当任何一个黑洞最后塌缩成为最小黑洞 M_{bm}时，温度高达 10^{32}k，其辐射能量的速率也非常快。所以 M_{bm}的寿命τ□$_{bm}$短至与 t_p几乎相同。因此，M_{bm}只能爆炸消失在普朗克领域。

《2》。结论：既然任何一个黑洞因为发射霍金辐射的最后命运是收缩成为一个 $M_{bm} = 10^{-5}$g 最小黑洞，而 $M_{bm} = m_p$ 又不可能再继续收缩，只能在普朗克领域爆炸解体消亡。那么，在任何一个黑洞的内部就绝对不可能出现和存在比 M_{bm} 密度温度更高的“奇点”。

第一：假如在一个大黑洞 M_b 内有一个小黑洞 M_{bs}.则 $M_b> M_{bs} > M_{bm}(=10^{-5}g)$。按照寿命公式(8b)，$M_{bs}$将会比 M_b 要早得多收缩成为 M_{bm},于是 M_{bs}就会立即在普朗克领域爆炸消失成为一簇高能的γ□射线。这些γ□射线然后在 M_b 内与其它的粒子相互碰撞降低能量，逐渐转变为 M_b 内的一般粒子。最后，当 M_b 收缩成 M_{bm}时在普朗克领域爆炸消亡。

第二：当大黑洞 M_b 内万一由于某种特殊条件突然地造成大塌缩，塌缩出一个小黑洞 M_{bx} 内有许多的更小的黑洞 $M_{bxn} > M_{bm}$ (=10^{-5}g). 按照(8b)，由于每一个 M_{bxn} 的寿命都相当的短，这些更小的黑洞 M_{bxn}就会先相互碰撞和合并后，与 M_{bx} 容为一体，成为一个整体的小黑洞 M_{bx}。或者，在大黑洞 M_b 内由于某种特殊条件突然地造成大塌缩，塌缩出许多个大小不同的小黑洞 M_{bx}。那么，这些个 M_{bx} 的寿命由于比 M_b 短得多，它们就会先碰撞合并，然后与 M_b 容成一体。无论是哪一种情况，M_b 最终的命运都是都是由于发射霍金辐射而最后塌缩成为 2 个 $M_{bm}= 10^{-5}$g 最小黑洞爆炸消失在普朗克领域。

第三：为什么罗杰·彭罗斯和霍金根据广义相对论方程推导出黑洞收缩必然会出现“奇点”呢？因为他们在推导时是假定质量守恒的纯引力收缩，而没有考虑引力收缩时必然产生的温度升高的辐射压力，更没有考虑物质收缩到普朗克领域时，会产生时空的不连续而无法继续收缩。这样，当然会出现“奇点”。

结论：上面的推导和结论都是根据霍金黑洞的量子理论得出的。霍金黑洞的量子理论认为：黑洞有温度，它就会从其视界半径上发出热辐射，即霍金辐射。当黑洞收缩而质量减少时（质量不守恒），黑洞的质量 M_b 愈小，其温度 T_b 愈高，其热辐射粒子的质量 m_{ss} 就愈大。所以，当任何一个黑洞 M_b 收缩到最后成为 $M_{bm}= 10^{-5}$g 最小黑洞时，其温度达到宇宙的最高温度 10^{32}k。因此，M_{bm} 只能在普朗克领域爆炸消亡（物质和时空结构相变）。所以绝不可能再继续塌缩成为“奇点”。

【九】。黑洞的霍金量子辐射 m_{ss} 与真空能，零点能。

《1》。对宇宙中每一物质质点引力的对抗必然使得真空能变得非常巨大。

量子理论告诉我们, 真空并非一无所有。真空会发生涨落，即不断有虚的正反粒子对产生，其中一个粒子有正能, 另一个有负能。它们产生后很快湮灭。由于存在的时间极短, 我们观测不到它们。假如有人试图去观测, 由于虚粒子对存在的时间极短, 时间-能量测不准关系导致的能量增量, 会掩盖住它们, 使我们测不到它们。霍金指出, 如果上述真空涨落发生在黑洞表面附近,则会导致黑洞发射霍金辐射的明显的物理效应。

量子理论预示，真空中蕴藏着巨大的本底能量，它在绝对零度条件下仍然会存在，称为真空零点能。对卡西米尔（Casimir）力（一种由于真空零点电磁涨落产生的作用力）的精确测量，证实了这一物理现象。关于卡西米尔效应的最新实验结果证明，真空中确实存在零点能。关于零点能的设想来自量子力学的一个著名概念:海森堡测不准原理。该原理指出：不可能同时以较高的精确度得知一个粒子的位置和动量。因此，当温度降到绝对零度时粒子必定仍然在振动；否则，如果粒子完全停下来，那它的动量和位置就可以同时精确的测知，而这是违反测不准原理的。这种粒子在绝对零度时的振动（零点振动）所具有的能量就是零点能。**狄拉克**从量子场论对真空态进行了生动的描述，把真空比喻为起伏不定的能量之海。

《2》。霍金和现在所有的科学家们将黑洞的霍金辐射用“真空能的虚粒子对”的瞬时的产生和湮灭来解释。他们认为，由于能量涨落而躁动的真空就成了所谓的狄拉克海，其中偏布着自发出现而又很快湮灭的正-反粒子对。量子真空会被微型黑洞周围的强引力场所极化。反粒子被黑洞捕获而正粒子留在外部世界显形。因此造成黑洞自发地损失能量，也就是损失质量。在外部观察者看来，黑洞在蒸发，即发出粒子气流。”[7]

但是各种大小不同的黑洞的霍金辐射能量范围从（10^{16}~10^{--45}）erg，即从 10^{19}GeV~10^{-33}eV，温度从（10^{32}~10^{--29}）K。[13] 如果这些黑洞可以在宇宙空间**随意分布**的话，那就要求宇宙空间各点的真空能所具有的能量范围和温度范围完全符合上面的广泛的要求，这种状态有可能存在吗？**如有可能，真空中的能量就应该以分立的互不相干的涨落形式存在。这样，就使得范围如此之广的宇宙背景谱线所包含的能量极其巨大。**这可能就是J. Wheeler估算出真空的能量密度可高达 10^{95} g/cm^3 而等于普朗克粒子m_p 的密度的原因。[9]

《3》。“大家可能不相信真空能有这么大的力量，但是实际上真空里蕴含的能量非常之大，有国外的科学家计算过，他们当时用量子力学的观点来进行计算，说是一立方厘米里蕴含着 10^{95} 次方克的能量。”[11] **.** 如果J. Wheeler和其他著名的量子学者们关于真空能密度的计算可高达 10^{95} g/cm3 是正确的话，则，按照量子场论所计算的真空能值比现在真空中实际密度的观测值要大 10^{122} 倍，[17] 因为我们宇宙空间现在实际的能量物质密度 ≈ 10^{--30}g/cm^3，因此，专家们计算出的真空能的密度就 ≈ 10^{93}g/cm^3 = 实际上普朗克密度 = 最小黑洞M_{bm} ≈ 10^{--5}g的密度 = 我们宇宙诞生时的密度。

这就是真空能 $\approx 10^{93}$g/cm^3 比宇宙现在实际的能-量物质密度大$\approx 10^{122}$g/cm^3 的来由。如果这种观念，理论和计算都正确的话，我们现在的宇宙空间的各处每 1cm^3 内有多少个宇宙的总质量呢？我们现在宇宙的总质量$\approx 10^{56}$g,，当它处在 10^{93}g/cm^3 密度时，$10^{93}/10^{56}$g $\approx 10^{36}$。**这就是说，我们现在的宇宙空间各处的 1cm^3 内就有$\approx 10^{36}$ 个现有宇宙 $\approx 10^{36}$ 我们现有的宇宙的总质量。这可信吗？这可能吗？**

《4》．如果J. Wheeler们估算出真空的能量密度可高达 10^{95} g/cm3 计算是正确的话，则真空能的状态就是：1*.我们宇宙诞生时的状态；2*，最小黑洞M_{bm}= 10^{-5}g的状态； 3*. 普朗克领域的状态。

普朗克时间是仍然有意义的最小可测时间，比这更短的时间没有任何意义。所以在我们今天理解的物理定律框架内，我们只能认为宇宙创生时，它的年龄就已经是 10^{-43} 秒，而它的密度就是普朗克密度（1 普朗克质量除以 1 普朗克体积，为约 10^{93} 克每立方厘米）。而要重现宇宙创生时的条件，制造出普朗克粒子 m_p，地球上目前最大加速器的威力需要再提高 1 亿亿倍。[5]

《5》，现在许多国家的科学家们都在绞尽脑汁的设计真空能发动机或发电机，企图从真空中提取无限大的和无赏的能量。

如果如此巨大密度 10^{93}g/cm^3 的真空能可以被提取，无疑将是人类所能够利用的最佳能源了。它不但廉价无污染，而且，可以说取之不尽用之不竭。**目前，尽管大多数物理学家认为不能从真空中提取能量**，但美国得克萨斯州奥斯汀高级研究所的成员们却**坚信宇宙中有“免费的午餐”**，他们的目标就是要向真空中索取能量。该所所长 Puthoff 甚至指出：“对于这个领域的狂热分子（比如我们自己），我们认为 21 世纪可能是零点能的世纪。”[9] Moray B. King 坚持认为零点能是可以提取的，并在这方面做了长期的研究工作。他的专著“Tapping the zero-point energy”受到普遍欢迎。 King 的依据主要来自普里高津的耗散理论。根据普里高津的理论，非线性非平衡体系在一定条件下，可以产生自组织效应，从混沌走向有序。由于挠场相干等原因，可以使随机背景的电磁场产生自组织，从而提取零点能。

更多的人，从电化学异常、非平衡磁场及引力场的角度出发，探索提取零点能的有效而简单的途径，并取得了某些成就。1997 年，美国航空航天局主办了一个名为“突破性推进物理”学术研讨会，据与会者称，零点能成了这些探讨何种“突破”的人的中心话题。美国航空航天局甚至制订了详细的研究开发计划。2001 年 1 月 20 至 22 日，第一届国际“场推进”会议在英国召开。世界各地的科学家齐聚英国，研究“利用零点能推动宇宙飞船引擎”的可能性，一旦成功，人类将可在太空中自由来去，而且不需要耗费任何燃料，飞行数百年之久也没有问题。2001 年 6 月 23 日，在瑞士的Weinfelden召开未来能源和引力研究国际会议，200 多位科学家讨论了多种新能源和反引力研究的进展。[9] 当然，还存在着许多真假难辨的实验。

许多发明家很早就研制成效率大于 100%的能源装置，如：美国有许多类似于水泵的效率大于 1 的能源装置，已经申请专利（US Patent:5188090,5279262），**但由于不能解释其机制，得不到科学界的承认而不能推广**。还有许多类似的例子，或由于技术不成熟，或造价太高, 或发明家本人过于追求经济利益而不能产业化。美国黑光能源公司 R.L. Mills 研制的镍/钛电解系统，热效率可达 850%。曾吸引到 2000 万美元的投资。他用新的氢氧化物和聚合态理论解释过量熵的出现，遭到以诺贝尔奖得主 P. Anderson 等人的反对。由于学术上的争执导致商业利益的损失，引起了法律诉讼。Nature 杂志曾以“新氢能挑战怀疑主义（New form of hydrogen power provokes skepticism）”为标题报道了这件事。由此可见，阐明物理机制，进行科普宣传，得到广泛认同，是重要的。国外有许多学术杂志对零点能研究进行宣传报道，如 Journal of New Energy, Infinite Energy, New Energy Times， New Energy Technologies 等。[9] 有人认为，二十一世纪是真空工程的世纪，物理学的发展趋势是研究宏观宇宙和微观粒子相结合，研究自旋及由自旋产生的挠场的性质，利用零点能，开发零点能.[9]

《6》. 问题是：真空能究竟是多大？是否有确定的数值？如果这个问题不能首先解决，其它的一切都是空谈。

第一；如果真空能就是真空中正-负虚粒子对很快的产生后湮灭的零点能，那么宇宙中最大的基本粒子就是普朗克粒子 m_p，即最小黑洞 $M_{bm}= 10^{-5}g = m_p=(hC/8\pi G)^{1/2} = 10^{-5}g$。而 $M_{bm}= m_p$ 产生和湮灭的时间只有 10^{-43} 秒，如果有更小的黑洞粒子，其产生和湮灭的时间则更短。可见，人们不能像黑洞的霍金辐射一样提取真空能，它只是向空间发射（输出）能量的方式。因此，霍金用真空能解释黑洞的霍金辐射是难以解释通的。还不如【五】节中用牛顿力学的介绍来得正确。

第二；可见，人们要提取存在于真空中的能量（这不是暗能量，暗能量定义为负能量）所存在的重大疑难问题在于：

1*. 如果按照J. Wheeler和所有权威科学家们估算出真空的能量密度可高达 10^{95} g/cm3 是正确的话，在这样高的密度下，真空能就应该有 10^{32}k高的温度。果如此，真空能就会自然地不用提取就能由真空流向我们宇宙，但是，为什么没有这种情况发生呢？

2*。霍金既然用真空能解释黑洞的霍金辐射，说明真空能的性质与我们宇宙中的能量-物质的性质是相同的，能够相互起作用的。而按照真空的能量密度可高达 10^{95} g/cm3，我们宇宙中每一个 1cm^3 的空间内就有 10^{36} 个我们宇宙（总质量），为什么在一般的情况下，真空能不与我们宇宙中的能量-物质发生作用呢？

3*。 既然如此多的真空能实际上不与我们宇宙中的能量-物质发生作用，说明这些真空能既无引力也无电磁力，而是具有与我们宇宙中的能量-物质不同作用力的能量-物质。若果如此，我们怎么能提取这些能量-物质为我们所用呢？我们有什么能力改变他们之间的作用力性质以为我们所用呢？

4*。 既然真空能与我们宇宙中的能量-物质现在还不起作用，这表明是相互绝缘的，那么，计算出它的密度=10^{95}g/cm^3 又有什么根据和意义呢？用对我们宇宙能量-物质的计算方法为什么对它们也适用呢？

5*。如果真空能有 10^{95}g/cm3，它怎么能长期地稳定而不膨胀爆炸随时产生出无数新的宇宙呢？

6*。如果用一个 1000 顿大小的动力装置能够提取 $R = 10^{-12}$ cm 原子大小的这种密度=10^{95}g/cm^3 的真空能，其总质量即达到我们现有宇宙的总质量 10^{56} 克，这么多的能量将如何有效地控制呢？怎么能够控制这么小的能量和高温度不从现有的物质装置中泄露呢？

《7》. 关于卡西米尔效应的最新实验结果证明，真空中可能确实存在零点能。但是这种能量是很微弱的。 而惠勒等所计算出来的能量密度达到 10^{93}g/cm^3，连他们自己都不愿意相信，所以千方百计力图降低。但是效果仍然欠佳。这就表明，**真空能的概念和理论存在着重大的缺失，不是简单的修修补补所能解决的。**因此，需要首先解决的问题是真空中究竟有多少真空能？如果这个问题不解决，其它的一切都是空谈。

最有可能的情况是真空能只与宇宙中的暗物质有关。如果是这样，则真空能的密度就很难大于宇宙的现有密度 10^{-30}g/cm^3 的若干倍.

S•温伯格在 80 年代末做过一个研究，假设星系的存在是产生智慧生物的前提，那么，要形成星系就会给宇宙常数一个很大的限制，他的计算结果是，**宇宙常数不能超过临界密度的 100 倍。和量子场论相比较，这是一个很好的结果了。**

【十】。如果人造黑洞定义为符合史瓦西公式的引力黑洞，它们也许永远不能被人类制造出来。

20 多年来，各国的一些科学家发表了对人造黑洞许多耸人听闻的不适宜的言论和文章。俄罗斯科学家阿力山大•陀费芒柯(Alexander Trofeimonko)指出迷你小黑洞可以在实验室内制造出来作为“黑洞炸弹”，可以杀死上百万的人。在 2001 年 1 月，英国的理论物理学家伍尔夫•里昂哈特(Wolf Leonhart)宣布他和他的同僚会在实验室制造出一个黑洞。

作者曾在《人类也许永远不可能制造出任何真正的人造引力(史瓦西)黑洞》[14][13] 一文中对各种大小不同黑洞的参数值作了计算，并得出结论：**人造引力黑洞是不可能被制造出来的。**我们只能认为宇宙创生时，它的年龄就已经是 10^{--43} 秒，而它的密度就是普朗克密度，为约 $10^{93}g/cm^3$。而要重现宇宙创生时的条件，人为地制造出 10^{--5} 克的普朗克粒子，地球上目前最大加速器的威力需要再提高 1 亿亿倍。**更重要的问题是：在对撞机上的物质团碰撞时，并不是两团中的所有粒子在准确的同一时间发生碰撞。因为粒子之间有距离，所以一对粒子碰撞后，轮到下一对粒子碰撞时，需要经过时间t，**

$$t = d_p/C \qquad (9a)$$

上面(9a)式中，C为光速，d_p为相邻的原子之间的距离。当对撞机上的物质是中子星物质时，其相邻原子间的距离约是 10^{--14}cm。这样，$t \approx 10^{-24}$s。如果碰撞后形成的小黑洞的寿命$\tau□_b > 10^{-24}$s，黑洞才有可能得到补充的物质而存在和长大。但是 10^{--5} 克的普朗克粒子的寿命仅有 10^{--43}s，而想制造出比普朗克粒子小得多的质子 10^{--24}g时，根本不可能在碰撞后吸收到任何的物质粒子而成长为更小的黑洞。即使假设其能够成为小黑洞，它的寿命 $<<10^{--43}$s。因此。即使这类小黑洞能在对撞机上暂时碰撞出来，也会因其寿命太短得不到临近物质粒子的补充而立即变成高能量的□γ□射线而消失。如要制造出比 10^{--5} 克的普朗克粒子的寿命更长的更大的小黑洞，使其寿命达到 $> 10^{--24}$s，该小黑洞的质量大约要达到 10 克，但是对撞机的能量就应比现有的最大对撞机的能力约大 10^{32} 倍。即使人类未来能够制造出如此大能量的对撞机，**但如何能够保证这个 10 克中的所有粒子能在真正准确地在对撞机上同时准时地产生碰撞呢？**

【十一】。宇宙常数 Λ 与 真空能；零点能；暗能量。

真空能"在国外称为"Zero Point Energy"。如果把宇宙常数当作真空能量，以相对论和量子论为基础的计算结果，如上所述，却比现在宇宙密实际度的观测值大了 122 个数量级；想尽各种已知办法，理论计算的数值也要大几十个数量级。问题还在于，这些数据分析的理论框架，恰恰是爱因斯坦引力场方程和宇宙学原理。我们对于观测宇宙竟然如此束手无策，以至于 **2004 年物理诺贝尔奖获得者格罗斯提出：“知识的最重要的产品是无知。”**

“Letts-Cravens”效应：用激光照射电解池阴极会激发过热的产生，这一现象由三个科学家小组各自独立地观测到（Michael Mckubre, Edmund Storms, 和 Mitchell Swartz）。此实验结果有两个特点。1*。 实验的输出功率是输入功率的 30 倍；例如：当输入激光束功率为 30 毫瓦时，电解池输出为 1 瓦。2*。这一实验重复性很好。来自佛罗里达的 James Patterson 博士和他的同事们向公众展示了一种结构简单、坚固和构思巧妙的**气相“冷聚变”反应器**，该反应器能持续不间断地产生过热输出。而且该装置的全部细节均无保留地向公众公开。

现代宇宙学中通常把宇宙学项并入能量动量张量， 这相当于引进一种能量密度为 $\rho_\Lambda=\Lambda/8\pi G$， 压强为 $p_\Lambda=-\Lambda/8\pi G$ 的能量动量分布，这就变成为了非零压宇宙模型。 这是一种十分奇特的能量动量分布， 因为在广义相对论中， 当能量密度与压强之间满足 $\rho+3p<0$ 时， 能量动量分布所产生的 “引力” 实际上具有排斥的作用。 因此在一个宇宙学常数 $\Lambda>0$

的宇宙学模型中存在一种排斥作用。 这种排斥作用与普通物质间的引力相平衡使得 Einstein 成功地构造出了一个虚拟的静态的宇宙学模型， 其宇宙半径为 $R=\Lambda^{-1/2}$。见公式 (1c)。**但是，必需指出，这种只考虑**（$\rho_\Lambda=\Lambda/8\pi G$， 压强为 $p_\Lambda= -\Lambda/8\pi G$ ）的能量动量分布的假设，只能**勉强近似地**用于黑洞外部的物质粒子的收缩，而不能用于发射霍金量子辐射的黑洞视界半径R_b的收缩。就是说，**错误的假定“黑洞内外的收缩可以运用一组相同的公式连续的通过黑洞的视界半径R_b”的结果，必然导致**“裸奇点”的出现。

虽说静态宇宙模型的构造是如愿以偿了， 但 Einstein 对所付出的代价却很耿耿于怀，他在那年给好友 Ehrenfest 的信中说自己对广义相对论作这样的修改 “有被送进疯人院的危险”。 几年后， 在给 Weyl 的一张明信片中他又写道： “如果宇宙不是准静态的， 那就不需要宇宙学项”。

爱因斯坦说过没有幻想的民族就是没有希望的民族，科学需要有幻想。这就是说，所有上面的具有Λ能量作用的东西，如真空能；零点能；暗能量，都可以单独地或者集合地装进爱因斯坦的宇宙学常数项Λ中去，虽然这违反了爱因斯坦的本意，但后世的广义相对论学者们是可以按照自己的意愿为所欲为的发挥自己的幻想的。特别是这种可大可小的真空能，零点能，暗能量等，也许最适合于装入Λ，这并不难，难的是现在尚无人能够取适当的数值或者关系式作为准确的排斥力装入Λ，使广义相对论方程达到与其引力的平衡而解出来。所以现在有关真空能，零点能，暗能量等问题主要的已经不是理论问题而是实验的问题，即如何用实验证实它们具有确定值的存在而不是幻想，它们是有确定的数值呢还是变化莫测地可大可小？

【十二】。N 维空间。数学上的 N 维空间与真实的宇宙 N 维空间是什么关系？如何证实？

1944 年 9 月 18 日，美国亚历山大群岛上的艾勒蒙多夫空军基地的一架 C47 训练机执行一项飞往阿拉斯加的安德鲁空军基地的飞行任务，途中将飞越塔肯拿山，进入北极圈，航程近 1000 英里。柯勒机长是艾勒蒙多夫空军基地首屈一指的飞行专家，何况那天是晴空万里。C47 训练机载着全机 19 人在暮色中起飞，不久，地面航空站接到柯勒机长的报告，C47 机正在飞越 9000 英尺的塔肯拿山，此后地面站值班人员再也没有接到 C47 机的报告。一种不祥的预感向地面站的值勤人员袭来，他将 C47 机失去联系的消息通知了美国空军的有关部门。美国空军和民航应急营救机构都迅速派出营救直升机在塔肯拿山区进行长时间的搜索。不久，在离塔肯拿山不远的狄斯阿波峰的悬崖峭壁上发现了 C47 训练机的残骸。但飞机上 19 个人（或 19 具尸体）以及他们的背囊行李却无踪影。仿佛是上帝把 19 条生命以及与生命相关的所有信息都带到了天堂上去。这一不解之谜几十年来一直无法揭开，使得狄斯阿波空难成为人类空难史上最大的悬案。

于是“四维世界论”者提出，目前人类只认识了三维空间，对四维世界还一无所知，他们认为四维世界是客观存在的，只是未被我们发现而已。世界上的万物都可进入四维世界，从而离开我们人类所能感知的世界，从我们的视野中消失。他们解释说，一维定位线段，二维定位平面，三维则定位立体空间，那么四维世界是什么？连“四维世界论”者自己也说不清楚，目前他们没有完整的理论，拿不出什么有说服力的证据，于是狄斯阿波空难事件成了他们的依据之一。“四维世界论”者认为，在极其寒冷的极圈内存在着四维世界，C47 机无意间闯到了四维世界与三维空间的临界面，19 名机上人员及其随身背囊进入四维世界而从我们的视野中消失了，飞机则被挡在三维空间，坠落于悬崖。他们说，惟有“四维世界论”才能解释清楚这看似离奇的狄斯阿波空难事件，反之，狄斯阿波空难事件也证实了四维世界的客观存在。

类似于上述那些无法证实的理论或假说是不科学不可信的，为了让真相大白于天下，科学家们感到有必要重新组织一次事故现场搜索调查。2008 年 6 月，由各学科的专家组成

的科学考察团重新登上了狄斯阿波峰，借助高科技的冰下探测仪等先进设备对当年的事故现场及其周边地区进行了大规模的搜索调查，令人遗憾的是，结果仍然一无所获。

数学上有多少维是以其有多少个独立参数来决定的。所以，1*。真实的空间有多少维和物体在几维上运动是两回事。物体在几维空间运动决定于如何选取坐标。2*。物体在有多少个独立参数的作用下运动和在真实的几维空间上运动又是两回事。3*。在N维之间有多少维是相互独立的，等价的和可以相互转换的？一个站立不动的人如将坐标原点放在其足下，如何？那就是 0 维。如将该人所走的直杆放在X轴上，就是作 1 维运动。如将直杆放在X-Y平面上，该人就在 2 维空间运动。同样，如将直杆放在 2 维空间，他就在作 3 维运动。爱因斯坦在广义相对论方程中将时间作为 1 维与空间的 3 维并列合成为 4 维时空。但是这 4 维并不是对等的。要用数学公式来描述一个物体的运动，必须有时间这 1 维再配合空间的 1 维或 2 维或 3 维。而时间维的正反决定了事物运动的因果关系，是不能颠倒的。**在广义相对论方程里，时间维与空间维是分立的，不等价的，不能相互转换的，**只是相互配合地作用。在其它理论所定义的的N维空间（比如，11 维，26 维等）里，关键是各维空间之间又是什么样的关系？它们之间有多少维是等价的，独立的，能够相互转换的呢？如何证实真实的物体在N维空间的具体形象和运动状况？

【十三】。宇宙加速膨胀与暗能量和多宇宙。多宇宙的实质就是各层的大黑洞内部套有一个或多个小黑洞。

在 1998 年,由美国加里福里亚大学的劳仑斯伯克莱国家实验室的 Saul Perlmutter 教授和澳大利亚国立大学的 Brain Schmidt 所分别领导的两个小组通过对遥远的 Ia 型超新星爆炸的观测发现了我们宇宙的加速膨胀，他们指出那些遥远的星系正在加速地离开我们. **现在，多数的科学家们认为我们宇宙的加速膨胀是由于宇宙中存在具有排斥力和负能量的神秘的暗能量所造成的**，某些科学家们正为获得以后的诺贝尔奖而努力寻找这种暗能量.。

根据最新观测的结果分析, 我们宇宙诞生于 137 亿年前，那时暗能量並没有随宇宙诞生而出现,而暗能量却是在大约 90 亿年前蹦出来的。究竟什么是暗能量呢? 现在还无人知道. 中国科技大学物理学教授李淼就幽默地说过: “有多少个暗能量的学者,就能想像出多少种暗能量”.[16] 那么, 我们宇宙的加速膨胀就只能用具有排斥力和负能量的神秘的暗能量来解释吗? 按照黑洞的原理和其本性, 任何一个黑洞的膨胀产生于吞噬外界的能量物质或与其它黑洞的碰撞,它所吞噬的能量物质愈多，就膨胀得愈快。作者在《对宇宙加速膨胀的最新解释: 这是由于在宇宙早期所发生的宇宙黑洞间的碰撞所造成的》[15] 一文中, 对我们宇宙早期的加速膨胀将用一个宇宙黑洞和另一个宇宙黑洞在其早期的碰撞来解释. 虽然本文中的论证可能相对地简单粗糙,但比现有的其它各种理论的论证更为合理。

上述的观测表明，所谓的 “暗能量”並不是随宇宙的诞生而出现,而是在宇宙的诞生后约 50 亿年才蹦出来的; 由于它的出现造成了宇宙的加速膨胀. 这就清楚地表明暗能量不是我们宇宙所固有的，而是来自我们宇宙黑洞视界的外界，即外面的宇宙。这就是多宇宙存在的强有力的证据.

况且, “近来,在我们的宇宙空间的星系中心，发现了许多超重大级黑洞。一个超重大级黑洞的质量约等于(10^9~10^{12})太阳质量.。据此计算，其平均密度约小于 10^{-12}g/cm^3.。 这些超重大级黑洞往往处于星系的中心，在这些黑洞的中心之外，也可能远离中心处会有许多恒星及其行星存在。在几十亿年之后，就可能有智慧生物出现在其内的某些行星上。而他们将无法知道他们本黑洞外的世界。这就是说，甚至在我们同一个宇宙内，未来在不同的超大级黑洞内的智慧生物之间或许也无法互通信息. **因为每一个黑洞就是一个完全独立的封闭宇宙。因此，在这些之后生物的眼里，他们的宇宙只能是他们的所处星系中心的黑**

洞，连其外面星系他们都无法知道。幸好我们的太阳系不在银河中心的超重级黑洞内，否则，我们连整个银河都无法知道，更不会知道我们整个的宇宙了.

因此, 我们宇宙中各星系的超大级黑洞之间的关系是和我们宇宙黑洞与其它宇宙黑洞之间的关系是一样的。因为我们宇宙一直就是一个真实的超级巨型黑洞。我们宇宙内的某 2 个星系的超大级黑洞也可能在未来发生碰撞而产生加速膨胀，正如我们宇宙黑洞与其它宇宙黑洞在 90 亿年前发生的碰撞一样。再比如，我们的银河系就正在与仙女座星系接近与合并。它们中的某 2 个黑洞在遥远的未来就有可能发生碰撞。这与我们宇宙在 90 亿年前所发生的与另外一个宇宙的碰撞的性质是一样的。只不过发生碰撞的黑洞有大小不同和层次不同而已。**因此。简单的说，多宇宙的实质就不过是黑洞之外有黑洞，一层一层地大黑洞内套有许多小黑洞的另外一种说法而已。**

【十四】总的分析和结论：

《1》.自从爱因斯坦发表了狭义相对论和广义相对论后 100 年来，給科学研究开辟了一条新路，形成了一种新模式。大批的科学家们热衷于搞理论，作纯粹的理论研究，用数学公式提出新观念和新理论。现在这种研究模式已经成为科学研究的潮流，甚至成了主流。究其原因，主要有两条，第一，现在做科学实验需要昂贵的科学设备和仪器，还要一群科学家集体的配合工作才能完成。而个人无此能力。第二，作纯理论研究不需要资金，可以自己一人单干。所以现在各种新理论模式五花八门的，符合实验结论的就成为新理论，如夸克模型。而**现在尚无实验验证的就只能作为一种假设或者猜想**，比如弦论，膜论和N维空间等。虽然那些新观念新理论的创始人都很有宝贵的思想和大胆的幻想，但是往往也有许多虚幻的成分、不切实际的成分，和自我吹嘘的成分。如果后继的研究者没有深厚的科学理论功底和正确的哲学观，迷信的追随前人留下一些不真实的思想观点，就可能一辈子误入歧途。以爱因斯坦的天才智慧，后半辈子约 40 年研究统一场论，企图统一广义相对论和量子力学，尚且无果而终。难道不值得后人深思吗？

普朗克非常重视上个世纪之交以爱因斯坦和他自己为代表的革命性的思想方法，他指出：“这种新的思维方式远远高于理论科学研究，甚至知识论研究所取得的任何成就。”对普朗克来说，“相对论引发的一场物理学观念的革命。在深度与广度上只有哥白尼体系引发的天文学革命可与之相比”。

《2》。从第【三】节可知，从霍金的黑洞量子辐射理论，就可以得出宇宙中不会出现“奇点”的结论。再从【十二】节可知，在我们视界范围以内的宇宙并不是一个孤立的宇宙。**多宇宙的存在是可以确信的**。哈勃定律本身就证明我们宇宙随时间增加和视界的扩大，我们宇宙的物质总量在不断地增加。宇宙还在膨胀，我们宇宙黑洞视界内的物质总量并不是一个恒量，也许还在继续增加。因此，用恒质量研究宇宙的广义相对论方程和所推导出的临界密度的概念都是不符合实际的。只有黑洞理论及其吞噬外界物质（包括与其它宇宙黑洞的碰撞）和发射霍金辐射的观念来解释和推算我们宇宙黑洞的生长衰亡规律才比较正确**.**

《3》。广义相对论方程必须修正**：**物理学本来就是实验的科学，是建立在可靠的实验的基础上的。牛顿的万有引力定律是建立在克普勒 3 定律的基础上的。同样，狭义相对论是建立在迈克尔孙-莫雷实验和劳伦兹变换的基础上的。但是，广义相对论方程确是纯粹想象出来的。**由该方程直接导出“奇点”结论是不符合我们宇宙和物理世界的真实性的，是违反热力学定律的。**因此，广义相对论方程中的能量-动量张量内应该包括对抗引力收缩的热压力（温度）。请看(21a)式，$T_r \propto 1/R$, $T_m \propto 1/R^2$，**恒量的绝热的物质团的引力收缩**

必然会引起其温度的升高的。这就是说，1*。广义相对论必须与热力学紧密的联系起来。霍金的黑洞理论之所以比较成功有效，就是因为符合热力学的各种定律和量子力学。2*。同时，还必须按照具体温度和密度情况在物质团的中心加入一定半径R的对抗引力塌缩的坚实核心。但如此一来，广义相对论方程就变质变种变丑了，而且今后能不能解出来也成问题。

《**4**》**.** 显然，广义相对论方程中之所以会出现“奇点”，是因为将物质粒子当作点结构来处理的结果。所以弦论，膜论，终极理论（T.O.E—Theory Of Everything）等新理论将物质粒子假设成为弦或者膜等非点结构就可以避免“奇点”在数学方程中出现。但是弦或模的尺度都是在普朗克尺度，即 10^{-33}cm，因此弦论和膜论者也许永远也提不出任何实验验证，只是纸上谈兵，只是物理学家在玩数学游戏而已。这是爱因斯坦研究广义相对论思路的发展。这也可能是爱因斯坦开了一个坏的头的结果。**他们是在数学中找物理学规律**。目前国际有一批庞大弦理论队伍。他们还要继续研究下去，但是这个题目可能没有任何实际的用途。下一步物理学将走向何处？同样，**这许多新理论虽然避免了“奇点”的产生，但是如果不与热力学结合在一起，将来仍然难得成功。**

《**5**》。**物理学的未来将走向何处？**

第一；现在的物理学家们对 3 种场—引力场（质量），电磁场（电荷），扰场或旋场（物体的角动量和粒子的自旋）及其相互之间的 4 种作用力（引力，弱作用力，电磁作用力，强作用力）的相互关系并没有搞清楚。特别是粒子的微观运动受热运动的强力干扰使其运动变得非常复杂。这使得粒子复杂的微观运动与物体的宏观运动的统一变得极度困难。**物理学家有能力用数学方程统一宏观运动与微观运动，整体运动与个体运动吗？**

微观的物质粒子和宏观的物体都有一致的或者说同样独立的 3 要素：引力质量，角动量（自旋）和电荷。小至基本粒子，如夸克，电子，质子等都有质量，自旋和电荷。大至任何物体，如行星恒星星系和大小黑洞等也都有**质量，角动量和电荷**。它们本身还都产生一定强度的**引力场，自旋场和电场**。实际上，**温度也可以看成是 1 种场**。所以任何一个微粒子（量子）是也**同时受引力场，扰场，电磁场和温度场 4 种场**的相互作用并在其中运动。它们之间的相互作用不仅仅使它们能够产生复杂的运动，而且能结合成结构复杂的物体。这就使得微观的物质粒子的运动和宏观的物体的运动产生巨大的差别。物体的宏观运动决定于该物体处在场位置的势，即该点场的强度和方向。这是比较容易解决的。

而粒子的微观运动就太复杂了。粒子除了受外界强场的作用作宏观运动之外，它还有1*，与其它粒子之间所产生的场发生作用而相互影响其微观运动。2*。特别是每个粒子都在一定的温度下作不规则的热运动。3*。粒子与其它许多粒子在所组成的复杂结构内在其特定的位置上作微震荡。所以量子力学只能对特殊物质内的特殊粒子的运动作特殊的处理，比如各种半导体，激光等。对粒子群的运动只能运用概率函数来处理。

第二；**电子间相互作用的复杂性**。**我们现在这个五彩缤纷的物质世界和人类的高级智慧都是由许多原子中的电子的复杂结合所产生的和复杂的运动和相互作用而形成的。**现代物理学，量子力学中的许许多多的混乱观念和理论均可能来源于对电子及其复杂运动认识的缺乏；现代科学既不了解电子的内部结构，也不了解它的运动状态和规律，特别是热运动的影响，更不了解电子之间的相互作用和发射吸收电磁波的状况，许多物理学家还将电子当作点结构来处理。因此，也就不知道它有多少的正常态和受激态。事物的“突变”就可能是电子们在非正常状态下受特殊的激发作用所引起的后果。混沌系统对外界刺激的倍增反应就可能类似于电子的某稀有震动频率所受的共振效应。如果新的理论连电子的复杂作用都不能解释，那么，这种新理论又能够起什么用呢？

第三；光子和电磁波有无引力质量？中子、质子、电子，光子等所有微观粒子都存在自旋。使电子自旋有序排列的力量称为交互作用力，此力可能完全是量子力学效应，其作用范围只有数埃，电子在物质内运动会因散射、热扰动等因素,使得自旋平均值为零。光子也有自旋。既然如此，光子为什么没有质量呢？光子为什么在恒星附近发生偏折呢？光子的偏折可以用广义相对论来解释，说明光子的运动路线要走测地线。但这只是一种解释。是否是唯一正确的解释？何况广义相对论并不完善，缺点很多。所计算出来的光的偏折值比实际的观测值相差还不小。

第四：光在真空中的速度是否是恒定值？光(量)子有自旋,其结构是怎样的？同样，中微子的结构是怎样的？爱因斯坦：“整整 50 年的自觉思考，没有使我更接近解答‘光量子是什么’这个问题”。

第五；**热力学定律是我们宇宙中最主要最根本的规律，它们规定了物质物体和事物生长衰亡的变化方向，是因果律在物理学中化身。温度的变化是破坏事物结构内部平衡和稳定的主要因素，是改变事物结构的主要原因。但是，粒子的热运动只符合概率规律，所以是最难解决的问题。因此，任何新理论如果不能与热力学结合在一起，终会难以成功。**

所有的新理论，弦论，膜论，终极理论等必须面对和解决至少上面的这些个问题，而且实验物理学对上述问题的解决应该走在理论的前面。否则，那些新理论可能只是一堆美丽的高超的数学公式游戏。

====全文完====

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The General Theory of Relativity (GTR), Singularity, Black Holes, Hawking Radiations, The Origination of Our Universe, The Universal Black Hole, Zero Point Energy, Vacuum Energy, Dark Energy, Planck Era, The Universal Constant Λ, etc,

==Querying whether many current new theories and concepts in modern physics can be relied on==

Dongsheng Zhang
Graduated in 1957 From Beijing University of Aeronautics and Astronautics. China.
Permanent address: 17 Pontiac Road, West Hartford, CT 06117-2129, U. S. A.
Email: *ZhangDS12@hotmail.com*

【Abstract】: Right now, almost all current new theories and concepts in modern physics, such as black holes (BH), vacuum energy, dark energy, etc, are linked with The General Theory of Relativity (GTR). About 40 years ago, Roger Penrose and Hawking had demonstrated that Singularity is an indispensable component part of GTR. However, no any Singularity indication would exist in the real physical world, it shows GTR could have some important defects and be impossible to get correct conclusions for studying our Universe and black holes, etc. One of the important defects of GTR equation is not to link with thermodynamics, which has the most important laws in nature and is the embodiment of the law of causality in physics. In this article, author would study our Universe and BHs with Hawking's theories of BHs, which is linked with thermodynamics all along. As the result, only owing to emitting hawking radiations, any BHs would finally abstract to minimum BH of $M_{bm} = m_p = (hC/8\pi\ G)^{1/2} = 10^{-5}g$ (3e) and explode in Planck Era. m_p is Planck particle, and no Singularity could appear and exist in nature. [Academia Arena, 2010;2(7):64-95] (ISSN 1553-992X).

【Key Words】: The General Theory of Relativity (GTR),,;Singularity; black Holes; Hawking radiations; the origination of our Universe; Zero Point Energy; Vacuum Energy; Dark Energy; N dimension spaces; the universal black hole; Planck Era; The Universal Constant Λ;

马博士：请将此新文替换 **Academia Arena 2010 2(5)**上的旧文。谢谢。由于此文在该杂志的最后一篇，所以我将此文冒昧地改成 **11** 号字体。虽增加了篇幅，但是更方便阅读。不知可否？如您不同意，请告知。我可改回 **10** 号字体。谢谢。祝好。张洞生拜托。

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对宇宙加速膨胀的最新解释: 这是由于在宇宙早期所发生的宇宙黑洞间的碰撞所造成的

张 洞 生 E-mail: *ZhangDS12@hotmail.com*
1957 年毕业于北京航空学院, 即现在的北京航天航空大学

【内容提要】： 在1998年，由美国加里福里亚大学的劳仑斯伯克莱国家实验室的Saul Perlmutter教授和澳大利亚国立大学的Brain Schmidt所分别领导的两个小组，通过对Ia型超新星爆炸的观测，发现了我们宇宙的加速膨胀。他们指出那些遥远的星系正在加速地离开我们。[3] **现在，多数的相关的科学家们认为我们宇宙的加速膨胀是由于宇宙中存在具有排斥力和负能量的神秘的暗能量所造成的**。其中一些科学家们正为获得以后的诺贝尔奖而努力寻找这种暗能量。特别是，我们宇宙诞生于137亿年前，那时暗能量並没有随宇宙诞生而出来，而暗能量却是在大约90亿年前蹦出来的。.[3] 究竟什么是暗能量呢? 现在还无人知道。中国科技大学物理学教授李淼就幽默地说过: “有多少个暗能量的学者，就能想像出多少种暗能量”。[3] 那么，我们宇宙的加速膨胀就只能用具有排斥力和负能量的神秘的暗能量来解释吗? 按照黑洞的原理和其本性，任何一个黑洞的膨胀产生于吞噬外界的能量-物质和与其它黑洞的碰撞，它所吞噬的能量物质愈多，就膨胀得愈快.[参考后面的公式 (3e)~(3i)]。在本文中，**对我们宇宙的加速膨胀将用一个宇宙黑洞和另一个宇宙黑洞在其早期的碰撞来解释。 虽然本文中的论证可能相对地简单，但比现有的其它各种理论更为合理。**

【关键词】： 宇宙黑洞，宇宙的加速膨，暗能量, 有排斥力的暗能量, 有负能的暗能量, 胀, 宇宙黑洞的碰撞和合并，多宇宙，超光速的空间膨胀，[Academia Arena, 2010;2(7):96-101] (ISSN 1553-992X).

【附注】。请读者在阅读下面的文章内容时，最好能够同时阅读参考文献[1]和[2]。

【I】.我们宇宙的加速膨胀证明了多宇宙的真实存在.

新近的观测表明，**所谓的 “暗能量”並不是随宇宙的诞生而出现，而是在宇宙的诞生后约 50 亿年才蹦出来的。由于它的出现造成了宇宙的加速膨胀， 这就清楚地表明暗能量不是我们宇宙所固有的，而是来自我们宇宙的外界，即外面的宇宙。这就是多宇宙存在的强有力的证据**。况且，“近来，在我们的宇宙空间，发现了许多超重级黑洞，.一个超重级黑洞的质量约等值于(10^7~10^{12})太阳质量$\mathbf{M_\theta}$。据此计算，其平均密度约等于 $0.0183 g/cm^3$ ”。 在这些超重级黑洞中，也会有许多恒星及其行星存在，而这种黑洞往往处于星系的核心地位，其外围有太多的能量-物质可供吞噬使其不断长大。 几十亿年之后，就可能有智慧生物出现在其内的某些行星上。而他们将无法知道他们本黑洞外的世界。这就是说，甚至在我们同一个宇宙内，不同的超重级黑洞内的智慧生物之间也无法互通信息。因为每一个黑洞就是一个完全独立的宇宙。幸好我们的太阳系不在银河中心的超重级黑洞内。否则，我们连整个银河都无法知道，更不会知道我们现在整个的宇宙了，因此，**我们宇宙内各超重级黑洞之间的关系，是和我们宇宙与其它宇宙之间的关系是一样**的。因为**我们宇宙一直就是一个真实的超级巨型黑洞**。[1][2] 上述在我们宇宙中的超重级黑洞可吞噬其外面能量-物质，或与其它的黑洞相碰撞。同样的道理，**我们这个宇宙黑洞也会吞噬我们宇宙外的能量物质或和其它宇宙黑洞发生碰撞**。由此可以推论，在我们宇宙这个真正的大黑洞内，里面套着层次不同的大小黑洞。那么，在我们宇宙黑洞之外，也应该是有比我们宇宙黑洞更大更多的黑洞一层一层地套着。只是由于受宇宙年龄的限制，我们看不见而已。因为我们宇宙在生成时，总质量的尺寸只有现在一个原子的大小 10^{-13}cm的“宇宙包”，当时同时生成的一定会有许多大小不同的其它的“宇宙包”一起生成。而后造成与我们宇宙黑洞的碰撞和合并，这才是多宇宙的真实概念。

【II】. 暗能量是怎样提出来的。 任何对宇宙的加速膨胀解释的理论，必须符合我们宇宙的平直性要求和当今较准确的观测值($\Omega = 1.02 \pm 0.02$)。而只有本文的解释才符合此要求。有排斥力的暗能量和所有其它理论都可能成为找不到的幽灵，因为它们都不符合此要求，解释不了我们宇宙的平直性。

爱因斯坦的广义相对论场方程如下:

$G\mu\nu = 8\pi G\, T\mu\nu + \Lambda g\mu\nu$ [4] (2a)

Gμν 是描述时空几何特性的爱因斯坦张量。 Tμν 是物质场的能量-动量张量。Λgμν 是宇宙学项。其中 Λ 被誉为宇宙学常数。Λgμν 具有排斥力，它是爱因斯坦为了保持我们宇宙中引力和斥力的平衡，后来才加进去的。[4] 为了便于分析，Tμν 可分为下面三项:

$$T\mu\nu = T^1\mu\nu + T^2\mu\nu + T^3\mu\nu \qquad (2b)$$

按照当今的较准确的观测和理论计算， **$T^1\mu\nu \approx 4\%T\mu\nu$，**[3] $T^1\mu\nu$ 代表可见的有引力的普通物质， 如星星、星际间物质等。根据对许多星系旋转速度分布的观测和理论计算，**$T^2\mu\nu \approx 22\%T\mu\nu$，**[3] i。e。$T^2\mu\nu \approx (5 \sim 6)\ T^1\mu\nu$。 $T^2\mu\nu$ 代表有引力的不可见的星系中的暗物质。**$T^3\mu\nu \approx 74\%\ T\mu\nu$，**[3] 它就是 除 $(T^1\mu\nu + T^2\mu\nu)$之外的所谓的暗能量。暗能量与 $(T^1\mu\nu + T^2\mu\nu)$ 一起的总量必需能保持我们宇宙的平直性和 $(\Omega \rightarrow 1)$，即 $\Omega = \rho_r / \rho_o \approx 1$，因为 Guth 和 Linde 所提出的宇宙暴涨论的预言以及宇宙动力学均要求，宇宙的平直性和 $\Omega = \rho_r / \rho_o \approx 1$，也就是要求宇宙的实际密度 ρ_r 必须极为接近其临界密 ρ_o。近来，许多较准确的观测已证实 $\Omega = 1.02 \pm 0.02$，[4] 而较好地符合理论的要求，当然，这里所提到的暗能量是指具有**有引力暗能量.**

然而，为了解释新近对遥远的Ia型超新星爆发所发现的宇宙的加速膨胀，许多科学家提出了一些新理论，他们将 ($T^3\mu\nu + \Lambda g\mu\nu$)合并到一起成为 Λgμν，认为 Λgμν 就是 ($T^3\mu\nu = 74\%T\mu\nu$)，而具有排斥力的未知的和神秘的暗能量。新理论最著名的代表是量子场论。在该理论中，把 ($T^1\mu + T^2\mu\nu = 0$) 当作真空状态，或者说是最低能量状态或量子场的基本态。[4] 也是微观宇宙的零点能。而将宇宙中($T^1\mu + T^2\mu\nu \neq 0$)的宏观能量物质即普通物质作为量子场的激发态。对宇宙真空状态的观测到是非常符合于 ($T^1\mu\nu + T^2\mu\nu$) = 0。于是，Λgμν 正好作为具有排斥力的$T^3\mu\nu$的真空能。**不幸的是，按照量子场论所计算的 Λgμν值比在真空中实际的观测值要大 10^{123} 倍（该数值来源于：现在宇宙的真实密度约为 10^{-30}g/cm^3, 再加上按照J. Wheeler等估算出真空的能量密度可高达 10^{93}g/cm^3）。由于这种原因，用量子场论来解爱因斯坦的广义相对论场方程就会遇到无法克服的困难。** 很显然， 由量子场论所计算出来的如此庞大的真空能量值，是无法保持宇宙的平直性和使张量Gμν 在爱因斯坦的广义相对论场方程中与实际的观测值相符合的。量子场论似乎把真空能量当作“无限的免费午餐”， 在宇宙中任何一点究竟储藏有多少真空能量和能被取出来多少? 为什么从真空中出来的负能量不和宇宙中现有的正能量发生湮灭? 如何使 74% 的具有负能的暗能量 Λgμν保持宇宙的真实的平直性? 用量子场论解决上述问题就难免不违反宇宙的根本规律—因果律。由此可见，任何新理论，包括量子场论在内，如要恰当的解释我们宇宙的加速膨胀，就必不可违反宇宙的平直性。而且要使**Ω** 比当今的准确的观测值 ($\Omega = 1.02 \pm 0.02$)[4]还要准确。

其实，许多科学家和一些观测并不支持有 “神秘暗能量” 或 “有排斥力的暗能量”的存在。

意大利国家核物理研究所的里奥托称：“宇宙的加速膨胀不需要神秘暗能量，它只不过是被忽略的大暴涨后的膨胀效应”。[5]

欧洲航天局的 XMM 牛顿天文望远镜的科学家们，观测到了炽热气体在古老星系团和年青星系团中的比例是一样的，**他们认为只有宇宙中不存在暗能量才能解释这种现象。** [6] 然而,现今 ($T^1\mu\nu + T^2\mu\nu$)的总量是太少了，不足以维持宇宙的平直性和使宇宙的实际密度 ρ_r 极为接近其临界密 ρo。因此，$T^3\mu\nu / T\mu\nu \approx 74\%$是维持宇宙的平直性所必需的。**但是，这里的 $T^3\mu\nu$ 应当是那些未被观测到的和看不见的而有正能的暗能量。**[1][2][3][4]

在 2007 年 1 月 8 日，一个美国科学研究小组宣，,经过几年的努力，**他们首次绘出了我们宇宙暗物质的三维图**。他们指出，**在我们宇宙，大约有 1/6 是可见物质，其余的 80%以上都是暗物质。**[7] 他们实际上否定了暗能量的存在。

近代宇宙学通常将宇宙学项并入物质场的能量-动量张量，这就相当于引进一个能量密度的能量-动量分布，即 $\rho\Lambda = \Lambda/8\pi G$, 或者 $p\Lambda = -\Lambda/8\pi G$.[4] 因而**近代宇宙学从引进 ρΛ 和 pΛ 已经实际上认为热能的排斥力是宇宙中引力的天然的对抗者。** 因此, 近代宇宙学是无需有排斥力的暗能量的。

【III】. 黑洞在吞噬外界能量-物质或与其它黑洞碰撞后的膨胀规律，以下只研究无电荷、无旋转和球对称的引力（史瓦西）黑洞。不管黑洞内部状态和结构有多么大的差别，其在黑洞视界半径R_b上的 4 个参数 M_b，R_b，T_b 和 m_{ss}必须服从下面的 3 个公式，(3aa)，(3ab)，(3ac)。这是黑洞的本质属性。

A． 黑洞 M_b 在其视界半径 R_b 上的 3 个基本守恒公式，

$R_b = 2GM_b/C^2$，或者 $R_bC^2/2G = M_b$ [9][2] **(3aa)**

$T_b M_b = (C^3/4G) \times (h/2\pi\kappa) \approx 10^{27}gk$ [11] **(3ab)**

$$m_{ss} M_b = hC/8\pi G = 1.187\times10^{-10} g^2 \quad (3ac)$$ [1][2]

公式**(3aa)**是根据施瓦兹恰尔德对广义相对论的特殊解，是任何真正的引力黑洞或者说施瓦兹恰尔德黑洞存在的必要条件。**(3ab)** 是霍金量子辐射 m_{ss} 在黑洞的 R_b 上的温度 T_b **的公式，(3ac)是** m_{ss} 在黑洞的 R_b 上的霍金量子辐射的相当质量。M_b-- 黑洞的质量, R_b--黑洞的视界半径，C—光速，M_θ —太阳质量，C--引力常数, **h—普朗克**常数，**κ--**, 波尔兹曼常数，

4 个参数M_b，R_b，T_b 和 m_{ss}服从 3 个公式，所以，只有定出其中任何 1 个参数的数值，黑洞在R_b上的其它参数值全都确定了。所以，如果不需要考虑黑洞内部的状况和结构，只考虑在其其在黑洞视界半径R_b上的状态，那么，黑洞就是宇宙中最简单的实体。

B。当黑洞吞噬外界物质时**,** 下面常用的球体公式作为辅助公式，

$M_b = 4\pi\rho_b R_b^3/3$ (3b)

从公式(3aa) 和 (3b),

$3C^6 = 32\pi G^3\rho_b M_b^2$ (3c)

$dR_b = (2G/C^2)dM_b$ (3d)

$dR_b/dt = (2G/C^2)\, dM_b/dt$ (3e)

公式 (3c) 和 (3d) 表明, 当 M_b 由于吞噬外界物质而增加 10 倍时，其密度 ρ_b 会降低 100 倍, 而 R_b 增加 10 倍。黑洞视界两对面的相对膨胀速度 V_b，于是 $V_b = 2dR/dt$， 因此,

$V_b = (4G/C^2)\, dM_b/dt \le 2C$ (3f)

结论：1*。 在 $dR_b/dt = C$的条件下，当$dt = 1$ 秒时，$dM_b/dt = 2\times10^{38}$g/sec，这相当于每秒吞噬外界物质达到 10^5 太阳质量M_θ。 所以，每一个黑洞，无论其质量M_b是多小，只要每秒吞噬外界能量-物质2×10^{38}g/sec，即 10^5 M_θ，其视界半径R_b就以光速C膨胀。当无外界能量-物质可吞噬时，黑洞会不停地发射霍金辐射m_{ss}，M_b随着不停地减少，直到最后变成为最小黑洞$M_{bm}= m_{ss} = m_p = 1.09\times10^{-5}$g在普朗克领域爆炸解体消亡。$M_p$—普朗克粒子。[1 2*。不要小看这$dt = 1$ 秒的时间，我们宇宙诞生于最小黑洞$M_{bm} = m_{ss} = m_p =1.09\times10^{-5}$g，其Compton时间仅为 10^{-43}秒，当宇宙成长到 1 秒时，它已增长了 10^{43} 倍，因而宇宙的质量由$M_{bm} =1.09\times10^{-5}$g增加到 10^{-5}g$\times10^{43} = 10^{38}$ 克，这正是上面$dM_b/dt = 2\times10^{38}$g/sec的数值。

黑洞视界的膨胀的加**(**或减**)**速度 a_b 是: $a_b = dV_b/dt$**,** 于是,

$$a_b = (4G/C^2)d^2M_b/dt^2 \quad (3g)$$

公式(3g) 表明, **黑洞视界的加(或减)速膨胀a_b 直接正比例于其每秒吞噬外界物质的增多或减少。因此， 黑洞吞噬外界物质所造成的加(或减)速膨胀是其正常的活动的表现。这也是黑洞碰撞或合并时，黑洞视界半径和内部产生相应的加速膨胀的机理。** 从公式(3a) 和 (3d),

$$R_b + dR_b = (2G/C^2)(M_b + dM_b) \quad (3h)$$

C．从公式(3aa)，**如果两个黑洞 M_{b1} 和 M_{b2} 碰撞以后**, R_{b1} 和 R_{b2} 分别是其施瓦兹恰尔德半径。于是，$R_{b1}C^2/2G = M_{b1}$, $R_{b2}C^2/2G = M_{b2}$, 结果为，

$$M_{b1} + M_{b2} = (R_{b1}+R_{b2})\, C^2/2G \quad (3i)$$

这样一来, 一个新的黑洞形成了。其质量是 $M_{bn} = M_{b1} + M_{b2}$。其施瓦兹恰尔德半径是 $R_{bn} = (R_{b1}+R_{b2})$。

结论: 1*。 从公式 (3d) 和 (3i) 可得出下面的(3j)。可见，一旦一个黑洞形成了，不管它是增多或减少其质量，或甚至与其它黑洞相碰撞，它仍然是一个黑洞，在它最后收缩成为 10^{-5}g的最小黑洞(M_{bm})而消失在Planck Era前，它将永远是一个黑洞。[1][2] **2*。由于黑洞只有在发射霍金辐射m_{ss}时才会收缩，但是一般黑洞的m_{ss}非常微弱，而且发射的极慢，所以，此时R_b的收缩是极慢的。**

$$dM_b + M_{b1} + M_{b2} = (dR_b + R_{b1}+R_{b2})\, C^2/2G \quad (3j)$$

【IV】. 我们宇宙一直就是一个真实的宇宙黑洞 (UBH). 它完全遵从黑洞在其视界半径 R_b 上的 3 个公式--(3aa)，(3ab)，(3ac)，

A1, 现代精密的各种天文望远镜实际的观测数据表明，我们宇宙球体具有精密而可靠的数据。**我们宇宙真实可靠的年龄A_u = 137 亿年**[2].[3] 于是，由此计算出，其视界半径$R_u = C\times A_u = 1.3\times10^{28}$ cm, 密度 $\rho_u= 3/(8\pi GA_u^2) = 0.958 \times 10^{-29}$ g/cm^3. 所以，宇宙的总质量 **$M_u = 8.8\times10^{55}$g.** **A2. Hubble 常数的实际的可靠的观测数值是 $H_o= (0.73\pm0.05) \times 100$kms^{-1}Mpc^{-1} [3],** 由此算出宇宙的实际密度 $\rho_r = 3H_o^2/(8\pi G) \approx 10^{-29}$g/cm^3. 并得出宇宙年龄 $A_r^2 = 3/(8\pi G\, \rho_r)$, $\therefore A_r = 0.423 \times 10^{18}$s = (134±6.7) 亿年。结果，**宇宙的总质量$M_r = 8.6\times10^{55}$g。**

由此可见，两种不同的精确测量数据所得出的结果几乎完全一致。因此，为了计算方便，下面取我们宇宙的数据如下。 取宇宙总质量**$M_u = 8.8\times10^{55}$g**。宇宙年龄**$A_u = 137$** 亿年，视界半径**$R_u = 1.3\times10^{28}$ cm**， 宇宙密度**$\rho_u = 0.958\times10^{-29}$ g/cm^3**。

B. 既然现在按照实测密度ρ_u = **0.958 ×** 10^{-29}g/cm^3, 我们宇宙黑洞质量(M_{ub})的密度**$\rho_{ub} = \rho_u$**. 于是，可按黑洞公式计算出来. 设 M_{ub} 是我们宇宙黑洞的能量物质的总量, R_{ub} 是起施瓦兹恰尔德半径. 从公式(3aa) $R_{ub}C^2/2G = M_{ub}$, 和公式 (3b) $M_{ub} = 4\pi \rho_r R_{ub}{}^3/3$, 和 $\rho_r \approx 10^{-29}$g/cm^3、可算出，**我们宇宙黑洞的组成是: $M_{ub} = 8.8\times10^{55}$g, $R_{ub} = 1.3\times10^{28}$cm, $\rho_{ub} = 0.958\times 10^{-29}$g/cm^3**。结果，与上面一致。

证实我们宇宙 (M_{ub})是真正的宇宙黑洞的确凿证据. 如果我们宇宙(M_{ub})是真正的宇宙黑洞, 它应当由宇宙大爆炸所产生的大量原始的最小黑洞$M_{bm} = 1.09\times10^{-5}$g, $R_{bm} = 1.61\times 10^{-33}$cm, $T_{bm} \approx 0.65\times10^{32}$K所组成,[2] 由公式(3aa) 和 (3i)可知，取**M_{bm}是组成我们现在宇宙M_{ub}**的总数N_{ub1}是：$N_{ub1} = M_{ub}/ M_{bm} = 8.8\times10^{55}/1.09\times10^{-5} = 8.073\times10^{60}$. 同时, 从公式 (3i)可见, $N_{ub2} = R_{ub}/R_{bm} = 1,3\times10^{28}\text{cm}/1.61\times10^{-33}\text{cm} = 8.074\times10^{60}$. **由于 $N_{ub1} = N_{ub2}$, 这就是确凿的证据表明我们宇宙是一个真正巨大的宇宙黑洞-- UBH. 我们宇宙黑洞M_{ub}**的Compton 时间t_{bc}.

$t_{bc} = \mathbf{R_{ub}/C = 1.3\times10^{28}/3}\times10^{10} = 0.433\times 10^{18}/3.156\times10^{7} = 137{,}3\times10^{8}$ 年 （4a）

C.。宇宙的平直性和 ($\Omega = \rho_r / \rho_o = 1$) 是宇宙黑洞的本性:：按照哈伯定律，在我们宇宙，距离任何一点 P 为 R_p 的相对膨胀速度 V_p为, H_o--哈伯常数,

$V_p = H_o R_p$ (4b)

从公式(3aa)和 (3b), 在黑洞视界上，当 R_p 延伸到 R_{ub}时, $V_p = C$, 于是,

$H_o{}^2 = 8\pi G \rho_o /3$ (4c)

既然我们宇宙是一个真正的宇宙黑洞，它就必然是一个封闭的球体，它就只能有一个密度。因此, ρ_o 就是我们宇宙黑洞的临界密度。从公式 (3aa) 和 (3b)可知，它是单值，且仅由M_{ub} 或 R_{ub} 所决定。[1].[2] 然而，宇宙的实际密度 ρ_r 也是来自同一个观测的H_o，i。e。 $H_o{}^2 = 8\pi G \rho_r /3$。**其必然结果是: ρ_r 应完全等于公式 (4b) ρ_o**. 所以, ($\Omega = \rho_r/\rho_o = 1$) ,或者说，**$\rho_{ub} = \rho_r = \rho_o$**是宇宙黑洞的本性。反过来, $\Omega = \rho_r/\rho_o = 1$ 也可证明我们宇宙是一个真正的宇宙黑洞。.

D。 既然我们宇宙**M_{ub}**来源于**$N_{ub1}\times M_{bm}$**个宇宙出生时最小黑洞**M_{bm}**的**N_{ub1}**个不断地合并所造成的膨胀，也就是说，**M_{ub}**的视界半径**R_{ub}**一直在以光速在膨胀，这种结果与我们宇宙黑洞**M_{ub}**外有充分的能量-物质可供吞噬，以达到**R_{ub}**一直在以光速在膨胀个效果是一样的。这就造成了,

$A_u = 137$ $\times10^{8} = t_{bc} = 137\times10^{8}$ (4d)

如果现在我们宇宙黑洞 M_{ub} 外已经没有能量-物质可被吞噬，那么，**$A_u > t_{bc}$.而且，哈伯常数 $H_o = 0$。**

【V】. 我们宇宙的加速膨胀(AEOU)是由于两大宇宙黑洞在其早期的碰撞所造成的.

在分析我们宇宙的加速膨胀 (AEOU)时，我们是根据下述的事实和情况作一步一步的分析和推论的。

A；科学家们根据遥远的 Ia 型超新星爆炸，发现我们宇宙的加速膨胀是发生在宇宙大爆炸之后的约 50 亿年之后，即距今约 90 亿年之前，那是在宇宙演化中的物质占统治地位的时代。在我们宇宙黑洞内，星系、星团、恒星等已经形成.

B；根据(3j) 式可知，无论 1 个黑洞与其它黑洞的碰撞或者合并，或者吞食外界的能量-物质，总是小黑洞 M_{bx}吞噬大黑洞 M_{bd}和其中的能量-物质而变大，也就是说，是小黑洞 M_{bx}吞噬大黑洞 M_{bd}后变成二者合一的更大黑洞($M_{bx} + M_{bd}$), 而不是大黑洞 M_{bd}消化掉小黑洞 M_{bx}. 因为按照黑洞的本性，黑洞只有在发射霍金辐射时才收缩变小。但是一般黑洞的霍金辐射是非常非常地微弱的，比电子和电磁波都微弱。所以，在宇宙中，都是小黑洞吞噬大黑洞内的能量-物质而变成大，而后二者的视界半径重合为一，即（$R_{bx} + R_{bd}$）。

C；从对 (3f)式的说明中可以看出，如果我们宇宙黑洞M_{ub}在任何时候，在 $dR_b/dt = C$的条件下，当 $dt = 1$ 秒时，$dM_b/dt = 2\times10^{38}$g/sec，即相当于每秒能够吞噬外界能量-物质达到 10^5 太阳质量M_θ的条件下，其R_b就会以光速C的速度膨胀。如果在某个时候，其外围有大大超过 10^5 M_θ（太阳质量）的能量-物质，他会在 1 秒钟内吞噬 10^5 M_θ后，而后 1 秒 1 秒地吞噬完其余的能量-物质，其视界半径R_{ub}只会以≤C(光速)的速度而膨胀，而质量M_{ub}也将 1 秒增加 10^5 M_θ。因为这些大能量-物质是可以被黑洞分割地吞噬的。**这就不会产生超光速C的加速膨胀。**

D；同样，如果我们宇宙黑洞M_{ub}在任何时候，其外围能量-物质少于 10^5 M_0时，根据瞬时吞噬外界能量-物质的多小而决定其视界半径R_{ub}的膨胀速度，他会尽可能快地以光速C先吞噬完这些少于 10^5 M_0能量-物质，然后歇着一会休息，或者发生一点微弱的霍金辐射。等外面再有能量-物质时，接着吞噬。但不会产生产生超光速C加速膨胀。

E；当我们宇宙黑洞M_{ub}外有大于 10^5M_0黑洞M_{bw}，即$10^5M_0 \le M_{bw} \le M_{ub}$时，就会与$M_{bw}$发生碰撞与合并。由于$M_{bw}$是一个整体，不能被$M_{ub}$所分割，因此，2 个黑洞在接触碰撞时，就会产生加速膨胀，而可能产生超光速的空间膨胀，并且M_{bw} 可能会进入M_{ub}的内部吞噬M_{ub}的能量物质。最后的结果，按照公式(3j)是成为一个新的更大的黑洞，其质量是（$M_{bw} + M_{ub}$），视界半径是（$R_{bw} + R_{ub}$）。关键问题是2 个黑洞在接触碰撞时所产生的加速膨胀和产生超光速的空间膨胀会维持多长的时间？作者现在尚不知道，因为现在还没有观测到2 个黑洞在接触碰撞时的图像过程和数据。

如果在$M_{bw} > M_{ub}$的情况下，特别是在$M_{bw} >> M_{ub}$时，M_{ub}可能被吸进M_{bw}的内部，在M_{ub}被吸进内部之前，肯定会产生加速膨胀，和超光速的空间膨胀。但被吸进M_{bw}的内部之后，长大了的M_{ub}会在M_{bw}的内部吞噬其能量-物质，而继续增长，直到吞噬完所有的M_{bw}的能量-物质后，二者合并为一个新的大黑洞，其质量是（$M_{bw} + M_{ub}$），视界半径是（$R_{bw} + R_{ub}$）。M_{ub}在吞噬足够多的内部能量-物质的过程，应该是以光速每 1 秒吞噬10^5M_0能量-物质的过程，也是视界半径是 R_{ub}以光速膨胀的过程。

F。那么，我们宇宙黑洞在 90 亿年之前所产生的加速膨胀究竟是与那一种大小的黑洞发生的碰撞和合并的呢？注意到，由于我们宇宙黑洞的Compton时间t_{bc}与我们宇宙的年龄A_u完全相等，即$A_u = t_{bc}$，这说明我们宇宙黑洞从诞生的时刻 5×10^{-44} 秒起直到现在，总的结果是以光速在膨胀，即每秒都在吞噬约10^5M_0能量-物质。而且现在在我们宇宙黑洞M_{ub}之外仍然还有能量-物质可被吞噬，因为M_{ub}的R_{ub}还在以光速膨胀。根据以上的情况分析，有 2 种情况比较适合：**1a***。在 90 亿年前，我们宇宙黑洞M_{ub}与宇宙中的 1 个巨大黑洞M_{bw}相碰撞，然后合并，由于$M_{bw} >> M_{ub}$, 合并后，我们的M_{ub}到现在仍然处在巨大的M_{bw}内部，每 1 秒还在从M_{bw}中吞噬进10^5M_0的能量-物质，而R_{ub}仍在以光速膨胀。 **1b***.也有可能在 90 亿年之前，我们的M_{ub}与另外一个$M_{bw} > M_{ub}$相碰撞和合并后，M_{ub} 现在已经进入M_{bw}内部，但是M_{bw}外面还有比它更大的黑洞套着它，而M_{bw} 和 M_{ub}的视界半径都在以光速膨胀。这正如我们宇宙内，一个超级黑洞内有一个恒星级黑洞的关系是一样的。 **2***。我们宇宙黑洞M_{ub}从诞生起就处在一个非常庞大的黑洞内，在 90 亿年前与其中的 1 个小黑洞M_{bw}发生碰撞与合并，$M_{bw} < M_{ub}$。合并后，我们长大的新黑洞（$M_{bw} + M_{ub}$）现在仍然处在那个非常庞大的黑洞内，每 1 秒还在从其中吞噬进10^5M_0的能量-物质。不过从宇宙演化的过程来看，这第 **2***。种情况很难出现，因为在宇宙创生时，所有的宇宙黑洞都是同时创生的，很难形成大黑洞内套生小黑洞的情况。

结论：第 **1a***。种情况比较符合我们宇宙在在 90 亿年前产生加速膨胀的状况。

G．假设我们宇宙黑洞在 90 亿年与另外一个宇宙黑洞在碰撞前的质量为M_{ub1}，其视界半径为R_{ub1}。我们宇宙黑洞现在的质量为$M_{ub} = 8.8\times10^{55}g$, $R_{ub} = 1.3\times10^{28}cm$, $\rho_{ub} = 0.958 \times 10^{-29}g/cm^3$. 见【IV】B. 现求$M_{ub1}$和$R_{ub1}$如下。

上面已经说过，我们宇宙的年龄 A_u =137 亿年。在这 137 亿年内，宇宙保持在等光速 C 而膨胀。所以现在的 $R_{bu} \approx C\times A_u$, 。再按照公式(3aa)，$R_bC^2/2G = M_b$，所以得出 我们宇宙的质量与其年龄成正比，即

$M_{ub} \propto A_u$ (5a)

既然 2 黑洞的碰撞和合并发生在 90 亿年前，那么,

$M_{ub1}/M_{ub} = (137 - 90)/137 = 34.3\%$, (5b)

$R_{ub1}/ R_{ub} = (137 - 90)/137 = 34.3\%$ (5c)

$(\Delta M_{ub} = M_{ub} - M_{ub1}) / M_{ub} = 65.7\%$ (5d)

所以，$M_{ub1} = 0.343\ M_{ub} = 3\times10^{55}g$, $R_{ub1} = 0.343\ R_{ub} = 0.446\times10^{28}cm$。

讨论：从上面的计算可以看出一个非常有趣的问题。我们宇宙黑洞在 90 亿年前的质量$M_{ub1} = 34.3\%\ M_{ub}$，而$T^1\mu\nu + T^2\mu\nu$的 2 项物质(见【II】节)，即可见物质和星系中暗物质之和约为现在宇宙中总能量-物质的 26%。M_{ub1} 与（$T^1\mu\nu + T^2\mu\nu$）接近。现在科学家们所测定的宇宙中的暗能量（暗物质）约为$T^3\mu\nu \approx 74\%$。ΔM_{ub}与$T^3\mu\nu$接近这几个百分数如此之接近，是偶然的吗？使得人们不得不怀疑，M_{ub1} 是否就是$T^1\mu\nu$

$+ T^2\mu\nu$？而（$\Delta M_{ub} = M_{ub} - M_{ub1}$）是否就是$T^3\mu\nu$？我们知道，当一个黑洞吞噬外界能量-物质和物体时，由于黑洞视界外对外界能量-物质和物体的潮汐作用和吸积盘中物质转变为辐射能，所以外界能量-物质和物体ΔM_{ub} =（$M_{ub} - M_{ub1}$）经过黑洞视界进入黑洞后，都变成能量了。那么，ΔM_{ub} =（$M_{ub} - M_{ub1}$）是不是就是我们现在观测不到的暗物质或暗能量呢？

VI. 几个简单的结论：

A. 黑洞的膨胀，及其视界半径 R_b 的膨胀，有 **2** 种方式，**1** 是吞噬外界能量-物质的膨胀，由于外界能量-物质可以被分割，所以 R_b 在吞噬外界能量-物质时是以 ≤ 光速 **C** 在膨胀。现在人们观测到的符合哈勃定律的宇宙膨胀就是这种膨胀。另外 **1** 种是黑洞与其它黑洞碰撞合并开始时所产生的膨胀，由于黑洞内的能量-物质不能被分割，所以在开始碰撞的一段时间内会产生超光速的空间膨胀，这就是人们观测到的加速膨胀。这与宇宙诞生时，许多最小黑洞 M_{bm} 的合并，所产生的宇宙“原初暴涨 **Original Inflation**”的机理是同样的。[2]

B．我们宇宙黑洞$M_{ub1} = 3\times10^{55}$g在 **90** 亿年前与宇宙中的另外一个巨大的宇宙黑洞发生碰撞，产生了人们现在观测到的我们宇宙的加速膨胀，即视界半径的超光速空间膨胀，而后我们宇宙黑洞进入那个大黑洞内部继续吞噬其内部的能量-物质而使其视界半径R_b以光速**C**膨胀，直到现在，宇宙黑洞的质量M_{ub}由$M_{bm} =1.09\times10^{-5}$g增加到$M_{ub1} = 3\times10^{55}$g，再经过 **90** 亿年后，$M_{ub}$增加到现在的$M_{ub}= 8.8\times10^{55}$g。

C．我们宇宙黑洞M_{ub}的命运。如果M_{ub}外无能量-物质可被吞噬，那么M_{ub}将会不停地向外发射霍金辐射m_{ss}, M_{ub}也会不停地减少收缩，直到最后收缩成为最小黑洞$M_{bm}=1.09\times10^{-5}$g而在普朗克领域爆炸消失，其寿命按照霍金的黑洞寿命公式 $\tau \approx 10^{-27}M_b{}^{3}{}_{(s)} \approx 10^{133}$ 年。但是现在哈勃常数仍然正常，表明M_{ub}外不知还有多少能量-物质，而M_{ub}只有在吞噬完外界的所有能量-物质后，才会收缩，直到最后成为最小黑洞$M_{bm} =1.09\times10^{-5}$g而在普朗克领域爆炸消失，其寿命将>>$10^{133}$年.

D．我们宇宙黑洞 M_{ub} 现在正处在另外一个更大的宇宙黑洞 M_{ubb} 内，而 M_{ubb} 是否处在其外面一个更大更大的宇宙黑洞内？M_{ubb} 之外是否有其它的大黑洞伙伴？我们都受宇宙年龄的限制而无法知道。但是，在我们现在的宇宙黑洞 M_{ub} 内部，许多星系中小超级大黑洞和恒星级黑洞并存，超级大黑洞内也能存在恒星级黑洞，就是说，我们宇宙黑洞内各种黑洞并存和大黑洞内套着小黑洞的模式是否也是我们宇宙黑洞 M_{nb} 外面的大宇宙中黑洞存在的模式相同？

====全文完====

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