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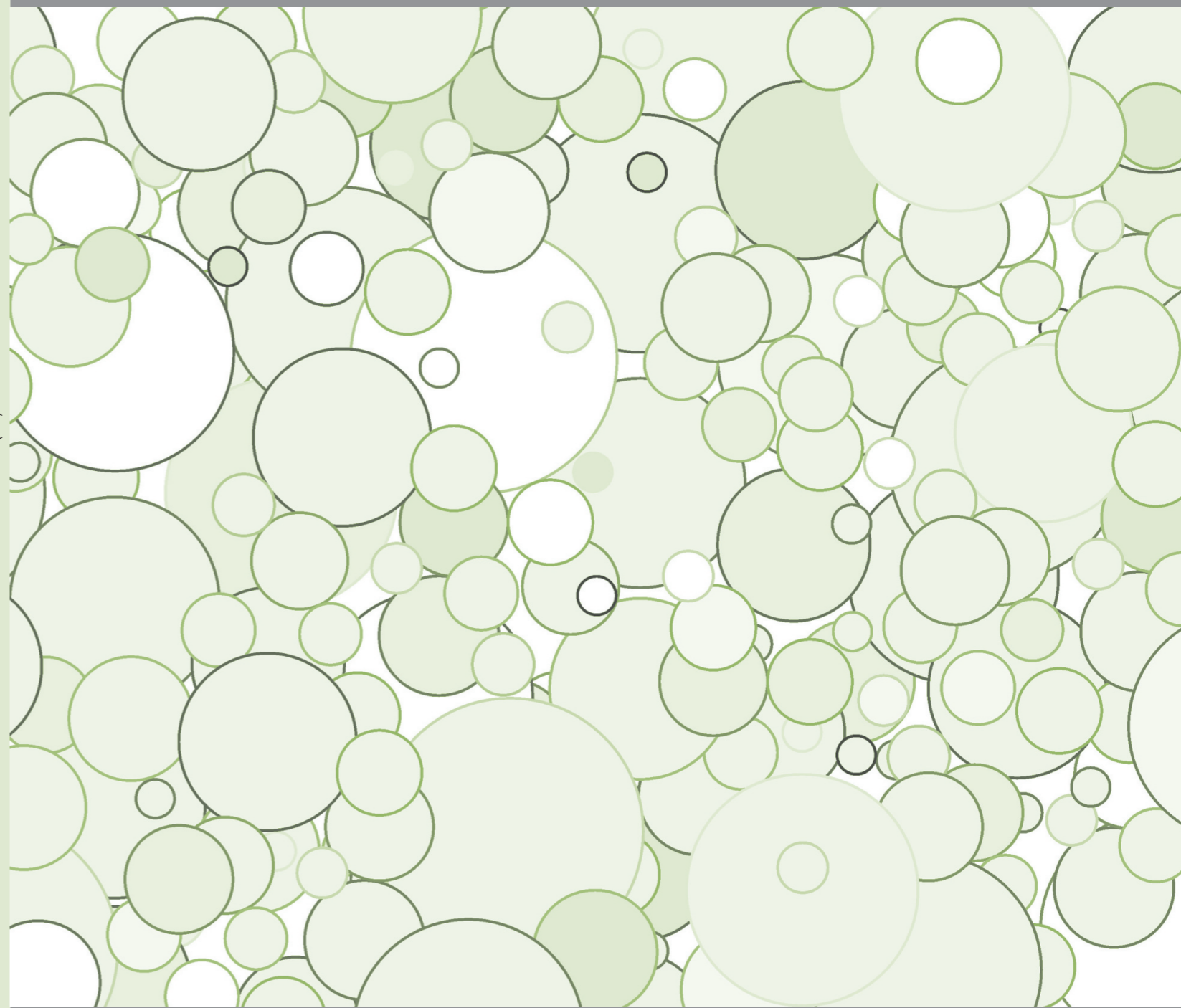
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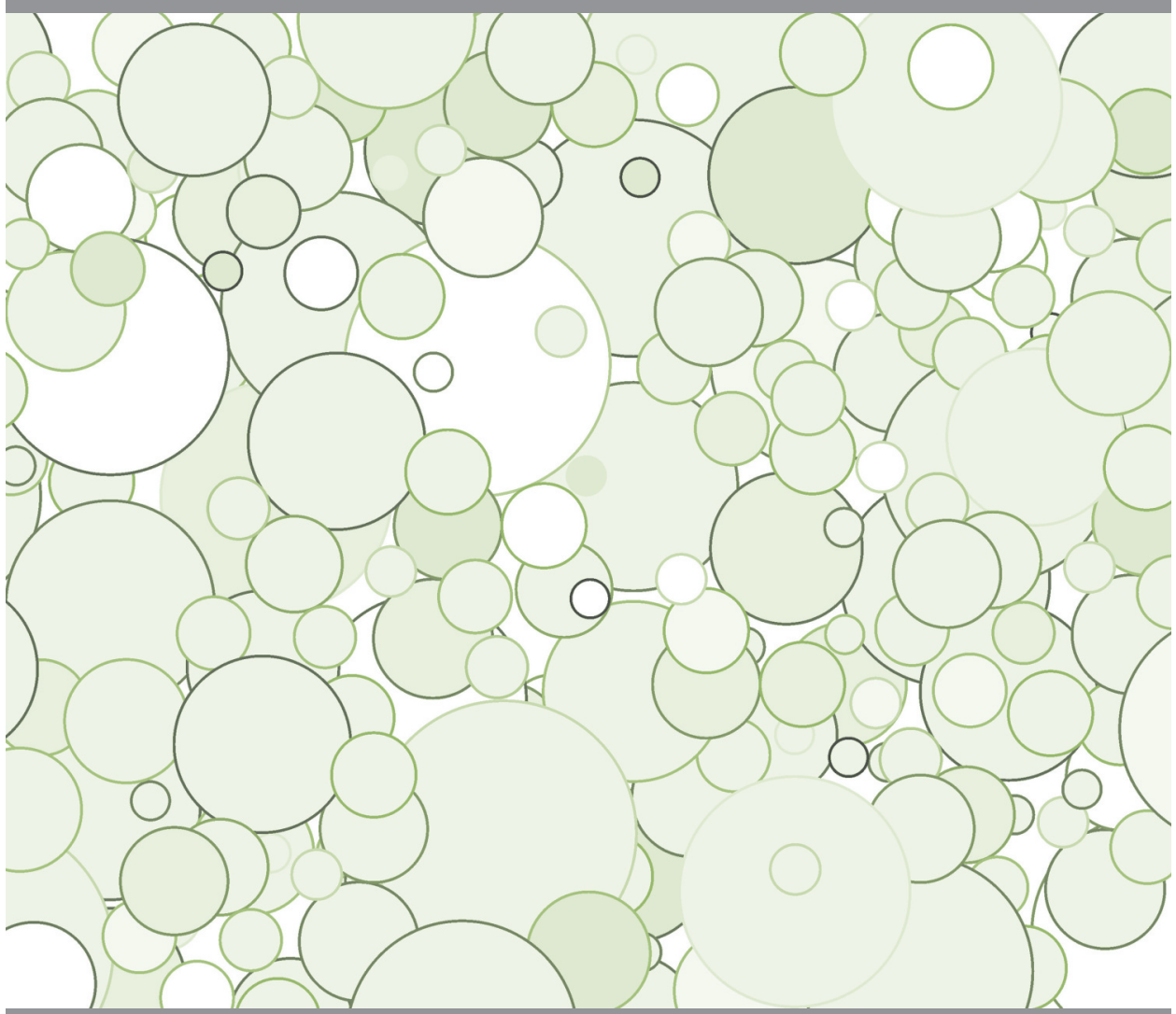
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学术争鸣

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学术争鸣于2009年元月1日在美国纽约马斯兰德出版社发刊, 主要目标为提供科学家与工程师及社会工作者学术辩论的发表园地, 专业领域包含哲学、科学、技术、宇宙学、数学、物理、化学、生物学、医学、土木、电机、化工、机械工程, 等, 编辑群将以最专业客观的立场为所有投稿作者服务。

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Customer Relationship Management (CRM) in Banking System

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Abstract: In past years, banks of country have not considered customer-centering and its components due to different social and economic problems and dependency of banks on the government and more important due to excess of supply on demand, then couldn't use modern marketing well. People don't have any motivation to go to banks since that no one considered them and their needs and also because all branches of banks offer same services. So, they have to go to banks just to supply basic needs and in other words it can be said that now customers offer service to banks not banks to customers. According to environmental changes we will face, banks should consider some issues beforehand such as equipping themselves, recognizing customers' expectations and needs, and even market condition, because each bank which can recognize these needs and meet them sooner than the competitors will be success in this competition. In this article it was tried to assess role of Customer Relationship Management and its weakness and strengths in Banks of Iran then finally some recommendations are offered in order to modify and improve quality of services in Bank.

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Key words: Customer Relationship Management (CRM), bank, Iran, customer - oriented

Introduction:

One century ago and before Super market, market and automobile evolution, people went shopping from public markets next to their houses. Retailers knew customers by name and were aware of their needs. Customers also kept their loyalty to those markets and repeated their shopping. This ideal relation with customer was changed by economic growth of countries, migration to cities from villages and increase in competition, then the customers were more dynamic and many chain shops and supermarkets were built in result of Benefit due to mass marketing. In such conditions the prices were low, quality of goods was high and similar but customer relationship was established without name and personal confrontation.

Consequently, customers were disappointed and inclined toward those suppliers who offer intended goods and services by lower prices and by most desired specifications. In current years and after occurred revolutions in the field of IT, we have seen rise of Customer Relationship Management concept (CRM) as an important approach in business, which its intent was to refer to individual marketing. This is a simple concept which states that different customers claim different productions and services

and we should seek to market each individual customer instead mass marketing. In this person to person approach, data obtained from each customer (such as previous purchases, needs and requirements) will be used for framing used goods and services which finally increase probability of acceptance. This approach is the result of progresses in the field of IT. Necessary and basic point which should be noted here is that CRM means Customer Relationship Management not customer relationship marketing.

Management includes more extensive concept than marketing and contains production, human resources, management, services, selling and inspection and development thus CRM requires organizational approach over all levels of business that should be customer-centering for conducting business not for simple strategy of marketing. CRM includes all functions of organization (marketing, production, customer services and etc.) which requires direct and indirect contact with customers.

Transiting from traditional economy and removing geographical borders for business and consequently increased competition caused that the customer as basic component being represented as central focus of bank activities. In other words, marketing is now in its evolutionary path it means that

finding new customers isn't its only goal and the main focus is on the demand management through growth and directing customers toward loyalty ladder of Banks.

Nowadays, customers' satisfaction isn't sufficient for them to be loyal to banks and in addition their confidence also should be established. In this communication, the aim is to establish long-term and mutual connections with bank stakeholders and specifically the customers so that more customers being maintained and less leave bank and the result is more market share and profitability for bank [2].

Definitions for customer relationship management:

CRM includes three main components: customer, relationship and management. Here customer is final user who plays role of supporter in value-maker relationships. Relationship means to establish more loyal and beneficial customer through learning communication and finally the management means creativity and leading one customer-centering business process and putting customer at the center of processes and experiences of organization.

Today, strategic importance was given to Customer Relationship Management in organizations. In hard competition conditions, on time and organized relationship with customer is the best way for increasing customers' satisfaction, increased selling and decreasing costs as well. According to this, CRM is considered as kind of commercial strategy [1, 3].

To recognize customer; factor for strengthening relationship:

Previous ideas about customer relationship considered CRM as a factor for satisfying customer, in other words this assumption existed that when customer face with best type of services will choose it and won't refer to other competitors, in simpler words customer satisfaction which is the result of service quality equals customer loyalty.

But the fact is that customer satisfaction isn't always equal to loyalty and there are some probabilities as following:

- About 40% of satisfied customers change their selections without any reason and doubt.
- Between 65% through 85% of customers that select new manufacturers claim that satisfied with previous selections and had no problem.
- 85% of satisfied customers however incline to other manufacturers.

Certain services for specific customers:

Customers' data gathering process for providing preliminaries of recognizing customers usually face with certain issues. Naturally, question-answer process by organization will create some considerations about customers' privacy and shared area. This question will be presented that how we can collect customers' databank without any violation. In other words aim of accessing to planning goals of customers databank is presence of confidence in data security and organization trusteeship is considered important by customers. At the other hand it can be said that all customers also won't affect organization in a same way and certainly attracting key customers' satisfaction contains higher sensitivity.

In psychology perspective, customers are classified to 4 main groups:

- 1) Loyal customers: those who recognized organization services totally better than other organizations
- 2) Relatively loyal customers: those who recognized these services a little better than other competitors
- 3) Unfaithful customers: those customers who didn't recognized organization services better than other competitors
- 4) Loyal customers of competitors: those customers who recognized competitors' services totally better than organization services.

So it is necessary to plan and implement efficient system for attracting and keeping key customers in addition to recognize each group of customers so that especial program being planned and finally organization can change lower customer groups to higher ones during evolution process of this communication.

Establishing loyalty is process which will be created through progressive process. Yet, certain services are offered in order to keep key customers.

Goals of CRM:

Goals of CRM in Noll's perspective:

Noll (2000) stated that key point of CRM is to identify things that make value for customers, then offering them. In this perspective, while customers held different attitudes toward value but there are many ways to satisfy them. So the goals of CRM are:

- Identifying certain values of each part of customers
- understanding relative importance of those needs for each customer part
- Determining whether offering such values will be effective in positive way

- Communicating and offering suitable values of each customer in a way that they want to receive data
- Measuring results and proving efficiency for investment

Main goals of performing CRM in financial institutes and banks are:

- 1) Identifying certain values of each part of market and customers
- 2) Offering customers desired values in their requested way for receiving data
- 3) Dividing different parts of market and improving process of target customer relationship
- 4) Increasing income obtained through commission fee for delivering services
- 5) Increasing satisfaction and customers loyalty
- 6) Optimizing canals for delivering services to customers
- 7) Attracting new customers based on obtained experiences with previous customers
- 8) Obtaining customers comments and interests in order to optimize strategy and operation process

Strength and weakness points of CRM in Iranian banks:

Strength points:

- 1) Saving in time
- 2) Offering services fast and accurately
- 3) Improvements in staff treatment with customers
- 4) Offering certain services to key customers
- 5) Offering consultation services
- 6) Having databank of customers' history
- 7) Increased profitability
- 8) Increased customers satisfaction level
- 9) Establishing useful and mutual communication
- 10) Increased customers' values and greatness

Weakness:

- 1) Time consuming and costly
- 2) Lack of accepting CRM implement by managers, personnel and customers
- 3) Lack of proper infrastructure for implementing CRM
- 4) Time and place conditions of branch which affect possibility of customer access to bank
- 5) Offering certain services with higher quality by peer banks
- 6) Presence of unfaithful customers and presence of loyal customers of peers

Conclusion:

CRM system can help to keep current customers and attract new ones. One of the most important customers' expectations from banks is speed and decreased waiting time. Obtaining customer and keeping them aren't easy task. Clerks of bank consider bank services asker as client not customer and if customer being considered as client such as many organizations, so personnel know them who need to clerks and treat in every way they want and even they don't answer them, and never people's confidence means customers who are sources for obtaining profit. Whenever we consider them as customer whom our life depends on them, so marketing and ways of dividing market will finds meaning. In banking system, customers are at main focus and all jobs will be done to satisfy them and attract them. Therefore, those banks will be success in computational space among banks, who can gain more customers loyalty. At the other hand, according to more sensitivity of customers against service delivery by banks, they always ask better services.

Suggestions:

- 1) Establishing data bank of key customers: preparing one data bank of fixed and key customers history
- 2) Offering extensive and needed educations to bank personnel (especially to cashiers) about how to treat customers : cashiers are personnel of bank frontier so it is necessary to educate them when face with customers in certain circumstances
- 3) Use active experts personnel in banks
- 4) Use more developed and advanced equipment
- 5) More control personnel performance
- 6) Establishing workgroups and/or committee which deal with customers' demands and complaints which requires time and investment
- 7) Imagine yourself as a customer in order to better understand his/her type of feeling

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4/20/2013

统一基本粒子系和原子系弦学之桥 --- 现代实用量子弦学发轫 (1)

叶眺新

Recommended by Zhang Dongsheng, zds@outlook.com

摘要: 对于氢原子谱线的波长数据, 我们用从原子系量子数轨道圆弦图和正切基角 $\theta=45^\circ$ 出发的数据处理方法, 合乎逻辑地导出了 2013 年的巴尔末公式。这种肯定, 能否扩容到基本粒子系, 即有物质族数目的类似“巴尔末公式”的新量子数质量谱公式吗? 我们已经整整奋斗和等待了半个世纪。

[叶眺新. 统一基本粒子系和原子系弦学之桥---现代实用量子弦学发轫 (1). *Academia Arena* 2013;5(3):5-17] (ISSN 1553-992X). <http://www.sciencepub.net/academia.2>

关键词: 巴尔末公式 光谱 超弦 量子数质量

弦论、弦学、弦图, 是超弦或超弦理论和圈量子引力理论等理论的统一的简称, 是人类目前在数理科学中取得的最大发现。它的基本表叙是纯旋量表叙, 简称三旋; 它解决质量起源是两种弦图。穿越历史时空, 让哥白尼、玻尔、威滕等三位分属于太阳系、原子系、基本粒子系模型创新的领军人物, 在今天走到一起来考虑未来三系统一的虚拟生存的弦论框架、模具像什么? 也许和大家一样回答的是卢瑟福-玻尔行星原子核式量子数轨道圆弦图。这是自 1884 年巴尔末发现氢原子可见光波段的光谱并给出的经验公式以后, 为 20 世纪初普朗克、庞加莱、爱因斯坦等科学大师们开创量子引力理论的辉煌统一大厦, 奠定的第一块基石。但基本粒子系还有一张巴拿马运河船闸-马蹄形链式量子数轨道弦图, 是人们不知道的。它也是在发轫中的实用量子弦学。

一、巴尔末公式和新量子数质量谱公式等价性证明

什么是卢瑟福-玻尔行星原子核式量子数轨道圆弦图 (简称“核式弦图”) ? 它跟巴尔末多项式 $m^2/(m^2-n^2)$ 的意义是什么? 巴尔末公式是:

$$\lambda = b[m^2/(m^2-n^2)] \quad (1)$$

式中 λ 是光谱的波长。 m 和 n 为正整数序数, m 为跃迁前的能级, $m \geq 2$; n 为跃迁后的能级, 且 $n \geq 1$ 。 b 是一个常量, 称为巴尔末常量, 通过实验确定 $b = 364.56$ 纳米。

在 1854 年巴耳末给出氢的可见光谱波长之前, 没有人能预测氢谱线的波长。巴耳末之后里德伯又花了近 4 年时间, 将他的经验公式扩充为里德伯公式。巴耳末-里德伯原始的公式在 1888 年提出, 在 1980 年完成。而巴耳末公式 $\lambda = b[m^2/(m^2-n^2)]$ 的形式, 2012 年才出现在重庆出版集团重庆出版社出版的由包新周等先生翻译的[英]曼吉特·库马尔的《量子理论》一书中。但它的说明仅限于 1913 年玻尔

提出的玻尔原子量子数弦图模型, 以说明为何巴尔末公式能够解释氢原子的谱线。这是不够的。

玻尔的弦图假设是: 原子中电子的绕核运动时, 只能在符合一定量子化条件的轨道弦上运转, 这些轨道弦上运动着的电子既不能辐射能量, 也不能吸收能量, 这时称电子处于稳定状态, 其余的则称激发态。但玻尔的弦图从来没有说明过波粒二象性, 为什么? 因为玻尔轨道弦的波动和波长, 是真正像正弦曲线水波式的驻波运动。直到 2013 年 2 月 3 日, 才真正出现说明微观轨道圆弦驻波运动的莫比乌斯齿轮视频。

请看北师大特聘的海归计算机专家蒋迅先生博客作的“莫比乌斯齿轮”动画视频, 这是第一次出现在蒋迅的博文《【数学都知道】2013 年 2 月 3 日》中的视频。这种莫比乌斯齿轮, 不同于另外那种被莫比乌斯带齿轮环抱的若干小齿轮的莫比乌斯齿轮动画视频, 它是在环形轨道, 沿圆环的切线与圆面的垂直面方向, 和圆面自身的平面方向两个系列, 由互套并咬合的环圈齿轮组装成的传动。这个我们多年等待的难得的视频, 它解决了玻尔驻波运动量子化条件的轨道弦, 既连续又间断的波粒二象性图像难题。

蒋迅莫比乌斯齿轮的自旋、自转、转动中主要的线旋, 是属于我们对类圈体的三旋的定义。所谓三旋, 请看广东省计算机专家邱嘉文先生博客为我们做出的三旋动画视频: 面旋指类圈体绕垂直于圈面的中心轴线旋转; 体旋指类圈体绕圈面内的任一轴线旋转; 线旋指类圈体绕体内环圈中心线的旋转。莫比乌斯齿轮的每列小齿轮不仅能实现稳定轨道弦的条件, 是电子的轨道角动量 L 只能等于 $h/2$ 的整数倍, 而且还能体现弦论定义的弦振动基本特征, 是自旋的定义。

这样电子在轨道弦不辐射能量, 是因为它的能量已经在用于莫比乌斯齿轮的传动。而电子在原子核外轨道弦由一个定态跃迁到另一个定态时, 一定

会放出或吸收辐射能，也可以理解。即如果电子从能态 E_1 跃迁到 E_2 ，根据普朗克-爱因斯坦公式，辐射能的频率为 $h\nu = E_2 - E_1$ 。式中， E_1 、 E_2 分别代表始态和终态的能量； ν 为电子的速度， h 为普朗克常数。若 < 0 ，表示跃迁放出能量；若 > 0 ，表示跃迁时吸收辐射能。蒋迅莫比乌斯齿轮量子轨道圆弦图，联系玻尔理论处理氢原子后来把光谱分成线系，都是起源于巴尔末多项式 $m^2/(m^2-n^2)$ 的这个发现。

1、“勾股数”量子轨道圆弦图之谜

在历史上，解释氢光谱的本质曾是物理学上的一个难题。

氢所发出的谱线是不连续的。巴尔末是瑞士科学家，他发现的氢光谱波长规律的巴尔末公式 $\lambda_n = b[m^2/(m^2-n^2)]$ ，当其中 $n=1$ 时，表示的是跃迁到基态的谱线，即莱曼系。莱曼系是物理学上氢原子的电子从主量子数 n 大于等于 2 跃迁至 $n=1$ 的一系列光谱线。当 $n=2, 3, 4$ 时，称为巴尔末线系、帕邢线系、布拉克线系等，依此类推。历史上第一条莱曼系的谱线是莱曼在 1906 年在研究被激发的氢原子气体紫外线光谱时发现的，其余的谱线在 1906 年至 1914 年间陆续被发现。

1) 氢原子光是氢原子内的电子，在不同能阶跃迁时所发射或吸收不同波长、能量的光子而得到的光谱。玻尔的原子量子数弦图，能说明氢原子光谱为不连续的线光谱；而且自无线电波、微波、红外光、可见光到紫外光区段，都有可能有其谱线。可是要知道，巴尔末给出的经验公式 $\lambda = b[m^2/(m^2-n^2)]$ ，是在以 1905 年爱因斯坦发表用布朗运动统计的数学方法测量，才证实原子的存在的划界之前。

即使在这之后，人们才弄清氢原子是由一个质子及一个电子构成的最简单的原子；但巴尔末多项式 $m^2/(m^2-n^2)$ 是在这之前，基于人们早就发现氢原子光谱在可见区和近紫外区有好多条谱线，构成的一个很有规律的系统的。理论和实验都证明氢原子谱线的间隔和强度是向短波方向递减，因此光谱一直是了解物质结构理论的主要基础。

如研究其光谱，可借由外界提供其能量，使其电子跃至高能阶后，在跳回低能阶的同时，会放出能量等同两高低阶间能量差的光子。再以光栅、棱镜或干涉仪分析其光子能量、强度，就可以得到其发射光谱。或以一已知能量、强度之光源，照射氢原子，则等同其能阶能量差的光子会被氢原子吸收，因而在该能量形成暗线。我们之所以认为，2012 年重庆出版社出版的库马尔《量子理论》书中的巴耳末公式 $\lambda = b[m^2/(m^2-n^2)]$ 形式，还没有完善，还可以改进，是我们认为 $[m^2/(m^2-n^2)]$ 把波长与序数 (m, n) 用多项式关联起来的表示，实际 m^2 和 n^2

是属于“勾股数”，道理是原子弦图中的量子数构成了直角三角形。

2) 什么叫勾股数？如重庆药师张绍涛先生 2012 年出版的《勾股数》一书，讲勾三股四弦五的勾股定理，必须知道直角三角形两条边的长度才能求第三条；问如果只知道一条边的长度，能不能通过公式求出另外两条边的所有长度的所有组合呢？张绍涛为此自创了新公式。巴尔末早就是瑞士的一个“张绍涛”。

因为如果把巴尔末公式中的 $[m^2/(m^2-n^2)]$ ，看作一个张绍涛勾股数新公式，那么我们就能够利用原子系玻尔量子数轨道圆弦图，将序数正整数条件与圆周曲线拟合，证明它是一座统一基本粒子系弦学与原子系弦学之桥。下面就是这种巴尔末公式和新量子数质量谱公式相互暗中等价性的证明。

3) 自然数本身就是一些自然量子数。如果量子数等价弦数，那么把量子数性质上完全相同但质量（或能量或波长）数性质却不同的各种超对称粒子归在一处的一个根本特征，就是勾股数；它包含的是与同位素现象、放射性现象等价类似反映的，从原子系到基本粒子系中量子数相同而质量（或能量或波长）数不同的，由质子等粒子衰变产生的多粒子夸克等价的量子数的超对称现象。

但玻尔理论及其以后理论都没有看出这一特点。玻尔的原子量子数弦图，能够看到的只是电子在氢原子的弦线能阶；它们要将玻尔、里德伯和莱曼联结在一起，就必需以巴耳末公式所描述的量子化，以 m 对应于开始时的能阶， n 对应于结束时的能阶。

这只需要将 n 以 1 来取代。这就是巴耳末公式的莱曼系。因此，每一条辐射弦的波长都对应于一种电子从主量子数弦大于 1 的能阶上跃迁至第一阶的能量。但正因为是这一点，即只能是 $n \geq 1$ ，而不能是 $n=0$ ，这使反映勾股数所在的波长面只能固定在 45° 的投影面上。那么用勾股数来求它的一个直角三角形的对边长，虽然这个直角三角形不是在玻尔轨道圆弦的半圆形内，但还是可以设对边长在半圆外的切线上。即我们可以设所有系列的光谱线，在半圆上的基角或所张的对角都是 $\theta = 45^\circ$ 。

由于 $\text{tg}45^\circ = 1$ ，所以 $\text{tg}45^\circ$ 乘以巴耳末公式 $\lambda = b[m^2/(m^2-n^2)]$ 的两边，其值不变。即与 $\lambda = b[m^2/(m^2-n^2)]\text{tg}45^\circ$ 形式的公式是等价的，但的意义却大变。因为在一个直角三角形中， $(m^2-n^2)\text{tg}45^\circ$ 是意味求切线上的那条直角边长。而这里又类似已经知道了一条斜边为 m ，一条直角边长为 n ；由于 45° 直角三角形的两条直角边长是相等的，所以 $(m^2-n^2) = n^2$ ；代入 $\lambda = b[m^2/(m^2-n^2)]\text{tg}45^\circ$ 得：

$$\lambda = b[m^2/(m^2-n^2)]\text{tg}\theta = b[m^2/(m^2-n^2)]\text{tg}45^\circ = b \quad (1-2)$$

4) 但在实际标示中,是不能表示为 $b(m^2/n^2)$ 的。因为会出现 $m^2/0^2=b$ 这样的不合理的情况,失去巴耳末公式所描述的勾股数量子化的意义。这一特点在夸克核式弦图中很明显,因为它们的 $n=0$ 。为了说明巴耳末公式 $\lambda=b[m^2/(m^2-n^2)]$ 本身不符合实际,我们先来验算一下。巴耳末最先发现,如果 n 被固定为 2, 而把 m 定为 $m=3,4,5$ 或 6 的话,则他的公式得出的值几乎依次与已知的四条光谱线波长完全相配。

这是瑞典物理学家埃斯特伦发现并测量和分别取名为阿尔法、贝塔、伽马和德尔塔的四条线,它们分别为 656、486、434、410nm 的波长。检验证明符合得相当的好:

$$\text{阿尔法 } \lambda = 364.56[3^2/(3^2-2^2)] = 656.21$$

$$\text{贝塔 } \lambda = 364.56[4^2/(4^2-2^2)] = 486.10$$

$$\text{伽马 } \lambda = 364.56[5^2/(5^2-2^2)] = 433.93$$

$$\text{德尔塔 } \lambda = 364.56[6^2/(6^2-2^2)] = 410.13$$

2、物质族质量谱公式推证之谜

巴耳末公式 $\lambda=b[m^2/(m^2-n^2)]$ 求勾股数量子化的意义不同寻常。因为科学中很多实在的东西需要实际的测量才能准确知道,但巴耳末只用一个常量 $b=364.56$ 纳米,就能得出埃斯特伦测量出的阿尔法、贝塔、伽马和德尔塔的四条光谱线,这很了不起。例如门捷列夫通过对各种化学元素的原子量大小排序,搞出了化学元素周期表,但还不能少于元素的数目的常量,用一个数学公式测算出各个化学元素的原子量。对于氢原子谱线的波长数据,用从原子系量子数轨道圆弦图和正切基角 $\theta=45^\circ$ 出发的数据处理方法出发,我们也能合乎逻辑地导出 $\lambda=fN^2[m^2/(m^2-n^2)]\text{tgn}45^\circ$ 这样的巴耳末公式。上世纪 60 年代中期,我们已经知道质子、中子等核子的下一个层次是夸克,那么物质族的数目,是否也有类似巴耳末公式的物质族基本粒子质量谱计算公式呢?

对于有这种肯定,我们已经整整奋斗和等待了半个世纪。因为 1962 年我们上高中后,就已经知道巴耳末和里德伯以经验公式作为基础的原始公式,以及后来卢瑟福-玻尔的核式弦图的解释。这很容易联系我们早已发明的三旋量子数弦谱图,但由于众所周知的原因,我们只能千呼万唤求助于“山教”的基层劳作。直到 1996 年我们才在《大自然探索》杂志第 3 期发表了《物质族基本粒子质量谱计算公式》一文,以后又在 21 世纪初相继正式出版了《三旋理论初探》和《求衡论》两书,其中都献出有我们发现的类似“巴耳末公式”的粒子质量谱计算公式:

$$M = G\text{tg}N\theta + H \quad (2-1)$$

$$m_{\text{上}} = BH\cos\theta/(\cos\theta+1) \quad (2-2)$$

$$m_{\text{下}} = B - m_{\text{上}} \text{ (或 } B = m_{\text{上}} + m_{\text{下}}) \quad (2-3)$$

$$B = K - Q \text{ (或 } K = Q + B) \quad (2-4)$$

那么以上我们的公式真的和巴耳末公式有相似之处吗? 这里我们主要以 6 个夸克的粒子来说明, $M = G\text{tg}N\theta + H$ 能够对应巴耳末公式来求 6 个夸克和 6 个轻子的系列。

1) 这是如何推证的呢? 首先说原子系的波长 λ 和基本粒子系质量 M 的比例等价对应关系。众所周知, 波长 λ 是一种振动, 而振动是一种能量, 按玻尔-爱因斯坦质能公式, 能量可以转变为质量, 质量可以转变为能量, 这在原子-基本粒子域是常事。

2) 为何要首选正切函数 $\text{tg}N\theta$? 因为 6 个夸克的质量的实验测量值, 在直角坐标第一象限 90° 的角度内, 都能在正切函数表中找到相应的数字。当然这不是一种推证的方法, 但它也提供了一个说明, 物质族的基本粒子质量谱, 类似材料断裂或撕裂的应力计算公式, 即断裂或撕裂在微观有一种剪切应力, 剪切断面有小于 90° 的角度。而 90° 的角度可以分成三代, 设每组系列的 3 种夸克也像紫外、可见光和红外等氢原子谱线系列的各个波长数据, 也是分成 m 和 n 的正整数量子序数来对应的。

由于基本粒子是由宇宙大爆炸生成, 现在测的质量, 不同于宇宙生成。 m 为现跃迁前的能级, 应 $m \geq 1$; 那么 n 为跃迁后回到宇宙生成的能级, 应 $n = 0$ 。难题现转到问基本粒子系的夸克有多少种? 可分多少代? 每种夸克质量是多少? 在上世纪 90 年代以前, 我们能知道宇宙是由三种基本粒子组成, 它们是“上”夸克 u 、“下”夸克 d 和电子构成; 质子由两个 u 夸克和一个 d 夸克构成, 而中子由两个 d 夸克和一个 u 夸克构成。由于夸克质量是用与质子质量的对比来计量的, 且单个夸克又不能看见, 所以当时估计约定, u 夸克和 d 夸克分别为一个质子质量约 0.94Gev 的 1/3, 即约为 0.3Gev。

到 1991 年, 我们查到 G·Feldman 和斯坦博格发表在《科学》杂志 (《科学美国人》中文版) 第 6 期中的文章《物质族的数目》, 能提供的 6 种夸克质量数据是: 上夸克 u 、粲夸克 c 、顶夸克 t 、下夸克 d 、奇夸克 s 和底夸克 b 等的质量, 分别约为: 约 0.01Gev、约 1.5Gev、约 89Gev (未见到)、约 0.01Gev、约 0.15Gev 和约 5.5Gev 等。

到 1996 年我们发表《物质族基本粒子质量谱计算公式》的论文前, 我们尽自己的能力, 当时能查到的各种资料的 6 种夸克质量的最理想数据是: 上夸克 u 、粲夸克 c 、顶夸克 t 、下夸克 d 、奇夸克 s 和底夸克 b 等的质量, 分别约为: 约 0.03Gev、约 1.42Gev、约 174Gev、约 0.06Gev、约 0.196Gev 和约 4.295Gev 等。我们把 90° 的角度平分为三等分,

每份则为 30° ；但根据不确定性原理，我们不能把基角确定为 30° ，必须小于 30° 一点点，即基角约为 30° 。这样三倍于基角时，也就不会出现是 90° 这样的正切函数，是无穷大的这种不合理的现象。所以我们将 6 种夸克按质量大小的顺序，分别编号为三代两组的系列，只需求出两组夸克各自共同的基角 θ 、质量轨道模数 G 和质量模参数 H ；反过来 6 种夸克的质量，也就能算得出与实验对应提供的数据。

3) 其演算情况，根据高中数学的排列组合及两角和与倍角的三绝函数知识，6 类夸克按合理的排列组合，是四种系列，共 8 组 3 个方程联立，才能计算求解，得出各组的 θ 、 G 和 H 。这四种系列的排列组合应是：

上夸克 u 、粲夸克 c 、顶夸克 t ；下夸克 d 、奇夸克 s 和底夸克 b

上夸克 u 、奇夸克 s 、顶夸克 t ；下夸克 d 、粲夸克 c 和底夸克 b

上夸克 u 、粲夸克 c 、底夸克 b ；下夸克 d 、奇夸克 s 和顶夸克 t

上夸克 u 、奇夸克 s 、底夸克 b ；下夸克 d 、粲夸克 c 和顶夸克 t

以上四种系列共 8 组 3 个方程联立的排列组合作出后，因为基角 θ 倍数分代的编号是 1、2、3，没有 0，设符号为 N 。为了和巴尔末公式 λ 中的 m 和 n 符号一致，仍设定符号 m ，为 8 组 3 个方程联立求解中的夸克跃迁前的能级， $m \geq 1, 2, 3$ ；符号 n ，为夸克跃迁后的能级， $n = 0$ 。约定和确定后， N 、 m 和 n 是已知的正整数。我们知道质量是一种静止的能量，现在要证明 $M = G \operatorname{tg} N \theta + H$ 与 $\lambda = b [m^2 / (m^2 - n^2)] \operatorname{tg} \theta = b [m^2 / (m^2 - n^2)] \operatorname{tg} 45^\circ = b (m^2 / n^2)$ 式等价，即 $\lambda = M$ ，就要进一步说明为什么玻尔量子数轨道圆弦图的波长 λ 的振动，是和粒子的质量超对称等价成比例对应的？它们是：

A) 弦论合并量子力学与广义相对论后认为，普朗克尺度上的空间类似于格点或网格；格线之间的空间超越了物理的范围，粒子就只能从空间的一条“线”蹦到另一条。

B) 在极端的小尺度上，我们在宏观熟悉的空间和时间并不是突然失去了意义，而是较多地转变成其他更基本的概念，如振动或自旋，我们才能走得更远。

C) 有一些办法可检验弦论。但如说标准模型，它就回答不了为什么物质是由三代基本粒子组成？由哪些粒子组成？物质为什么有三代？等等。

D) 因为粒子性质只不过是标准模型的一部分输入参数。如果粒子性质不能确定下来，标准模型就无法运作。而在弦论中，粒子的性质是由弦的振动决定的。按质能公式 $E = mc^2$ ，质量和能量可以

彼此转化；粒子的质量，正是弦的振动能量。无质量的光子和引力子则对应着弦可能有的最平静温和的振动模式。在弦论中，实际振动模式是指向自旋的；不同的自旋的振动模式之间，有一种完美的平衡。如希格斯场预言的粒子，是自旋为 0 的振动模式与实验上发现的性质符合。但相比中国新弦学，西方的弦论振动模式太多，且所有的振动中的质量都太过巨大。

E) 玻尔放弃电子可以在任何给定的距离上围绕核运转的观念，提出电子只能占据几个选定的轨道弦，也就是“稳定态”，而不是经典物理学所允许的所有可能的轨道弦，于是他把电子的轨道弦给量子化了。现在问，量子弦论为什么要出现在对撞机周围的某几个特定的衰变弦路？因为某些标准模型法则在对撞机里是无效的；把标准模型量子数给量子弦论化，对弦论振动基本模式的这种自旋，也就像普朗克想象的黑体辐射振荡器，对能的吸收和释放以量子弦论化可推算出对撞机的粒子衰变方程一样。

F) 直线运动的物体有动量，这个动量是物体的质量乘以速度。而在圆周中运动的物体则有一种特性叫“角动量”，在环形轨道弦中运动的电子角动量，是电子的质量乘以它的速度再乘以其轨道弦的半径，表示为 $L = mvr$ 。这对弦论或任何其他进行环形轨道弦运动的物体的角动量，都没有做任何限定。玻尔知道，由旋转的电子形成的环弦，它的角动量只能是 $h/2\pi$ ，或 $2(h/2\pi)$ 、 $3(h/2\pi)$ 、 $4(h/2\pi)$ 等形式，直到 $n(h/2\pi)$ ，其中 n 是整数。其他那些非稳定态轨道弦则被禁止。

这就像站在梯子上的人只能站在梯级上，而梯级之间没有任何其他地方可落脚一样。在原子内部的电子所能拥有的能量也是这种情形。反过来说，希格斯海也像能量层级的弦梯。这架希格斯弦海原子能梯子的最低一个梯级为 $n = 1$ ，这时电子处于第一轨道弦，这就是最低能量的量子弦态。对氢原子来说，最低能量希格斯梯海能量层级态，称为“基态”，应该是 -13.6eV ，负号表示电子受到核希格斯海的束缚。如果电子占据着除 $n = 1$ 以外的任何其他轨道弦，那么这个原子就被称为处于“激发态”。这就是：

$$\lambda = M \quad (1-3-1)$$

$$\lambda = b [m^2 / (m^2 - n^2)] = b [m^2 / (m^2 - n^2)] \operatorname{tg} \theta = b [m^2 / (m^2 - n^2)] \operatorname{tg} 45^\circ \quad (1-3-2)$$

$$\lambda = b [m^2 / (m^2 - n^2)] = b [m^2 / (m^2 - n^2)] \operatorname{tg} 45^\circ = M \quad (1-3-3)$$

5) 现在如果物质族基本粒子质量谱计算公式，按基本粒子系质量 M 与原子系波长 λ 等价的巴尔末公式来计算，即让质量谱带上量子数多项式 $[m^2 / (m^2 - n^2)]$ ，公式应为：

$$M = G \operatorname{tg} N \theta + H = \lambda = b [m^2 / (m^2 - n^2)] \operatorname{tg} 45^\circ = G [m^2 / (m^2 - n^2)] \operatorname{tg} N \theta + H \quad (1-3-4)$$

$$M = G [m^2 / (m^2 - n^2)] \operatorname{tg} N \theta + H \quad (3)$$

3 个方程联立组合是： $M_1 = G [m_1^2 / (m_1^2 - n_1^2)] \operatorname{tg} N_1 \theta + H \quad (3-1)$

$$M_2 = G [m_2^2 / (m_2^2 - n_2^2)] \operatorname{tg} N_2 \theta + H \quad (3-2)$$

$$M_3 = G [m_3^2 / (m_3^2 - n_3^2)] \operatorname{tg} N_3 \theta + H \quad (3-3)$$

以上 (3-1、2、3) 中， $m_1=1, m_2=2, m_3=3; n_1=0, n_2=0, n_3=0$ ，所以它们具体为：

$$M_1 = G [1^2 / (1^2 - 0^2)] \operatorname{tg} \theta + H \quad (3-4)$$

$$M_2 = G [2^2 / (2^2 - 0^2)] \operatorname{tg} 2\theta + H \quad (3-5)$$

$$M_3 = G [3^2 / (3^2 - 0^2)] \operatorname{tg} 3\theta + H \quad (3-6)$$

以上 3 式中的 $[1^2 / (1^2 - 0^2)] = 1; [2^2 / (2^2 - 0^2)] = 1; [3^2 / (3^2 - 0^2)] = 1$ ，都等于 1，是一个值得探讨的有趣问题。其实它的道理是，如果把核式弦图质量起源的表叙面，硬要投影到巴尔末公式的波长的表叙面，质量谱被作为波长谱的一个新系列，那么它是量子数 n 的基态为 0 的特例，在 $\operatorname{tg} n 45^\circ$ 和 $\operatorname{tg} N_3 \theta$ 这两种正切函数同时存在的情况下是互不相容的。因为质量起源还有巴拿马运河船闸-马蹄形链式量子数轨道弦图（简称“链式弦图”），这在下节将解释，这里到此为止，但计算以上方程得出的是：

$$M_1 = G \operatorname{tg} \theta + H \quad (3-7)$$

$$M_2 = G \operatorname{tg} 2\theta + H \quad (3-8)$$

$$M_3 = G \operatorname{tg} 3\theta + H \quad (3-9)$$

可见以上 (3-7、8、9) 方程就是 (2-1) 方程 $M = G \operatorname{tg} N \theta + H$ 的具体计算形式。因为 (3-7、8、9) 方程是按基本粒子系质量 M 与原子系波长 λ 等价的巴尔末公式计算得来的， $M = G [m^2 / (m^2 - n^2)] \operatorname{tg} N \theta$ 与巴尔末公式 $\lambda = b [m^2 / (m^2 - n^2)] \operatorname{tg} \theta = b [m^2 / (m^2 - n^2)] \operatorname{tg} 45^\circ$ 等价，而 $\lambda = b [m^2 / (m^2 - n^2)] \operatorname{tg} 45^\circ$ 又与巴尔末公式 $\lambda = b [m^2 / (m^2 - n^2)]$ 等价，得证 $M = G \operatorname{tg} N \theta + H$ 与巴尔末公式 $\lambda = b [m^2 / (m^2 - n^2)]$ 等价。证毕。

二、希格斯海巴拿马运河船闸-马蹄形链式量子质量弦图

什么是希格斯海巴拿马运河船闸-马蹄形链式量子数轨道弦图？巴尔末多项式说明链式弦图型的 $M = G \operatorname{tg} \theta_n = G \operatorname{tg} (\theta \pm W^2)$ 的意义是什么？这是以下需要讨论的。

众所周知，自然界存在一些基本常量。仅在标准模型中，就有 28 个基本常量；它们在物理公式中属于耦合常数，是靠实验测得的。所以减少一个基本常量，都是科学的重大进步。而巴尔末公式为我们提供的，正是一种减少基本常量的方法和范例。因此如果仅说后来把所有光谱分成线系都是起源于巴尔末公式的发现，但这种评价巴尔末公式对原子光谱理论和量子物理的发展影响，还不够。

1、巴尔末公式常量 b 之谜

1) 在式 (1-3-1,2,3,4) 中，通过证明 $\lambda = M$ ，虽得出巴尔末公式与核式弦图质量谱公式有等价性，但在减少基本常量数方面后者没有可比性。例如，两组夸克系列，各组是 3 种夸克，而质量谱公式各组仍然需要 3 个未知的公共因子：即质量轨道模数 G 、质量轨道基角 θ 、质量模参数 H ，才计算得出来。质量谱公式减少基本常量数的方法，是要通过整个方程组来实现的。即使如此，质量谱计算公式减少基本常量数也还是有限。但巴尔末公式的减少基本常量数的量却很大，可以说在氢原子系列只需一个基本常量。这很令人羡慕。那么在夸克系列是否也只需一个基本常量？质量谱量子数多项式 $[m^2 / (m^2 - n^2)]$ 对应核式弦图是一些轨道圆，那么链式弦图的量子数多项式是怎样一种结构？作为生命起源与宇宙起源对应，著名的生殖整数数列也可以是量子数吗？

2) 作为核式弦图的勾股数量子化传奇，巴尔末和后来者们也许没有想到只需一个基本常量的秘密。这不奇怪，和我们一样，巴尔末本身的人生和公式的提出就已经够曲折。巴尔末是一个女子学校的数学老师，只是在贝塞尔大学兼职。由于他对数字游戏有兴趣，在大学兼职期间，该校一位研究光谱的物理学教授哈根拜希，鼓励他去找氢原子光谱的规律。因为埃斯特伦等人在 1850 年代已对氢光谱可见光区波段的 4 条谱线有精确测定；通过观测恒星光谱又发现紫外波段的 10 条谱线，然而它们波长的规律尚不为人所知。巴尔末从寻找可见光波段 4 条谱线波长的公共因子和比例系数入手，否定了将谱线类比声音的思路。快满 60 岁时，巴尔末才受投影几何的启发，利用几何图形为这些谱线的波长，确定了一个公共因子 $b = 364.56$ 纳米，写出了巴尔末公式。

巴尔末公式计算出的波长与埃斯特伦实际测量值符合得非常好，但埃斯特伦在 1874 年 59 岁已经去世。随后，巴尔末又继续推算出当时已发现的氢原子全部 14 条谱线的波长，结果也和实验值完全符合。1884 年 6 月 25 日，在贝塞尔自然科学协会的一次演讲中，巴尔末指出氢的光谱线的波长，可以由两个因数相乘而得到。同年又将其这个公式发表在当地一个刊物上，1885 年又刊载在《物理、化学纪要》杂志上。几年后，巴尔末又发表了有关氢光谱和锂光谱的各谱线频率之间的类似关系。

3) 前面我们验算过巴尔末的 $n=2$ 的四条可见区的氢原子光谱线。而巴尔末公式还表示过氢原子光谱的其他线系的波长值，我们还没有验算。根据核式弦图的勾股数量子化的秘密，我们在 (1-2) 式中推证得出所有的 $\lambda = b [m^2 / (m^2 - n^2)] \operatorname{tg} \theta = b [m^2 / (m^2 - n^2)] \operatorname{tg} 45^\circ = b (m^2 / n^2) = b (m/n)^2$ ，即只需一个基本常量，而不是巴尔末讲的需要基本常量

“两个因数相乘而得到”。谁更准确呢？我们来检验。

由于氢原子光谱还存在于紫外域和红外域，如莱曼系 $n=1$ 、帕邢系 $n=3$ 、布喇开系 $n=4$ 、芬德系 $n=5$ 、汉弗莱系 $n=7$...。但我们是库马尔《量子理论》一书 83 页图 7“能量层级，光谱线和量子跃迁”提供的数据定位在研究巴尔末公式。我们觉得，从原子系量子数轨道圆弦图和正切基角 $\theta=45^\circ$ 出发，虽然巴尔末公式 $\lambda=b[m^2/(m^2-n^2)]$ 中的 m 和 n ，是人为约定的简单的整数，但实际计算这些可见光系的四条光谱线的常量，只需一个 $b=364.56$ 纳米。巴尔末实在厉害，是他减少了 3 个测量数。

但不仅如此，如果巴尔末公式是我们讲的 $\lambda=b[m^2/(m^2-n^2)]\text{tgn}\theta = b[m^2/(m^2-n^2)]\text{tgn}45^\circ = b(m^2/n^2)$ ，那么通过把公式中的 n 约定为 $n=1,3,4$ 和 5 ，而让 m 轮番取不同的数值，就像巴尔末把 n 定为 $n=2$ 来产生 4 条最初已知的光谱线那样，也还能用一个常量，预测出氢原子在红外及紫外区域中存在着其他系列的光谱线。

4) 例如，当 $n=3$ ； $m=4,5$ 和 6 时，产生的红外线帕邢系列，我们的验算结果是：

$$m=4, \lambda=364.56[4^2/(4^2-3^2)]=833.28; \\ (1875, b=818.78)$$

$$m=5, \lambda=364.56[5^2/(5^2-3^2)]=569.63; \\ (1282, b=821.80)$$

$$m=6, \lambda=364.56[6^2/(6^2-3^2)]=486.10, \\ (1094, b=822.56)$$

$$\text{红外线帕邢系列弦统计平均实际 } b = \\ (821.80+821.80+822.56) \div 3 = 821.05$$

5) 当 $n=1$ ； $m=2,3,4,5$ 和 6 时，产生的紫外线莱曼系列，我们的验算结果是：

$$m=2, \lambda=364.56[2^2/(2^2-1^2)]=486.1; (122, \\ b=91.73;)$$

$$m=3, \lambda=364.56[3^2/(3^2-1^2)]=410; \\ (103, b=91.15;)$$

$$m=4, \lambda=364.56[4^2/(4^2-1^2)]=388.86; (97, \\ b=90.65;)$$

$$m=5, \lambda=364.56[5^2/(5^2-1^2)]=374.75; (95, \\ b=91.35;)$$

$$m=6, \lambda=364.56[6^2/(6^2-1^2)]=374.98; (94, \\ b=91.26;)$$

$$\text{紫外线弦统计平均实际 } b = \\ (91.73+91.15+90.65+91.35+91.26) \div 5 = 91.23$$

6) 以上 λ 计算式后的括弧内的第 1 个数据，是库马尔《量子理论》书中图 7 提供的。据此，我们分别求出每条光谱线的实际 b 值，以代换按巴尔末可见光系 b 不变的 $b=364.56$ 纳米值。我们再分别将红外和紫外系列每条光谱线中的 b 值作统计平均，求出以上统一的 b 值，这样 8 条光谱线，分别

只需 2 个实际的 b 值。可见光及红外和紫外系列共 12 条光谱线，分别只需 3 个实际的 b 值。

7) 其实由新巴尔末公式 $\lambda=b(m^2/n^2)$ 定位，这 12 条光谱线，只需 1 个实际的 b 值足够了。因为如果把可见光及红外和紫外系列的 3 个实际的 b 值，按紫外：可见光：红外的 b 值大小顺序求比例，其比值与它们之间的这个顺序编号 ($N=1,2,3$) 的平方相近。即： $91.23:364.56:821.05=1:4:9=1^2:2^2:3^2$ 。这是因原子系量子数轨道圆弦图属于一个 $\text{tgn}45^\circ$ 函数系列勾股数的道理。即如果把以上紫外、可见光和红外等光谱系列，看成是一个 $\text{tgn}45^\circ$ 函数统一体的原子系量子数船闸链式弦图的 3 代或 3 座码头，按编号大小顺序分别为 $N=1,2,3$ ，那么巴尔末公式的基本常量 b 值可扩充为：

$$b=fN^2 \quad (4)$$

即在氢原子光谱系列中，按紫外、可见光、红外的波长值大小顺序编号为 $N=1,2,3$ 的序列，那么只需 1 个实际的基本常量值就足够了。我们设这个新巴尔末常量符号为 f ，来代替原先的符号 b ， $f=91.23$ 纳米，那么新的 2013 年型的巴尔末公式为：

$$\lambda=fN^2[n^2/(n^2-m^2)]\text{tg}45^\circ=fN^2(n^2/m^2) \quad (1-4-1)$$

$$\lambda=fN^2(n^2/m^2)=fN^2(n/m)^2 \quad (1-4-2)$$

8) 这里的 f 、 N 、 m 、 n 等四个数，是一个“超对称体”，或“超对称群体”结构数。“超对称”体有两类，一类是空间从立方体到超立方体的扩倍；另一类是自旋从基角 θ 到周期的旋转。如把 N 、 m 和 n 等三个正整数量子数看成是长方体的三条边长， f 就是这个长方体的三条边长扩大的倍数，那么可见光及红外和紫外系列的光谱，就类似分属不同系列的一些“超对称”长方体。由此对应粒子的波长谱、质量谱、能量谱，可说明质量在原子系的元素和其同位素的多元化，在基本粒子系的粒子和其超伴子的超对称，以及物质是由大爆炸宇宙统一起源来的。那么还有没有自旋超对称体呢？

2、核式弦图与链式弦图之争

从验算巴尔末公式，使我们想到要再次验算物质族基本粒子质量谱计算公式。在 21 世纪前，我们能查到 6 种夸克质量的最理想数据是：上夸克 u 、粲夸克 c 、顶夸克 t 、下夸克 d 、奇夸克 s 和底夸克 b 等的质量分别为：约 0.03Gev、约 1.42Gev、约 174Gev、约 0.06Gev、约 0.196Gev 和约 4.295Gev 等。用 (3-7、8、9) 方程组来计算以上 6 类夸克，8 组 3 个方程联立求解 θ 、 G 和 H ，合理的排列组合是分四个系列。

计算十分繁难，不是每个系列的两组排列组合都合理，但最终得出的结果是：上夸克 u 、粲夸克 c 和顶夸克 t 是一组，与下夸克 d 、奇夸克 s 和底夸克 b 是另一组结合。由 $M_1=G\text{tg}\theta+H$ 、 $M_2=G\text{tg}2\theta+H$ 、 $M_3=G\text{tg}3\theta+H$ 等 3 个方程联立求解 θ 、

G 和 H, 由实验数据反求的结果, 第一组和第二组各自的 θ 、G 和 H 等基本常量值和验算分别是:

第一组的上、粲、顶夸克为: $\theta=29^\circ 52'$ 、 $G=1.22$ 、 $H=-0.671$

第二组的下、奇、底夸克为: $\theta=29^\circ 27'$ 、 $G=0.124$ 、 $H=-0.01$

上夸克 u: $M_1=Gtg\theta+H=1.22\times tg29^\circ 52'-0.671=0.03\text{Gev}$

粲夸克 c: $M_2=Gtg20+H=1.22\times tg59^\circ 44'-0.671=1.42\text{Gev}$

顶夸克 t: $M_3=Gtg30+H=1.22\times tg89^\circ 36'-0.671=174\text{Gev}$

下夸克 d: $M_1=Gtg\theta+H=0.124\times tg29^\circ 27'-0.01=0.06\text{Gev}$

奇夸克 s: $M_2=Gtg20+H=0.124\times tg58^\circ 54'-0.01=0.196\text{Gev}$

底夸克 b: $M_3=Gtg30+H=0.124\times tg88^\circ 21'-0.01=4.295\text{Gev}$

1) 以上 6 个夸克需要 θ 、G 和 H 两组 6 个基本常量, 一个没有少; 看来核式弦图质量谱公式起不到减少, 只勾股数边的分析作用。那么这个核式弦图是怎么回事呢?

作类似光谱线和量子跃迁的能级圆弦图, 作图的方法是: 用 X 轴和 Y 轴作平面直角坐标系, O 为坐标原点。设 $G=1$ 为半径作单位质量圆, $\angle n\theta$ 角的一边与圆交于 B 点, 过 B 点作质量圆的切线交于 X 轴的 C 点。再以 O 为圆心, OC 为半径作圆, 即为粒子对应的质量轨道。反之, 该轨道对应严格的质量轨道角, 它们各分成两组三代, 具有确定的值, 不能连续变化, 只能在确定值之间跳跃; 这种质量轨道角几乎三等分直角坐标系的第一象限角, 即与 30° 、 60° 、 90° 接近。与光谱线的勾股数相比, 这里 6 个夸克只有直角边 G, 设为单位圆一个常量可固定, 类似光谱线所属那个 $\text{tgn}45^\circ$ 函数。

另一条在切线上的直角边和它切割的弦长, 是跑动的。只有已知的代数 N 量子数才起到一点作用。即是说这里的 N、m 和 n 等三个正整数量子数没有形成“超对称”长方体, 要让它们起到减少基本常量作用, 只有让它们进入自旋超对称体。这时质量轨道基角 θ 作为“稳定态”, 处于最低能级, 成为夸克轨道弦上运动“基态” θ 的始态或终态。而作为夸克质量运动定态 M 的始态和终态, 它流落在正切函数表中的数值中, 成为夸克轨道弦上运动的“激发态”或“非稳定态”。

事情正是这样, 1996 年发表《物质族基本粒子质量谱计算公式》后的近 18 年中, 我们希望 6 种夸克的实验测量值趋于一个较相同的稳定, 但情况相反。例如我们搜集到三本专著: 2008 年 4 月出版的[英]安德鲁·华生的《量子夸克》(下称华著);

2010 年 7 月出版的陈蜀乔的《引力场及量子场的真空动力学图像》(下称陈著); 2012 年 4 月出版的[美]布赖斯·格林的《宇宙的结构》(下称格著), 提供的 6 种夸克, 上夸克 u、粲夸克 c、顶夸克 t、下夸克 d、奇夸克 s 和底夸克 b 等的质量分别是:

华著为: 约 0.004Gev、约 1.3Gev、约 174Gev、约 0.007Gev、约 0.135Gev 和约 4.2Gev 等(下称华生夸克质量)。陈著为: 2~8Mev、1.3~1.7Gev、137Gev、5~15Mev、100~300Mev、和 4.7~5.7Gev 约 4.2Gev 等(下称陈蜀乔夸克质量)。格著为: 0.0047Gev、1.6Gev、189Gev、0.0074Gev、0.16Gev 和 5.2Gev 等(下称格林夸克质量)。

我们采用 2012 年格林夸克质量数据为标准, 运用前面讲的排列组合四种系列和以上(3-7、8、9)方程, 分 8 组 3 个方程联立计算求解各组的 θ 、G 和 H。这 3 个方程 $M_1=Gtg\theta+H$ 、 $M_2=Gtg20+H$ 、 $M_3=Gtg30+H$ 联立, 但 8 组中 8 个夸克质量轨道连其基角 θ 也难得出合理的配对, 就更不说 G 和 H 了。其实这 18 年来我们没有停止过对质量谱计算公式的机制的研究。物质是宇宙的眼睛, 研究微观粒子没有弦图, 就没有科学。

2) 在这里要说明的是, 最先我们认为时空撕裂产生质量, 就分宇宙创生和一般的场相互作用力的两级撕裂。因为宇宙创生, 真空撕裂总是以轨道能级出现。而在一般的场相互作用中, 只起类似轨形面不平的摩擦撕裂效应; 如果达不到宇宙创生级的能量, 摩擦撕裂出的亚原子粒子, 不再是时空撕裂宇宙创生的轨形组合。

后来我们从希格斯场公式的基础是希格斯海“度规格子”出发, 把撕裂温和为“船闸”模型。希格斯海“度规格子”和类似长江三峡大坝的“船闸格子”或巴拿马运河的“船闸格子”是可以相通的。希格斯粒子类似希格斯海中的拖船、驳船或起重吊船、锚泊船。这样就出现了对称和超对称两类质量谱生存模具: 对称型是长江三峡大坝船闸模具, 船闸存在于长江中段; 超对称型是巴拿马运河船闸模具, 它类似运河两端进出有三座三级船闸, 围起巴拿马地峡的热带雨水, 形成一种高高的悬河, 河道可以双向通行, 让船只在其中来来往往, 好像一幅宇宙物质世界图景。

如果说巴拿马运河是人类在美洲大陆上的一次外科手术; 对巴拿马而言, 运河不是一条手术疤痕, 而是它最清晰的面孔, 那么宇宙大爆炸就是我们时空的一次自手术, 物质质量谱对时空而言也不是自手术的疤痕, 而是对人类认识宇宙最深沉的呼唤。

例如在标准模型, 存在 28 个基本常量。这是一个非常大的数字。因为基本常量是一个出现在自然定律中而且无法被计算的量, 只能通过实验来测

定。所以一直有不少人试图减少基本常量的数目，但迄今为止没有取得任何成功。物质族基本粒子质量谱计算公式，就是为减少基本常量的数目而作的最深沉的呼唤回应。因为 28 个基本常量中包括有电子、u 夸克和 d 夸克等稳定粒子的质量，和不稳定粒子由 w 和 z 玻色子，μ 和 τ 轻子、3 个中微子，4 个重夸克 s、c、b、t 等的质量以及携带的类似精细结构常数的自由参数、混合角和相位参量等，都要求人类给出。

质量谱计算公式 $M=GtgN\theta+H$ 运用“船闸”模型落差顺次模数、顺次基角、顺次参数等 14 个主要新参量来计算总共 61 种的夸克、轻子和规范玻色子的质量，虽然它们需要实验测量或设定，但这 14 个新参量的数目比 28 个基本常量中包括的稳定与不稳定夸克、轻子和规范玻色子的质量，以及它们携带的类似精细结构常数的自由参数、混合角和相位参量等的总目数少点，也就减少了 28 这个数字的总量。但是还比不赢巴尔末公式运用的勾股数，而像 1869 年俄国门捷列夫在编制化学元素周期表，得出元素原子量的大小有周期性的依赖规律一样，不是量子数的定量，只是定性。

关于运河两端进出有三座三级船闸的分代，日本小林诚和益川敏英基于卡比博的一次“分代”思想，也只是提出在强相互作用中存在三次“分代”的思想，但这也还不是我们的巴拿马运河船闸链式弦图类似巴尔末多项式勾股量子数 $(Nm)^2/(m^2-n^2)$ 的定量的意思，只是对此的一些定性的暗示。这里物质起源生成之难，难似过巴拿马船闸的受限。但坚持根据小林-益川理论和巴尔末多项式勾股数进行研究，分类排出物质族基本粒子质量谱量子数，也类似相应于巴拿马运河当局设计的那套复杂的规则。

3) 具体来说格林夸克质量给的 6 个夸克“船”，要过“船闸”，量子数分类弦图如果只留下一个基本常量，就只能是留给质量轨道基角 θ 。因为 6 个夸克的质量数据值，在正切函数表中都能查到，反求它们对应的质量轨道角度后，这是用通过实验确定 $\theta=?$ Gev 的方法。有了基角 θ 常量，通过“自旋超对称体”的 3 个量子数平衡调节基角 θ 的倍数，就能得知 6 个格林夸克质量。这里要说为正切函数和起平衡调节作用的“超对称体”3 个量子数的相互关系。实际不管是核式弦图还是链式弦图，都离不开它们，这是一种相辅相成的关系。在长方体或自旋周期的超对称体量子数确定的曲线，是轨道圆环；波长或质量的轨道角度正切函数确定的曲线，只能是直线或半个抛物形曲线。这两种轨迹线路的交点，才是具体粒子的波长或粒子的质量的实际分布。

以格林夸克质量为例，为了通过实验确定 θ 值，我们要把通过正切函数表中查到的 6 个夸克质量值对应的正切函数的角度，因它们是分别以角的度数和分数表示的，为了便于计算，就需要统一换算为角度的分数值。例如，0.0047Gev 上夸克 $u=15'$ ；0.0074Gev 下夸克 $d=17'$ ；0.16Gev 奇夸克 $s=545'$ ；5.2Gev 底夸克 $b=4747'$ ；1.6Gev 粲夸克 $c=3480'$ ；189Gev 顶夸克 $t=5381'$ 。现在我们直接用它们的角度的分数值表示 6 个夸克的质量值，用 X 轴和 Y 轴作平面直角坐标系的方法来表示格林夸克质量的超对称体的两种轨迹线路。X 轴和 Y 轴都同用角度的分数值的 1' 为单位“1”，这样作出整个 90° 内的正切函数确定的曲线，它是一条开口朝向 Y 轴正方向的半个抛物形曲线。再以格林夸克质量的 6 个自旋周期“超对称体”量子数平衡调节的质量值 15、17、545、4747、3480、5381 等，分别为半径，作质量轨道圆环弦线。

这时圆环弦线和正切函数半个抛物形曲线的交点，就是格林夸克质量的 6 个夸克在 X 轴和 Y 轴作平面直角坐标系中的具体位置。连接这 6 个点的轨迹，是一条带弯度的曲线，不是那种反映粒子波长勾股量子数的长立方体的对角线式的直线。但问题的难度却大大增加了，因为要重新设计不同于同心圆，而又能找到安排合理的量子数摆布的链式弦图，谈何容易？巴尔末公式的统一的 $tg45^\circ$ 的量子数多项式是：

$$N^2[m^2/(m^2-n^2)]tg45^\circ = N^2[m^2/n^2]tg45^\circ = N^2[(m/n)^2]tg45^\circ \quad (1-4-3)$$

其中量子数对应基态、稳定态、非稳定态、激发态、始态、终态的安排，在同心圆的弦图上都容易摆布；在众多光谱线系列也容易统一。但在链式弦图中却不相同。以格林夸克质量为例，要统一平衡调节质量值 15、17、545、4747、3480、5381 等的自旋周期“超对称体”量子数，不能用同心圆弦图，而以粒子费曼图和船闸巴拿马运河为蓝本，例如连接运河两端船闸的轨迹是直线；两端有船闸，是对称，也是超对称，也可是超对称破缺，但超对称破缺的量子数如何表达？设计出的超对称破缺的“船闸链”式弦图，虽然可以有多种，但如果运河和两端船闸的实体一旦修好，这是不能变更的，可以变的只能是码头的编码编号，即可动的只能是量子数，那么这些量子数如何分类和布局呢？要破解格林夸克质量谱存在一个常量的秘密，离不开分解多项式。

4) 下面是我们对格林夸克质量谱正切函数角度值分拆的多项式，它是有规律的：

$$\text{上夸克 } u: 15=15(1\times 1)+0\approx 15\times 6^0\times (1\times 1)+ (1\times 1)^2=16$$

$$\text{下夸克 } d: 17 = 15(1 \times 1) + 2 \approx 15 \times 6^0 \times (1 \times 2) - (1 \times 2)^2 = 26$$

$$\text{奇夸克 } s: 545 = 545(1 \times 1) + 0 \approx 15 \times 6^2 \times (1 \times 1) + (1 \times 2)^2 \approx 544$$

$$\text{粲夸克 } c: 3480 = 545 \times (3 \times 2) + 210 \approx 15 \times 6^2 \times (2 \times 3) + (4 \times 4)^2 \approx 3496$$

$$\text{底夸克 } b: 4747 = 545 \times (3 \times 3) - 158 \approx 15 \times 6^2 \times (3 \times 3) - (3 \times 4)^2 \approx 4716$$

$$\text{顶夸克 } t: 5382 = 545 \times (2 \times 5) - 477 \approx 15 \times 6^2 \times (2 \times 5) - (2 \times 2)^2 \approx 5384$$

3、向链式弦图进军

以上各式中后面的两对乘积多项式，是否有和巴耳末公式的量子数多项式相似的规律？我们按有规律相似的情况配对，这类航道归口及量子数有多种。以下就是对格林夸克质量谱中 6 个夸克质量值，分解成的含有量子数字的多项式：

$$(15-6-0-1-1-1-1) \text{ 上夸克 } u = 15 \times 6^0 \times (1 \times 1) + (1 \times 1)^2 \quad (4-1)$$

$$(15-6-0-1-2-1-2) \text{ 下夸克 } d = 15 \times 6^0 \times (1 \times 2) - (1 \times 2)^2 \quad (4-2)$$

$$(15-6-2-1-1-1-2) \text{ 奇夸克 } s = 15 \times 6^2 \times (1 \times 1) + (1 \times 2)^2 \quad (4-3)$$

$$(15-6-2-2-5-2-2) \text{ 顶夸克 } t = 15 \times 6^2 \times (2 \times 5) - (2 \times 2)^2 \quad (4-4)$$

$$(15-6-2-2-3-4-4) \text{ 粲夸克 } c = 15 \times 6^2 \times (2 \times 3) + (4 \times 4)^2 \quad (4-5)$$

$$(15-6-2-3-3-3-4) \text{ 底夸克 } b = 15 \times 6^2 \times (3 \times 3) - (3 \times 4)^2 \quad (4-6)$$

以上分拆的 6 个式中的数字，有很强的全息性。如上式前面括号内的那些量子数字，类比玻尔的量子能级理论，类比巴耳末公式中的常量 f 和量子数字 N 、 m 、 n 等四个数，马蹄形链式弦图中的常量和量子数字的意义是什么呢？首先“15”作为质量轨道圆弧基角 θ 这个共同的常量数角度分数，能确定下来，即 $\theta = 15'$ 。第二，“6”作为粒子夸克的共同数目类似一个繁殖系数，能确定下来。那么剩下的代表的量子数符号的什么意义呢？如含有的“0”，是否类似粒子质量谱的基态或终态？而且只有选择合理的马蹄形链式弦图，它们的位置才会恰当地出现在质量谱量子数多项式中；这类正整数数值链，自然界中有没有同它们类似的现象？这使我们想到著名的斐波那契生殖数列的组合排列。

1) 1228 年意大利数学家斐波那契在修订的《算盘书》中增加了一道兔子繁殖问题：假如兔子生下后的第二个月便有生殖能力，且每对兔子每月恰好生一对小兔(一雌一雄)的话，那么今有一对小兔，按上面所说的情况繁殖，问一年后将有多少对兔子？即斐波那契从兔子繁殖问题中提出了一个数

列：1、1、2、3、5、8……，从第三个数开始，每个数都是前两个数的和，继续推理下去仍是如此。

这一奇特的数列，也出现在其他很多地方，而称为斐波那契数列。斐波那契数列发人深省，这类问题的本质是有两类兔子：一类是能生殖的兔子，称为成年兔子。新生的兔子不能生殖；新生兔子一个月就长成成年兔子。求的是成年兔子与新生兔子的总和。每月新生兔对数等于上月成年兔对数。每月成年兔对数等于上个月成年兔对数与新生兔对数之和。斐波那契数列的性质其中有：相邻的斐波那契数之平方和(差)仍为斐波那契数；对连续的斐波那契数，首尾两项之积，与中间项平方之差为 1 等。

格林夸克质量对称破缺的巴拿马运河船闸-马蹄形链式弦图的摆布，和链式轨道弦图量子数多项式摆布的性质，就是以上 6 个格林夸克质量谱正切函数角度值分拆的多项式反映的性质。它们是否也类似斐波那契数列在其它地方的应用，如①花瓣数中的斐波那契数、②向日葵花盘内葵花子排列的螺旋线数？

向日葵花盘内，种子是按对数螺旋线排列的，有顺时针转和逆时针转的两组对数螺旋线。两组螺旋线的条数往往成相继的两个斐波那契数。1993 年才给出的解释是：这是植物生长的动力学特性造成的；相邻器官原基之间的夹角是黄金角----137.50776 度；这使种子的堆集效率达到最高。那么对应马蹄形链费曼图式的基态、稳定态、非稳定态、激发态、始态、终态等类似概念的量子数安排，通过此类大量弦图的分析会发现，存在微妙的“波浪”规律。众所周知，分析计算光谱线波长量子数多项式，是离不开弦图的；同样，要分析计算质量谱，求证合理的量子数多项式，也是离不开弦图。

2) 但符号编码的复杂性和数字计算的复杂性，还在于具体到每个夸克的计数时，因为在链式弦图的所在位置都不一样，需要确定唯一的链式弦图。我们给出的是不管蹄口左右向平行摆放，还是蹄口上下向竖直摆放，摆放形式不类似而又能合理的马蹄形链，整体如全息式“U”型的分形图示。以马蹄形磁铁蹄口向下摆放为例，是以三个大小不同的马蹄形磁铁蹄口向下的重叠摆放，但又稍有变化。

如将上夸克 u_{15} 和下夸克 d_{17} 构成的一个小马蹄形，称为 1 号马蹄形；蹄口向下摆放，作为整体“U”型的一边磁极。而作为马蹄形全息的再延伸，是将称为 2 号马蹄形的奇夸克 s_{545} 与顶夸克 t_{5381} 构成的一个最大的马蹄形，和称为 3 号马蹄形的粲夸克 c_{3480} 与底夸克 b_{4747} 组成的另一个次大的马蹄形，两者蹄口向下并重叠起来，再把它们各自下端一边的磁极，如奇夸克 s_{545} 和粲夸克 c_{3480} 连接到 1 号马蹄形的弯背处，作为整体“U”型另一边

的磁极。整体“U”型另一边的磁极，是底夸克 b4747 在内，顶夸克 t5381 在外的平行摆放。所以属于整体“U”型，上夸克 u15、下夸克 d17、奇夸克 s545 和粲夸克 c3480 等是同为一极，设其大极量子数的编码符号为的 m，这 4 个是同起 m=1；而底夸克 b4747 和顶夸克 t5381 作为大极的另一极，是同起 m=2。

其次，整体“U”型类似双航道，按质量大小从开端到终端，是分成三级码头层级，设其层级量子数的编码符号为的 n，上夸克 u15 和下夸克 d17 属于开端层级，是同起 n=1；奇夸克 s545 和粲夸克 c3480 是同起连接到 1 号马蹄形的弯背处，属于中间层级，是同起 n=2；底夸克 b4747 和顶夸克 t5381 属于终端层级，是同起 n=3。而在这三个层级的各自两个夸克由于所属位置有内外之分，上夸克 u15、奇夸克 s545 和顶夸克 t5381 等，是同起属于在整体“U”型的外层，同起 m=1；下夸克 d17、粲夸克 c3480 和底夸克 b4747 等，是同起属于在整体“U”型的内层，同起 m=2。等等，可见一种夸克的量子数不是不变的，而且可以是相同或不相同。

另外为了便于量子数计量，还可以将此“U”型全息式分形图，变换为“X”型的直线交叉式简图。“X”的交叉点包含奇夸克 s545 和粲夸克 c3480，其外的四端分别是上夸克 u15、下夸克 d17、底夸克 b4747、顶夸克 t5381 组成。设这种不连接的端点，其量子数的编码符号为 n，按质量大小它们分别 n=1、2、3、4。而将这 4 个端点和“X”中间的交点，归属极点或码头，设其量子数的编码符号为 m，按质量大小和码头层级，中间交点的奇夸克 s545 和粲夸克 c3480 的 m 同起 m=3；而前面那四端不连接的端点的 4 个夸克又分别为 m=1、2、4、5。可见在这里同一个夸克的量子数也不是不变的。

除此之外，马蹄形下端底连接到马蹄形的弯背处的，属于到站码。另外在弦图中，每个马蹄形除了本极的码号数字外，还有大小走向的来源问题；如有出现大于本极的码号数字的计量，就是本极的码号数字加上了来源那极的码号数字，所以作为单独的航道编号编码，这也是多项式中同一个夸克的量子数值变大的原因。

3) 这里再来说以上多项式指数中的 0 和 2，这类似两类兔子：新生的兔子不能生殖，类似指数“0”；能生殖的兔子类似指数“2”。1 号马蹄形是类似“新生的兔子”，0 在宇宙大爆炸时类似“有生于无”。从 2 号马蹄形和 3 号马蹄形开始，都类似“成年兔子”。我们把这种类似的生殖系数的量子数，设它的编码符号为 f， $f=6^2$ 或 6^0 。

其次，以上 (4-1、2、3、4、5、6) 等 6 式中，(1×1) 和 (1×1)、(1×2) 和 (1×2)、(1×1) 和 (1×2)、(2×5) 和 (2×2)、(2×3) 和 (4×4)、

(3×3) 和 (3×4) 等，各个配对中里的第一项，如 (1×1)、(1×2)、(1×1)、(2×5)、(2×3)、(3×3) 等 6 项里的组合，称为首部量子数，设编码符号为 S，再设 $S=n \times m$ 。其次，6 式中各个配对里的第二项，如 (1×1)、(1×2)、(1×2)、(2×2)、(4×4)、(3×4) 等，称为尾部量子数，设编码符号为 W，再 $W=m \times n$ 。这里 S 和 W 中的那些数字，不全是单纯的编码号数。作为整体马蹄形的两极，由于航道多少是对称破缺的，但作为类似单独航道的夸克，仍然是按两边各自质量的大小编号编码的。此类 n=1、2、3、4，和 m=1、2、3、4、5。因此如设 $S=nm$ ， $W=mn$ ，由此在大多数时候， $S \neq W$ ，但少数时也可 $S=W$ ，这也是以上 6 式配对的来历。

4) 总结以上全部的研究和分析，现在我们可以得出新量子数质量谱公式的格林夸克质量谱中，对应的正切函数的角度 $\angle \theta_n$ 的分数值 θ_n 公式： $\theta_n = \theta f S \pm W^2$ (5)

(5) 式中 $\theta=15'$ ，称为质量基角。f 称为质量繁殖量子数， $f=6^2$ 或 6^0 。S 称为首部量子数，W 称为尾部量子数； $S=n \times m$ ， $W=m \times n$ ，但大多数时候 $S \neq W$ ，少数时也可 $S=W$ ；其中 m=1、2、3、4、5，n=1、2、3、4。由此格林夸克质量谱公式为： $M = G t g \theta_n = G t g (\theta f S \pm W^2)$ (6)

由于 $G=1 \text{Gev}$ ，上式可写为 $M = t g (\theta f S \pm W^2)$ 。我们可以向世界宣布，新量子数质量谱公式只需要用一个质量基角常量 $\theta=15'$ ，就可以求出格林夸克质量谱中的 6 个夸克质量值。设 G 为质量单位符号， $G=1 \text{Gev}$ ，下面是我们的验算：

上夸克 u: $M_1 = G t g (\theta f S \pm W^2) = t g \theta_1 = t g 16' = t g 0^\circ 16' = 0.0046 \text{Gev}$

下夸克 d: $M_2 = G t g (\theta f S \pm W^2) = t g \theta_2 = t g 26' = t g 0^\circ 26' = 0.0076 \text{Gev}$

奇夸克 s: $M_3 = G t g (\theta f S \pm W^2) = t g \theta_3 = t g 544' = t g 9^\circ 4' = 0.16 \text{Gev}$

粲夸克 c: $M_4 = G t g (\theta f S \pm W^2) = t g \theta_4 = t g 3495' = t g 58^\circ 15' = 1.6 \text{Gev}$

底夸克 b: $M_5 = G t g (\theta f S \pm W^2) = t g \theta_5 = t g 4716' = t g 78^\circ 36' = 5.0 \text{Gev}$

顶夸克 t: $M_6 = G t g (\theta f S \pm W^2) = t g \theta_6 = t g 5384' = t g 89^\circ 44' = 202 \text{Gev}$

三、玻尔对巴尔末公式再发现是必需转向量子弦论

1、2012 年是粒子物理迎来革命的转折之年。科学是一种类似手术和自手术的现象。人类做工程、做实验，是对自然的一种手术或其他手术行为。而自然本身的大风暴、大地震，微观粒子的衰变、嬗变等现象，则类似自然自身的自手术行为。其次，人类头脑对归类收集到的工程、实验、自然现象等

信息,进行分析、计算、设计、预测等理论指导,也类似一种自手术行为。

从科学是一种手术和自手术现象的意义上说,2012年是一个转折之年:欧核中心(CERN)的大型强子对撞机(LHC)测“上帝粒子”,大亚湾测中微子,北京等地环保测PM2.5粒子,等等,前两者是非常之不容易。作为科学是一种手术和自手术,如何快速、低廉、准确地测量基本粒子?LHC的“手术”更是不容易。

2012年7月,欧核中心发布LHC的两个实验合作组CMS(超环面仪器)和ATLAS(紧凑缪子线圈),分别发现了质量为 $125.3\pm 0.6\text{GeV}\sim 126.5\text{GeV}$ 的疑似希格斯玻色子或称“上帝粒子”的新粒子。但在2012年11月有环球网报道,据来自LHC底夸克探测器(LHCb)的实验物理学家说,现在还不能对该现象进行反驳,但也无法进一步支持。还说在LHC紧凑 μ 子线圈工作的物理学家多里戈讲:在此之前与实验观测较为相符的超对称理论,很好地解释了标准模型框架下亚原子粒子的行为,但新粒子的发现,因对超对称理论构成打击,被受到质疑。可见对LHC的“自手术”也不容易。

而且反相反量群体中有人还说,LHC的粒子相撞,就像打碎瓦片,除瓦片碎片,没有原子,没有分子,什么也没有一样,LHC的方法不对。又有人说,门捷列夫周期表是错的,对元素 >18 核外电子排列按周期性排列是跳跃式排列,元素没有周期性。

与以上“自手术”观点不同,我们认为2012年欧核中心LHC既发现了上帝粒子又发现了超对称!为什么?高能粒子对撞是一个特殊的研究对象。LHC不是像打碎瓦片一样,LHC作为是一种手术与自手术行为,有严密的规律和要求,如LHC的粒子相撞是沿着从卢瑟福的“原子对撞机”就开始继承,并一直延续下来的。从卢瑟福到LHC实验的辐射粒子相撞,都是自然粒子自身有衰变的“自手术”,人类才能对此自然物质进行手术。在LHC的世界里,粒子对撞都处于激发态,它们质量谱如何分布?

对卢瑟福“原子对撞机”实验的辐射粒子相撞的手术现象,玻尔在“自手术”中提出了“核式弦图”,说明了有巴尔末公式类似的量子勾股数的规律。在上世纪60年代以前,中国历史上没有西方式大型粒子对撞机的手术与自手术行为,但中华民族的科科学也没有离开是一种手术和自手术的现象,而且类似的“核式弦图”的勾股数的规律,即中国“商高定理”比西方的“毕达哥拉斯定理”的发现,早得多。即中国“弦图”比西方的“弦图”早得多。没有大型粒子对撞机类似的手术与自手术,中华民族历史上,

除依靠实用的工程技术和实验的实践外,还主要是对自然全息现象的重视。

1)中科院高能研究所所长王贻芳教授对《中国科学报》采访他的记者吴益超说:“国外的科研环境和体系要比中国成熟得多,中国的体系不是自己长出来的,是学来的,硬生生地嫁接到中国的人文社会环境中,自然就会变异,发生一些显然有违科学本意的事。这一点,我们只能通过长期的努力去改变,使得我们的科研体系和科学思想更深入人心”。王贻芳教授讲的“深入人心”,就是要懂得科学是手术与自手术。

2)我们研究统一基本粒子系和原子系弦学之桥的目的,是因为巴尔末公式已为我们提供了一种减少基本常量的重要方法,学基因测序也要在向快速、低廉、准确地测量基本粒子进军;因为联系弦图,我国已有3070多年的历史。所以说,作为科学是一种手术和自手术的现象,在中国民间即使科研环境和体系不够成熟,但也不一定是硬生生地从国外嫁接到中国的民间社会环境中的。中国研究统一基本粒子系和原子系弦学之桥的体系,是自己长出来的,当然也有学来的。这一点,其实在我国也有基础。

3)问题的尖锐性还在于,弦论、弦学、弦图,在国外的科研环境和体系中,已发展成了一种统一的科学理论。即使在国内,怀疑的人更多,但反对科学是一种手术和自手术,其行为无异乎是一种科学的自杀。其实辩证地看,这类“自杀”也是一类“自手术”,是目前中国科学手术和自手术另一面的荣誉与尊严。例如,“弦图”一词,中国最早已经出现在公元3世纪三国时期的赵爽,作“勾股圆方图”注释《周髀算经》一书中。而《周髀算经》卷上,又最早记载西周开国时期,周公与大夫商高讨论勾股测量对话,就提到勾股定理的特例。可见“弦图”用于工程测量,这本身就一种手术与自手术行为,在西周开国时期的统治者和贵族也很重视。

4)但无可讳言,科学作为一种手术与自手术,后来在中国的科研环境和体系中没有深入人心。典型的就中医的内科强于外科;西医强于中医,也是外科强于中医。虽然三国时是中医的华佗,有对他刮骨疗伤、开颅止痛手术功夫的传说,但照当时的普通条件去实践,检验还不行。现代西医外科强于中医,这已是铁的事实。所以王贻芳所长说的,作为手术与自手术的科学体系,近代是硬生生地嫁接到中国的人文社会环境中,不是自己长出来的,也是有事实根据的。19世纪末20世纪初,人类开始走进微观世界,国外的科研环境和体系中提出了许多关于原子机构的模型,都来自卢瑟福的“原子对撞机”类似手术的实验,以及玻尔的“自手术”类

似其粒子是连续和不连续运动的弦路进行的。中国能成为弦论、弦学、弦图的世界大国、强国吗？

我们认为,此路只有一条,中国也要一心一意,挖空心思打造弦论。

2、学习玻尔挖空心思打造弦论

中国科学的自强,当然只能依靠我们自己。如果这条道路是沿着3070多年前开辟的实用弦图,打造实用弦论,这像基因测序的美国基因学家文特尔,创立塞莱拉基因公司开发霰弹枪法测序新技术,单挑“国际人类基因组计划”,追上多国合作小组一样,我们也能单挑LHC既测上帝粒子又测超对称!这行吗?我们来看玻尔的成功。

重庆出版集团出版库马尔的《量子理论》一书中说:当年类似搞LHC测粒子的卢瑟福,是玻尔的导师。1913年青年的玻尔,没有完全按照导师卢瑟福的“原子对撞机”类似的实验及其粒子是连续运动的弦路前进,而是标新立异,搞量子弦原子类似的把围绕轨道弦旋转的电子的角动量量子化,使核原子稳定了下来。

众所周知,人们做礼炮烟花烟火早就知道:明火的颜色与蒸发的金属有关:明黄色的是钠,深红色的是锂,紫色的是钾;每个元素都有自己独一无二的一组光谱线,在光谱中有固定的位置。每一种特定元素的原子所产生的光谱线的数量、间隔和波长都是独一无二的,像光的指纹一样可以用来指认这一元素。所以玻尔一看到巴尔末的公式后立刻就明白:这是电子在不同的允许轨道之间跃迁,从而导致原子释放出这些光谱线。由玻尔的理论发展而来的现代量子物理学认为,原子的可能状态是不连续的,因此各状态对应能量也是不连续的。这些能量值就是能级。

1) 卢瑟福的核式模型,能很好地解释自己的实验现象,因而得到许多人的支持;但是该模型与经典的电磁理论有着深刻的矛盾。按经典电磁理论,电子绕核转动具有加速度,加速运动着的电荷(电子)要向周围空间辐射电磁波,电磁波频率等于电子绕核旋转的频率,随着不断地向外辐射能量,原子系统的能量逐渐减少,电子运动的轨道半径也越来越小,绕核旋转的频率连续增大,电子辐射的电磁波频率也在连续地变化,因而所呈现的光谱应为连续光谱。

由于电子绕核运动时不断向外辐射电磁波,电子能量不断减少,电子将沿螺旋形轨迹逐渐接近原子核,最后落于核上,这样,原子应是一个不稳定系统。实验事实:原子具有高度的稳定性,即使受到外界干扰,也很不易改变原子的属性;且氢原子所发出的光谱为线状光谱,与经典电磁理论得出的结论完全不同。

2) 原子核的能级,是原子核所处的各种能量状态。它们直接反映核子间的相互作用以及原子核多体系统的运动规律。目前对于核能级的性质已有了一定的理解,特别是对低激发能级的性质已有了一定的理解。能级的标定:原子核能级的性质决定于核子间的相互作用,后者主要包括强相互作用(即核力)及电磁相互作用。在一个多体系统中,粒子间的相互作用所具有的不变性,能为这个多体系统提供了好的量子数。

由于核力和电磁力都具有转动不变性及空间反射不变性,所以角动量 I 和宇称 π 都是原子核的好量子数(即守恒量子数),它们是除能量以外标定能级的最基本的量子数。此外,核力还较好地满足同位旋空间转动不变性,但电磁力不具有这种不变性。所以在后者所起的作用不大的情况下,例如在轻核中,同位旋 T 仍是一个近似的好量子数,用它来标定能级是有意义的。能级的激发性质从原子核的衰变、反应性质和核结构理论可判定某一能级的激发性质。典型的激发有两类:一类是单粒子激发,如奇核子从一个单粒子态跃迁到另一个单粒子态。另一类是集体性质的激发,它是由许多单核子激发的相干叠加而成的激发。

玻尔在1913年提出了自己的原子结构假说,认为围绕原子核运动的电子轨道半径只能取某些分立的数值,这种现象叫轨道弦的量子化,不同的轨道弦对应着不同的状态,在这些状态中,尽管电子在做高速运动,但不向外辐射能量,因而这些状态是稳定的。原子在不同的状态下有着不同的能量,所以原子的能量也是量子化的。

在正常状态下,原子处于最低能级,电子在离核最近的轨道弦上运动的定态称为基态;原子吸收能量后从基态跃迁到较高能级,电子在较远的轨道上运动的定态称为激发态。一群氢原子处于量子数为 n 的激发态时,可能辐射出的光谱线条数为: $N = n(n-1)/2$;辐射出的光的频率 ν 由 $h\nu = E$ 决定,其中 h 为普朗克常量。

3) 但是探测器中捕获的撞击、散射、交换、吸引、排斥、衰变、嬗变和湮灭的基本粒子或粒子碎片粒子的质量谱,与粒子波动的光谱线系列的波长谱是相同的吗?也许玻尔他们当时给出的科学创建和发展,是分波动面或动量(或粒子质量)面进行的。这类似从两种角度 θ 摆置的同样弦图。

例如先说太阳系的弦图,这类似是无穷大 ∞ ,难以看清摆置的是椭圆面、双曲面、抛物面还是平面,就不去说它。这也类似相对原子系的波动面的角度 θ 的三角函数值系数为1,质量面的角度 θ 的三角函数值是0;但波动面的波长和动量面的质量则有对应性。这里有称为“三旋理论”新弦学的实践,其量子数质量谱公式也称“物质族基本粒子质

量谱计算公式”。库马尔《量子理论》书中的巴尔末公式和玻尔对巴尔末公式转向量子弦论的再发现分析，可对比《三旋理论初探》、《求衡论---庞加莱猜想应用》两书。后者也得到了一种类似的结论：决定一个粒子在三旋规范夸克立方周期编码全表中的位置的是基本粒子量子数的弦数，而不是基本粒子的质量（能量或希格斯场）。量子数与量子弦性质相同，普朗克常数是量子弦的单位。这样原子系中的放射性元素，对应等价基本粒子系的超对称粒子现象就不足为怪；在当时的条件下，门捷列夫周期表的认识，就像初期物质族基本粒子质量谱公式一样。

4) 如果把巴尔末公式 $\lambda = b[m^2/(m^2 - n^2)]$ 中 m 和 n 看成链式量子数，那么 m 和 n 为何物？如果一个具体的基本粒子的量子弦数，是由三旋规范夸克立方周期编码全表中的位置，即就是它的基本粒子量子数决定的，而不是它的希格斯场的质量在作决定，那么这不也类似门捷列夫元素周期表中原子系的放射性同位素模式。这里 m 和 n ，就类似三旋规范夸克立方周期编码全表中激发态分类的代数的起点和终点位置。

如果说这也是受玻尔对巴尔末公式必需转向量子弦论的再发现分析的启发，那么玻尔确实也是在有意忽略卢瑟福的核式模型的原子核从旁经过的阿尔法粒子的任何影响，而把注意力集中在原子的电子量子弦数上。对应 LHC 中的质子对撞所产生的粒子能量，如何办？是否也应由它和夸克中的量子弦基本振动模式所代替？

5) 现在来看 LHC 测粒子中有没有局限性？我们认为，对 LHC 所产生粒子和它们的量子弦进行思考，注意的是解释质子粒子是如何与夸克中量子弦进行互动的理论，才会揭示测量 LHC 中粒子产生的真实结构，把 LHC 中产生的基本粒子分析转变到对量子弦式粒子的分析：所有粒子都是振动的基本模式决定，而不是粒子连续释放的。这种超弦说法，超越被奉为经典的标准模型的领域，架构了

波动面的波长和动量面的质量有对应性和等量性，是连接了巴尔末公式和新量子数质量谱公式之桥；因为这很清楚，LHC 是以某种方式受到量子弦论的调节。

巴尔末公式 $\lambda = b[m^2/(m^2 - n^2)]$ 中， m 代表电子跃迁从激发态起点的轨道弦层圈的编号， n 代表电子激发态跃迁到落脚点的轨道弦层圈的编号。所以埃斯特伦发现并测量和分别取名为阿尔法、贝塔、伽马和德尔塔的四条光谱线，并不是元素原子的核外希格斯海能量层级轨道环圈的弦线，而是粒子激发态跃迁那段看不到的间断时空中的希格斯海能量弦的振动或波动。弦论使波粒二象性统一，光谱线使虚拟的弦模型得以间接的实在验证。所以玻尔挖空心思打造弦论，被卢瑟福说成：他们一起导演的量子弦化的原子，是思维对物质取得的一次胜利。

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The Commitment of Saudi Commercial Banks With the Requirements of the Internal Control Over E-Commerce Activities (From External Auditor Perspective)

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Abstract: This study aims to inspect the Commitment of internal audit units in the Saudi Commercial Banks with the control requirements on e-commerce activities, including **administrative** and legal requirements and the requirements of security, protection and technological requirements. Researchers have adopted on specialized literature review pertaining to accounting and e-business to formulate the conceptual framework. The data were collected through a questionnaire designed for this purpose and distributed to external audit offices to review Saudi commercial banks. The researchers distributed 50 copies; however there were 45 copies received and valid for analysis. Researchers have found a statistically significant relationship between internal control requirements in terms of administrative and technological requirements and the requirements of security, protection, and compliance with control over electronic commerce activities. Moreover, legislative and legal requirements for e-commerce activities in the Saudi commercial banks are still inadequate and there is no obligation to those requirements where you need those laws to keep pace with rapid developments in the area of electronic business development. In the light of the conclusions of the study, the researchers recommended that Saudi banks to develop regulatory systems to keep pace with the rapid developments in information technology and miscellaneous uses in banking industry, legal, structural and technical requirements of security and protection for electronic commerce activities.

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Key words: Internal control requirements, E-commerce, Legislative requirements control, The requirements of protection and security control, Technological requirements control, Administrative requirements control.

1. Introduction

The spread of electronic commerce and its practice by enterprises and entrepreneurs impose a set of challenges to internal and external audits in a similar way. Especially when the business risks resulting from exercise were taking into account as well as to strengthen confidence in the systems and methods, websites, Particularly since the belief in the idea of security of websites devoted to the exchange of information related to e-commerce is still surrounded by uncertainty and fear of inadequate security precautions designed to protect data across the Web, where it often may not match the internal control systems and security procedures followed in these facilities and developments in the area of electronic commerce. This Make auditors face significant challenges relating to development audit procedures when dealing with these changes, to allay these fears, (International Federation Of Accountants) issued statement No.9 (1013), on the impact of electronic commerce on the audit of the financial statements, which focused on the level of scientific knowledge to the references, and know-how, and risks of the customer, internal control and security considerations.

1.1 The problem of the study:

This study attempted to measure the compatibility of internal control systems currently applied in Saudi banks with internal control requirements on e-commerce activities from the viewpoint of the external auditor. It aims to answer the following questions (from the viewpoint of the external auditor):

1. To What extent do SCB be obliged to the legislative requirements for the control of electronic commerce activities?
2. To What extent do SCB be obliged to protection and security requirements for the control of electronic commerce activities?
3. What is extent of the obligation of SCB to the technological requirements for the control of electronic commerce activities?
4. What is extent of the obligation of SCB to the administrative requirements for the control of e-commerce activities?

1.2 Objectives of the study:

The aim of this study is to review the internal control requirements on e-commerce activities including: (legislative requirements and the requirements of the protection, security and

technological requirements and administrative requirements) and measuring the commitment of Saudi commercial banks.

1.3 The significance of the study:

This study is thought to be significant due to the following:

1. Description of the basic requirements for internal control over e-commerce activities and commitment of Saudi commercial banks from the viewpoint of the external auditor.
2. Description of the role of the external auditor in the control process on the work of the internal auditor regarding the electronic activities within commercial banks to ensure neutrality and independence.
3. Emphasizing the need for all control requirements for internal references to e-commerce activities such as requirements for protection and security and legislative requirements, technological and administrative requirements.

1.4 Hypotheses of the study:

This study seeks to test the following hypotheses:

1. SCBs do not comply with the legislative requirements for the control of ecommerce activities.
2. SCBs do not comply with the requirements of protection and security for ecommerce activities control.
3. SCBs do not comply with the technological requirements for controlling the ecommerce activities.
4. SCBs do not comply with the administrative requirements to control over ecommerce activities.

2. Literature Review "theoretical framework":

Due to the continuing evolution in the concept of business and internal control concepts, many terms have emerged that must be completely understood and discriminated because it is associated with a research theme. In this regard the researchers provide the following procedural definitions of concepts:

1. E-business: This concept was first introduced by IBM in 1977 to distinguish between e-business and e-commerce activities. IBM recognized e-business as an integrated and flexible access for distributing business value through distinctive link systems operations conducted through core business activities in a simplified and flexible using Internet technology (Amour, Daniel 2000). The concept of e-business using online techniques work and networks to develop existing business activities or to create

a new default business activities (2000 Greenstein and Marilyn Fein man).

2. E-commerce :The concept of ecommerce ad defined by Information Systems Auditing & Control Association (ISACA) indicate any trade done electronically between organization and clients, suppliers or common people who use internet service for this purpose)" (B to C) E-commerce Reviews 2003.
3. Internal control: A series of methods, procedures adopted by administration to exploit the supplies of banks adequately to protect against misuse, assuring accuracy and integrity of accounting entries. It includes four requirements — (the requirements of protection and security, legislative requirements, technological requirements, and administrative requirements). The international statement auditing ISA No. 1008 in paragraph (5) said: "internal control based on computer processing that help to achieve the overall objectives of internal control, both on manual procedures or procedures designed software and its impact on the environment of electronic information systems in the Organization (General controls) or affect certain control on accounting applications (application control). The above means that controls is divided into three main types: General controls, applied controls, end user controls (Mahmoud Anbar 2003). The study released by the Committee of the information technology Information of International Federation of Accountants Committee(IFAC) in February 2002 entitled E-Business and the Accountant indicating risks of information technology environment include:
 - a. Infrastructure Risk and inadequate procedures pertaining to security of information technology infrastructure.
 - b. Inadequate security procedures to prevent natural illegal access to sources of information.
 - c. Risks of inadequate information technology applications and processing controls input and output designed on applications of information technology), IFAC ITC, 2002).
4. Electronic Data Exchange: It is the process of transferring data to and from the information system of electronic methods using the technology linkage between various electronic units.
5. Internet: a global information network associated with the use of computers on a broad level, where the user is provided by a

great deal of information on all topics and fields.

6. Encryption: the process of encoding data in order to prevent people from looking at it without authority by using many complex codes that are hard to decode only through special programs.
7. Access to the network: a privacy level enjoyed by the user when accessing private data network.

2.1 Internal control requirements on e-commerce activities

2.1.1 First: security and protection requirements:

Basel Committee approved a set of requirements for security control electronic banking (Basel Committee on Bank Supervision):

1. Banks should take appropriate measures to verify the identity of customers who provided them with services online and the character of their authorization.
2. Banks should use methods of verification of the transactions and to promote (Non-Repudiation) and to determine accountability for electronic banking transactions.
3. Banks should ensure the availability of appropriate controls for authorization of access to electronic banking systems and databases and applications.
4. Banks should ensure the availability of appropriate actions to protect the credibility of data for electronic banking records and information.
5. Banks should ensure a clear validation of paths for all electronic banking transactions.
6. Banks should take appropriate measures to protect the confidentiality of information on electronic processes and these procedures must be consistent with the degree of sensitivity of the information to be transferred or stored in databases.

2.1.2 Secondly: technical and technological requirements

It is a set of software and hardware equipment and Internet sites, electronic business banking. The technological developments have increased the need to take advantage of these rapid developments of intense competition between banks, which kept pace with these developments to achieve competitive advantage and employing this technology and technical progress in favor of customer service. Therefore technical and technological requirements should be studied in terms of the availability of adequate infrastructure for the application of

e-commerce activities at banks. It must apply many controlling measures on technology used in the work to ensure continuity of work optimally to minimize the possibility of failure or failures by conducting ongoing preventive maintenance operations (Al-' ammuri 2006).

2.1.3 Thirdly: legal and legislative requirements

Basel Committee approved a set of requirements for legal and reputation risks of electronic banking (Basel Committee on Bank Supervision). Some of these are:

1. Banks should provide appropriate information in their websites to allow potential clients to reach informed conclusions about the identity and legal status of the Bank before entering transactions conducted through electronic banking.
2. Banks should adopt appropriate measures to ensure fulfillment of the requirements of confidentiality of customer by country where bank products and services based on electronic banking.
3. Banks should effective authority and continuity of activity and contingency planning processes to help ensure the availability of systems and services through electronic processes.
4. Banks are required to prepare appropriate plans include responding to accidents and limit (control) and reduce the problems arising from unforeseen events (including external and internal attack types) that may hamper the supply of systems and services based on electronic banking.

2.1.4 Fourth: administrative requirements

It is represented in good planning and appropriate regulation, particularly the use of electronic commerce in business that eliminates many of the traditional functions of the separation of duties. Administrative requirements include description of Organizational structure and characterization of powers and responsibilities. The requirements define the action and separation of opposing positions in management of information systems and the formulation of supervision mechanism for board of directors and senior management on electronic banking (Basel Committee on Bank Supervision).

3 .Previous studies

1. The study by (Zhao Ning & others, 2004), focused on audit in ecommerce period where researchers confirmed that the audit has developed in many financial firms, especially after the lack of audit revenues period. As the

- result of this situation, the American Institute of certified public accountants (AICPA) had select continuing review process as a service needed for the development of audit companies. This has a positive impact and assists professional to move towards a positive trend of defining a general framework for the concept of ongoing external audit (Ning Zhao 2004).
2. (Nearon, 2000), dealt with the journey of Internet evolution's till it has been used in the area of e-commerce, and the size of this trade and great increase in media attention. But the review lists of e-commerce and the application of the General auditing standards (GAAS), face substantial challenges for accountants. Although he doubts the degree of application review criteria for planning, audit manual, and adequate professional training, independence and internal control considering they don't apply equally to electronic commerce under transfer data electronically, as applied in conventional audit. Invited researcher to develop these standards to suit the information technology, because the services provided by the assurances needed for rehabilitation of offices audited and may affect the independence of reviewers (Bruce H. Nearon 2000).The researcher calls to develop these standards to suit the information technology, because the services provided by the audit offices needed for improvements and may affect the independence of reviewers (Bruce H. Nearon 2000).
 3. Tucker, (2000) pointed to the impact of information technology on internal control and the methods used by the audit to examine of the internal control system and control of information technology is one of the important factors for review. It is also noted that the reviewers should use highly skilled persons who have absorption capacity when preparing reports (Tucker, George 2000).
 4. The study by (Lee & Mayer & Chen, 2001) has focused on the impact of security control techniques in e-commerce, by studying the techniques of Authentication, encryption, Electronic Payment Systems and the Department of internal Security and Non-Electronic Payment Options. The study was conducted through a survey of students at three universities in different states in the United States. the study found that students who understand security techniques of business, but they are unfamiliar with electronic payment systems, and they Prefer to enter credit card information online when decide to purchase a product through the Internet (Lee 2001 & Mayer & Chen).
 5. The (Jabali, 2002), studied the recent trends in audit under technological variables in accounting information systems and indicate whether these trends positive or negative in the light of recent developments in information technology variables and what the size or orientation of the necessary developments and target in the audit, and the composition and qualify references to keep abreast of developments and changes in information technology systems, focusing in his study on the improvement of auditor. The study found that there is a real desire in development. The reviewers desire to develop their skills and abilities to cope with technological developments. Although there is still a considerable gap need concerted efforts until the upgrading scientific level profession. There are many topics that need further qualification and practice of external and internal auditors to keep abreast of developments, notably the electronic commerce. The researcher recommended that accounting curricula development, including adequate reference to the different methods of information technology and e-commerce systems, which will represent reality. Moreover, further theory and practice researches associated with information technology are recommended too to highlight the implications for audit (Jabali Mustafa, 2002).
 6. In his study, (kahosh, 2002), reviewed the issues and legal requirements for Internet banking, and challenges facing this kind of work that requires the transfer of data by electronic means, and efforts at the international and domestic levels to overcome those obstacles. The research have concluded that electronic trading is growing through Internet invasion of all areas of daily life for individuals and institutions, as there is international attention on privacy data transmission by electronic means. there are countries like the European Union regard privacy data as the basic requirements of electronic commerce, dealing with external parties. There is no Arab country has laws on confidentiality and data privacy (especially data transmitted by electronic means). The research recommended that work should be as quickly as possible to establish National laws to assure confidentiality and privacy of data transmitted by electronic means (Nader kahosh 2002).

4. Data Analysis and Hypothesis Testing:

4.1 Methodology of the study:

4.1.1 Data sources:

The researchers adopted the literature review in the area of accounting and e-business for the formulation of conceptual framework. The Preliminary data were collected for the study through questionnaire prepared for this purpose to cover and answer the questions posed in the problem and hypotheses.

4.1.2 Population and the sample of the study:

The study population includes the external audit offices on commercial banks in Saudi Arabia where 100 questionnaires were distributed. The researcher Retrieved 96 copies and only 90 copies are valid and can be analyzed. Therefore the percentage of valid copies is 90%.

4.1.3 Statistical Methods:

The appropriate statistical analysis of the data has been used in this study. The substantive goals within the framework of this study have been reached as well. The level of significance was (0.05) of the

corresponding trust level (95%). To interpret the results of tests conducted by researchers, the following are the most important statistical methods that were used:

4.1.4 Alpha Reliability Analysis:

Cronbach's Alpha Coefficient was used to measure the degree of reliability of the study sample to answers questions of the questionnaire. This coefficient depends on measure of the consistency of questionnaire and its ability to provide compatible results. Alpha can be interpreted as the correlation coefficient between the answers, thus alpha values can range between 0 and 1 and alpha value statistically acceptable is at least 60% of the results.

4.1.5 Descriptive statistics:

Some statistical methods that related to measurements of centralization and dispersion have been used. These methods include mean, Standard Deviation and The One-Way Analysis of variance.

4.2 General information:

Table No. (1) Demographic data of the study sample

| CHARACTERISTICS | CATEGORIES | PERCENTAGE |
|---|---------------------------|------------|
| Bank Annual Age | less than 10 years | 16% |
| | 10-20 years | 35% |
| | 20-30 years | 27% |
| | Greater than 30 years old | 22% |
| Number of years of application of e-commerce | less than 3 years | 18% |
| | 4-6 years | 22% |
| | 7-9 years | 31% |
| | Greater than 9 years | 29% |
| Average years of experience of workers in the Internal Audit Department in the bank | less than 5 years | 9% |
| | 5-9 years | 53% |
| | Greater than 9 years | 38% |
| The efficiency of workers in the Internal Audit Department | Very Poor | 9% |
| | Poor | 9% |
| | Average | 31% |
| | Strong | 35% |
| | Very strong | 16% |
| The independence of the internal auditor | Very Poor | 9% |
| | Poor | 20% |
| | Average | 42% |
| | Strong | 13% |
| | Very strong | 16% |
| The degree of familiarity with auditing standards adopted internationally | excellent | 7% |
| | Very Good | 40% |
| | Average | 29% |
| | Good | 20% |
| | Poor | 4% |

4.3 Preliminary data for the study questionnaire:

Preliminary data have been divided into several factors, some of these factors are linked to legal and legislative requirements, and each linked to the requirements of protection and security. And some are linked to the technological requirements and others associated with the administrative requirements. Moreover, other factors that may the extent of commitment to control e-commerce activities. The researchers have developed several questions on each of the factors. The above-mentioned results are as follows:

4.3.1 The factors of legislative and legal requirements:

Table (2) summarizes the results taken from the views of respondents. Each worker is indicated with arithmetic mean and standard deviation. The researchers study the degree of influence of special factors associated with all requirements, whether legal, legislative or protection and security. Also the researchers referred to a very great influence with the number 1 and the degree of influence of great with number 2 and degree of influence medium with number 3 and the degree of poor influence with number 4 and the degree of influence is very poor with number 5.

Table (2): the factors of legislative and legal requirements

| STATEMENTS | MEAN | STANDARD DEVIATION |
|--|-------------|--------------------|
| The Bank provides appropriate information in its website to allow potential customers to reach the identity of the bank and its legal status. | 2.20 | 1.14 |
| The bank allows the customers to conduct financial transactions through electronic banking to provide adequate safeguards for them. | 2.38 | 1.15 |
| The bank shall maintain the confidentiality of customer data from the legal aspects. | 2.27 | 1.03 |
| The Bank is committed to legislation and regulations necessary to implement e-business within the scope of Saudi law. | 2.24 | 1.03 |
| The Bank is committed to legislation and international laws concerning e-commerce applications in banks. | 2.36 | .98 |
| Bank copes with the rapid developments in legislation on e-commerce | 2.67 | .90 |
| The internal auditor is familiar with the basic criteria in determining the Legislative and legal actions with regard to electronic banking. | 2.71 | .99 |
| The bank provides the customer with clear legal texts and determines the nature of the legislation of e-business. | 2.78 | .85 |
| The appropriateness of current legislation and laws for the control of e-business. | 2.67 | 1.09 |
| Bank is committed to perpetuating the records of electronic transactions to identify clear Tracks for auditing used to settle conflicts. | 2.73 | 1.05 |
| Bank is committed not to use customer information for purposes beyond what is allowed Specifically for the purposes of or exceed what the customer has authorized. | 2.62 | 1.05 |
| General average | 2.49 | |

4.3.2 The factors of technological requirements:

Table (3) shows the same components as the previous tables which can be developed for descriptive decisions related to mean and Standard deviation. for each of the factors mentioned in the same table.

| FACTORS | MEAN | STANDARD DEVIATION |
|--|-------------|---------------------------|
| The bank infrastructure is appropriate for the practicing the activities of e-commerce. | 2.38 | 1.05 |
| The Bank uses sophisticated systems commensurate with the activities of e-commerce | 2.31 | 1.00 |
| The banking system provides high-speed access to the applications of electronic transactions. | 2.44 | 1.08 |
| The internal auditor is familiar with the nature of the work in electronic applications and heir trendiness in the bank. | 2.42 | 1.12 |
| Bank is committed to follow developments in hardware, software and techniques for e-commerce work | 2.58 | 1.16 |
| The current available software in the conduct of the audit process to periodically and continuously. | 2.58 | 1.10 |
| General average | 2.45 | |

4.4 The administrative requirements factors:

Table (4) shows the same components as the previous tables which can be developed for descriptive decisions related to mean and Standard deviation for each of the factors mentioned in the same table.

Table (4):The administrative requirements factors

| Factors | Mean | Standard Deviation |
|---|-------------|---------------------------|
| Senior management h is committed to designing a system of administrative supervision with concerning e-commerce activities. | 2.53 | 1.04 |
| Senior management is committed to the design and determines the policies and methods for risk management control pertaining to e-commerce activities. | 2.60 | .89 |
| Senior management is committed to providing strategic plans for e-commerce operations. | 2.58 | .97 |
| The Bank has the experience and adequate managerial competencies to practice new electronic business or adopt new techniques. | 2.76 | 1.15 |
| Senior management provides sufficient support for the development and utilization of modern techniques. | 2.58 | 1.14 |
| senior management Have high dynamic to oversee electronic commerce operations and rapid intervention to address any emergency problems. | 2.62 | 1.05 |
| Senior management is committed in audits of the essential aspects of Bank security control operations and accreditation | 2.44 | .94 |
| Senior management is committed to ensure the adequacy of security controls and protection for electronic commerce. | 2.24 | .96 |
| senior management Provide comprehensive and continuous formulation process to support the adoption of new technologies in the banking industry. | 2.56 | .94 |
| Senior management is committed to provide adequate autonomy of action of internal auditor regarding auditing e-commerce activities. | 2.38 | .96 |
| Senior management is committed to the training and qualification of human resources to keep pace with rapid technical developments regarding the work of the Bank electronically. | 2.64 | 1.19 |
| General average | | 2.54 |

4.5 Inferential Statistic

This part of the research demonstrates test and analyze the hypotheses. By reviewing the factors affecting commitment to e-commerce activities control and track the views of respondents, these factors have impact may have a direct relationship to the phenomenon. This impact is indicated by the view of the sample of the study. The research displayed the impact of various factors on phenomenon to control e-commerce activities. The inferential type of statistics is used to test hypotheses as follows:

4.5.1 The first hypothesis:

This hypothesis formed by statistical zero as follows:

Saudi commercial banks SCBs do not comply with the legislative requirements for the control of ecommerce activities.

Table (5) indicates using regression analysis to analyze the data associated with the commitment to control e-commerce activities with the dependent variable and the factors associated with legislative requirements as an independent agent to test the extent of the impact of the factors associated with legislative requirements to comply with control over electronic commerce activities. The value of testing is (2.454) and error amount 0.125. This explains the principle accept zero hypothesis and alternative hypothesis is rejected because the error amount greater than 0.05 level of significance (alpha value standard). This shows lack of commitment of Saudi commercial banks legislative requirements for the control of electronic commerce activities.

Table (5) testing the first hypothesis

| <i>sum</i> | <i>Mean</i> | <i>Calculated F</i> | <i>sig</i> | <i>Result</i> |
|---------------|-------------|---------------------|------------|---------------|
| 1.869 | 1.869 | 2.454 | .125 | No difference |
| 2.742 | .761 | - | - | - |
| 34.611 | - | - | - | - |

4.5.2 The second hypothesis

SCBs do not comply with the requirements of protection and security for ecommerce activities control.

The regression analysis is used in table number (6) in which the data associated with the commitment to control e-commerce activities with the dependent variable and the factors associated with security and protection requirements as an independent agent. They used to test the extent of the impact of the factors associated with protection and security requirements to comply with control over electronic commerce activities. The value of testing was (5,271) and error amount was (0.035). This explains the zero hypotheses

are refused to accept the alternative hypothesis because the error amount less than the level of significance 0.05 (alpha value standard). This demonstrates the commitment of Saudi commercial banks with protection and security requirements for the control of electronic commerce activities.

Table (6) testing the second hypothesis

| <i>Sum</i> | <i>Mean</i> | <i>Calculated F</i> | <i>sig</i> | <i>Result</i> |
|---------------|-------------|---------------------|------------|---------------|
| 3.632 | 3.632 | 4.763 | 0.035 | No difference |
| 32.791 | 0.763 | - | - | - |
| 36.423 | - | - | - | - |

4.5.3 The third hypothesis:

SCBs do not comply with the technological requirements for controlling the ecommerce activities.

With reviewing the table (7) regression analysis was used and the data associated with the commitment to control e-commerce activities was analyzed. The dependent variable and the factors associated with technological requirements were regarded as an independent agent to test the extent of the impact of the factors associated with technological requirements to comply with control over electronic commerce activities. The value of testing was (4.116) and error amount was 0.049. This explains the zero hypotheses that refused to accept the alternative hypothesis because the error amount less than level of significance (0.05) (alpha value standard). This results Demonstrates the commitment of Saudi commercial banks with the technological requirements for controlling the electronic commerce activities.

Table (7) testing the third hypothesis

| <i>Sum</i> | <i>Mean</i> | <i>Calculated F</i> | <i>sig</i> | <i>Result</i> |
|---------------|-------------|---------------------|------------|---------------|
| 3.190 | 3.190 | 4.116 | 0.049 | No difference |
| 33.324 | 0.775 | - | - | - |
| 36.514 | - | - | - | - |

4.5.4 The fourth hypothesis:

SCBs do not comply with the administrative requirements to control over ecommerce activities.

With review the table (8) regression analysis was used and the data associated with the commitment to control e-commerce activities was analyzed. The dependent variable and the factors associated with technological requirements were regarded as an independent agent to test the extent of the impact of the factors associated with technological requirements to comply with control over electronic commerce activities. The value of testing was (4.349) and error

amount was 0.043. This explains hypothesis is rejected and the alternative one accepted of zero because the error amount less than level of significance 0.05 (alpha value standard). this Demonstrates the commitment of Saudi commercial banks with the administrative requirements for control over electronic commerce activities.

Table (8) testing the third hypothesis

| <i>Sum</i> | <i>Mean</i> | <i>Calculated F</i> | <i>sig</i> | <i>Result</i> |
|---------------|-------------|---------------------|------------|---------------|
| 3.312 | 3.312 | 4.349 | 0.043 | No difference |
| 32.750 | 0.762 | - | - | - |
| 36.062 | - | - | - | - |

5. Findings:

In the light of the results of the statistical analysis of data for the study and based on the literature review and previous studies, researchers have reached the following findings:

1. Experience in internal audit section and competence have a significant impact on the control and reviewing activities on electronic processes and efficiency of the internal audit department personnel is strong enough to qualify them to achieve the required jobs.
2. The independence level of the internal auditor from the viewpoint of external auditor is average and below due to the influence of senior management on objectivity and independence. Therefore, an external audit process is needed for neutral opinion and objectivity of financial statements because these are the concern of Bank shareholders and customers and decision makers at the senior management level.
3. There is Suitable knowledge and interest to review global criteria used by auditors in commercial banks.
4. The commitments of banks with specific factors of legal and legislative requirements are inadequate due to the lack of keeping pace with legislation of rapid growth in e-business. There is no e-commerce so far of a comprehensive international legal framework and efficient infrastructure to support such framework.
5. The banks are significantly committed to the specific factors of protection and security. As a result these banks desire to provide maximum protection and security to achieve competitive advantages and prevent of the risks posed by e-commerce-related activities such as virus attacks and fraud information and hackers and unauthorized access.
6. The banks are significantly committed to technological requirements to keep pace with

any new technology in terms of hardware and software. That helps the banks c to provide high quality electronic services continually and ensure the obtaining of rapid updates in that area.

7. The commitment of banks to administrative requirements for electronic business was average for the inability of some departments to keep abreast with technological development in the field of electronic commerce besides the limitation of administrative policies and procedures related to the control of electronic business.

6. Recommendation:

Based on the foregoing findings the study recommends:

1. Commercial banks need to keep abreast of legal enactments relating to electronic business, especially domestic legislation and international legislation for competition among banks in the context of globalization and electronic commerce.
2. Departments of banks need to focus on policies, regulations and procedures concerning the work kept pace with the rapid development in information technology and the Internet and the need for structural change to keep up with the work the banks of these developments.
3. the need for continued attention in providing adequate infrastructure to implement programmes on e-business in terms of providing appropriate equipment and software for modern developments.
4. The banks need to keep pace constantly with security and protection that related to the security and confidentiality of electronic business information to protect the rights of customers, employees, shareholders and achieve competitive advantage, given the urgent need in this area.
5. Special budget for banks should be allocated to follow technological developments regarding e-business with the need to develop an apparent policy on the introduction of any new technology.
6. Continuous training of all workers in banks is needed. Particularly those working in internal audit unit, technologically and technically to keep up with developments in the area of electronic business. This enables the bank to keep abreast of developments relating to the work of the internal auditors and providing an encouraging environment to the so-called electronic audit.

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Challenge of Associated Gas Flaring and Emissions Propagation in Nigeria

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Abstract: Operations at gas plants and flow stations in Nigeria involve flaring of excess gas on twenty-four hourly basis. Combustion of associated gas contributes to the atmospheric content of carbon, nitrogen, sulphur and total hydrocarbon with its resultant effect that cause damage to the environment due to acid rain formation, global warming and ozone depletion. This study evaluates the challenges of gas flaring, spatial propagation of emissions and atmospheric conditions that affect their spread using the Idu Obosi in the Niger Delta of Nigeria as a case. The AirWare Model was used in the process of determining the distribution. The results showed that at higher wind speeds (5-8m/s), emission concentrations increases at closer distances (300m-1km) and decreases at increased distances. While at lower wind speeds (1-3m/s), high concentrations are experienced from 0-8km. Emission concentrations were more prevalent at closer range under the very unstable atmospheric condition, while under the stable and neutral conditions, concentrations are at farther distances. The trajectory of the study settlement relative to the flare shows that the habited area is well within the distance range (8km) of the modeling results. It is clearly shown from the study that meteorological factors such as atmospheric stability, wind speed and direction play an important role in predicting the behavior of pollutant plumes. The dominant wind direction was south-westerly meaning that pollutants will be transported to the northern and north-eastern direction of the study area. Oil companies should endeavor to reduce gas flaring by capturing the extra gas during oil production and channeling it to useful purposes or re-injection.

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Key Words: gas flaring, emission propagation, Niger Delta.

1. Introduction

Nigeria's petroleum endowment has been exploited for more than 50 years, but while oil companies gained from the resource, local communities in the oil rich but conflict-ridden areas live with the daily pollution caused by non-stop gas flaring. It has been reported that Nigeria has one of the world's highest level of gas flaring and flares about 16 per cent of the world's total associated gas (World Bank, 2002). In Western Europe, 99 per cent of associated gas is used or re-injected into the ground. Despite regulations introduced since 1969 to outlaw the practice in Nigeria, most associated gas is flared, causing environmental pollution. Gas flaring has been reported by many researchers to be a major cause of low environmental productivity in the Niger Delta, thereby impoverishing the inhabitants (Alakpadia, 2000; Daudu, 2001; Aregbeyen and Adeoye, 2001; Udoinyang, 2005; Akpabio, 2006; Ologunorisa, 2001). Studies carried out by Odjugo and Osemwenkhae, 2009, have shown that higher temperatures and soil temperature (at 5-10 cm depths) increases as one moves closer to flare site. Comparison with control sites, which is the ecological climatic condition of the study area, shows that flaring actually modify soil, water and air micro climate. The higher temperature generated by the

flare must have increased the evapo-transpiration rate in sites closer to the flare, hence decrease in the soil moisture and relative humidity. Temperature was found to have increased by 11.6°C at 500m from the flare site, 9.2°C at 1km and decreased to 4.3°C at 2km. Also studies carried out by Ede (1995) in Agbada, Bonny, Bomu, Obagi and Tebidaba areas of Niger Delta have shown that the concentration of air borne pollutants were maximum at night and minimum during the day, and analysis of rainwater samples collected at the Bonny site by the same author showed significant concentrations of sulphates, nitrates, total dissolved solids and total suspended solids. Gas flaring is found to have significantly affected the health of the inhabitants of Otujeremu, Igbide, Olomoro, Ubeji, causing ailments that affect the respiratory, eye, skin and intestines of people impacted (Efekodo, 2001; Odjugo, 2004; Otuaga, 2004).

Gas flaring is a widely used practice for the disposal of natural gas in petroleum producing areas where there is no infrastructure to make use of the gas. It is recognized as a waste of resources and an added source of carbon emissions load to the atmosphere. Despite this recognition, there is substantial uncertainty regarding the magnitude of gas flaring. Current estimates of gas flaring volumes

rely on voluntary reporting made by corporations and individual countries. There is very little independent data on gas flaring volumes and it is known that some of the reported volumes are low (NGDC, 2011). In 2004, Nigeria's volume of gas flared was equivalent to one-sixth of total gas flared in the world. Globally, the volume of gas flared between 1996-2006 (during which time awareness of the detrimental impact of flare emissions on the global climate grew) remained relatively constant, ranging between 150-170 billion cubic meters (BCM). Nigeria's share of the total volume is approximately 24.1 BCM of gas. By comparison, the U.S. flared 2.8 BCM during the same time period.

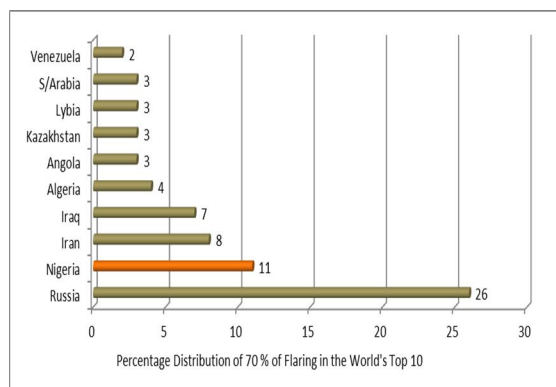


Figure 1: Top Flaring Nations (Data: Wikipedia, 2011)

Nigeria is the second biggest offending country, after Russia, in terms of the total volume of gas flared. Ironically Russia did announce it will stop the practice of gas flaring back in 2007. This step was, at least in part, a response to reports by National Oceanic and Atmospheric Administration (NOAA) that concluded Russia's previous numbers may have been underestimated. The report, which used night time light pollution satellite imagery to estimate flaring, put the estimate for Russia at 50 billion cubic meters while the official numbers are 15 or 20 BCM (Wikipedia, 2011).

The first order to reduce gas flaring in Nigeria was contained in the Petroleum Act 1969 where the operators were directed that:

“not later than five years after the commencement of production ... submit to the Minister, any feasibility study, program or proposal ... for the utilization of any natural gas, whether Associated with oil or not, which has been discovered in the relevant area.”

This order was ignored. Through the Associated Gas Re-Injection Act No. 99 of 1979, the Nigerian government required oil corporations operating in Nigeria to guarantee zero flares by January 1, 1984. Oil companies nonetheless have

continued to flare gas, merely paying nominal fines for breaking this law. The Act allowed some conditions for specific exemptions or the payment of a fee of US \$0.003 (0.3 cents) per million cubic feet, which increased in 1988 to US \$0.07 per million cubic feet, and in January 2008 to US \$3.50 for every 1000 standard cubic feet of gas flared. This is still considered meager and not a deterrent for companies, which find it easier to just pay the fine. The objectives of this study are:

- To determine the spatial profile of flare emissions and their concentrations at various receptors (distances) using the Air Quality Assessment and Management Model (AirWare).
- To analyze the various atmospheric conditions that could enhance or worsen the air quality within the flare impact area.
- To assess the problem of gas flaring in Nigeria and its implications.

2. Materials and Method

AirWare includes basic Gaussian model used in determining the average concentration of emissions. The accompanying 2D graphical interface generated was developed between 2005 and 2010. This model which was designed to support the European Environmental Directives (EED) also accommodates other broad range of applications and can be configured for use in specific national regulations. AirWare not only has a fully interactive, graphical and symbolic user interface, but incorporates a rule based expert system that can guide and control user requests and assures the completeness, consistency, and plausibility of data and scenarios assumptions. The main function groups that the system supports are:

- Data management and time series analysis (emission inventories, monitoring including real-time data acquisition).
- Planning, design impact assessment, optimization (emission control).
- Scenario analysis, forecasting (regular or event based).
- Communication: reporting and public information.

These groups are supported by a corresponding set of main functions and numerous auxiliary generic tools such as fully integrated GIS and the embedded expert system, as well as data import and export facilities. Basic models in AirWare also include a set of fast and efficient screening/regulative level models designed for fully interactive use, including ISC3/AERMOD (short term, 24hours, and seasonal long term), and the software can only be carried and operated on internet platforms.

2.1 Model Basic Equations:

The notation used following X in parenthesis is to give the three co-ordinates of the receptor location according to a co-ordinate scheme. Following a semi-colon, the effective height of emission of the source is given. The equation is given as four separate factors, which are multiplied by each other. These four factors represent the dependency upon emissions, or the source factor, and what occurs in the three dimensions parallel to the three coordinate axes.

$$X = (x, y, z; He) =$$

$$\text{Emission factor} = Q$$

$$\text{Downwind factor} = 1/U$$

Crosswind factor =

$$\frac{1}{(2\pi)^{1/2}} \sigma_y \exp\left[-\frac{y^2}{2\sigma_y^2}\right]$$

Vertical factor =

$$\frac{1}{(2\pi)^{1/2}} \sigma_z \left[\exp\left[-\frac{(He-Z)^2}{2\sigma_z^2}\right] + \exp\left[-\frac{(He+Z)^2}{2\sigma_z^2}\right] \right]$$

The notations used are as in Oke (1987):

- X → Air pollution concentration in mass per volume usually gm^{-3}
- Q → Pollutant emission rate in mass per time usually gs^{-1}
- U → Wind speed at the point of release, ms^{-1}
- σ_y → the standard deviation of concentration distribution in the crosswind direction, m at the downwind distance x
- σ_z → the standard deviation of the concentration distribution in the crosswind direction, m at the distance x
- π → the mathematical constant *Pi* equal to 3.1415926
- He → the effective height of the centre-line of the pollutant plume
- Z → Receptor distance above ground (m).

The concentrations at the receptor are directly proportional to the emissions. Parallel to the X axis, the concentrations are inversely proportional to wind speed. Parallel to the Y axis, that is, crosswind, the concentrations are inversely proportional to the crosswind spreading, σ_y , of the plume; the greater the downwind distance from the source, the greater the horizontal spreading, σ_y , the lower the concentration. The exponential involving the ratio of Y to σ_y just corrects for how far off the centre of the distribution the receptor is in terms of standard deviations. The receptor is y from the centre. Since the crosswind distribution centre is at $y = 0$, i.e. directly above the x axis. Parallel to the Z axis, i.e. vertical, the concentrations are inversely proportional to the vertical spreading of the plume, σ_z ; the greater the downwind distance from the source, the greater the vertical dispersion and the lower the concentration. The sum of the two exponential terms in the vertical factor represents how far the receptor height, Z , is from the plume centerline in the vertical. The first term represents the direct distance $He-Z$, of the receptor from the plume centerline; the second term represents the eddy reflected distance of the receptor from the plume centerline, which is the distance from the centerline to the ground, H , plus the distance back up to the receptor Z , after eddy reflection. After doing the multiplication the above relations simplify to:

$$X(x,y,z;He) = \frac{Q}{2\pi U \sigma_y \sigma_z} \left(\exp\left[-\frac{y^2}{2\sigma_y^2}\right] \left[\exp\left[-\frac{(He-Z)^2}{2\sigma_z^2}\right] + \exp\left[-\frac{(He+Z)^2}{2\sigma_z^2}\right] \right] \right)$$

(equation 1)

Derivation of additional equations for specific situations for receptors at ground level, $z = 0$, equation 1 reduces to:

$$X(x,y,0;He) = \frac{Q}{2\pi U \sigma_y \sigma_z} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \exp\left[-\frac{He^2}{2\sigma_z^2}\right]$$

(equation 2)

In order to make concentration estimates directly beneath the plume centerline, $y = 0$, at ground level, $z = 0$, the equation further reduces to:

$$X(x,y,0;He) = \frac{Q}{2\pi U \sigma_y \sigma_z} \exp\left[-\frac{He^2}{2\sigma_z^2}\right]$$

(equation 3)

To calculate concentrations at the plume centerline, $y = 0$, $z = H_c$, equation 3 becomes:

$$X(x,0,H_c) = \frac{Q}{2\pi U \sigma_y \sigma_z} \left(1 + \exp \left[\frac{-H_c^2}{2\sigma_z^2} \right] \right) \quad (\text{equation 4})$$

To calculate concentrations along the plume centerline at ground level from a ground level release, $y = 0$, $z = 0$, $H_c = 0$, equation 4 becomes:

$$X'(x,0,0) = \frac{Q}{2\pi U \sigma_y \sigma_z} \quad (\text{equation 5})$$

2.2 Modeling Parameters: In the course of modeling, the parameters considered were: the flare stack height (30m); exit velocity of gas (13m/s); flare stack diameter (0.85m); exit temperature of gas (1015°C); average ambient air temperature between (26 - 30 °C); flare gas heat rate (873mmBtu/hr); natural gas heat value (48MJ/kg); average dominant wind speed in the area (1, 3, 5 and 8m/s) and the prevailing wind direction which is south-westerly (SW).

3. Results

Figures 2 – 9 show the concentration results and analysis of model outputs. Emission concentrations were more prevalent at closer range under the “very unstable atmospheric condition at wind speeds; 1m/s (4.5 – 6.5km), 3m/s (1.2 – 2.2km), 5m/s (0.9 – 1.4km) and 8m/s (0.5 – 1km), respectively (see Figs: 2, 3, 5 & 7). The higher the wind speed the closer the emission impact under that condition. However under the stable and neutral conditions, emission concentrations are at farther distances i.e., from 6km and over (Figs: 6, 8 & 9). In comparing the rates of dispersion in the atmospheric stability categories, the results clearly show the behavior of the plume in the different conditions under various wind speeds. At low wind speeds (1-3m/s), high concentrations are experienced from 0 to 8km, while at strong winds (5-8m/s), concentrations are high between 300m-1km. At higher wind speeds, the concentration of the pollutants decreases at increased distance (see Figs 2-9). This explains the consequence of turbulent diffusion on the pollutants as they travel downwind from the source. Unlike the unstable conditions, for stable conditions at lower wind speeds, there are no significant concentrations at receptors closer to the emission source as it is beyond 8km (Fig. 4). These stable conditions which are more prevalent at night could be as a result of radiation inversion at the earth

surface in which stability of the atmosphere switches between the elevations of stacks. At elevated stacks above inversion, close to the ground the air is stable and this will inhibit dispersion around nearby receptors. Well above ground, the air is unstable and will cause the pollutants to mix with the air aloft, thereby inducing greater dilution. In this situation the ground will receive little or no surface impact; emissions will rather remain at the upper levels and be dispersed there. If eventually the stability of the atmosphere changes, it will affect those living downwind of the pollution source. The neutral condition also showed similar trend at lower wind speeds, but at higher wind velocity, concentrations would be prevalent from 5.3km and beyond (Figure 9). In the neutral set up, the atmosphere neither enhances nor inhibits mechanical turbulence.

Generally, buoyancy forces lift plumes and it takes some time to reach the ground (by bending and spreading). When there is no concentrations observable in the immediate vicinity of the emission source, then we can expect an increase for some distances as the plume touches the ground. In all the stability classes, ground concentration decreases according to the order: unstable > neutral > stable categories at lower and higher wind speeds (see all 2D outputs below). Stability assumes a critical role in determining the amount of turbulence in the atmosphere and thus directly affects the levels of dispersion. Turbulence and mixing can increase as well as decrease pollutants concentrations at certain points. In unstable conditions, ground level pollution is easily dispersed thereby reducing ground level concentrations. Elevated emissions, such as those released from a high stack, are returned more readily to ground level, leading to higher ground level concentrations and that is where emission pollution matters most. It should be noted that stable conditions means less atmospheric mixing and therefore higher concentrations around ground level sources, but better dispersal rates and so, lower ground level concentrations for elevated sources. Ground level sources are those according to U.S. EPA, defined for stacks between 0 - 10m, while elevated sources are those defined for stacks between 10 - 200m and above. This leads us to the fact that concentrations of pollutants also depend on stacks elevation as well as the rate at which pollutants are being emitted from the stacks. It should be noted that the emission source stack for this study is about 30m.

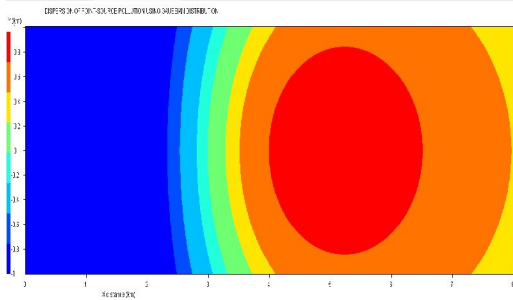


Figure 2: Very Unstable Atmospheric Condition at 1m/s Wind Speed

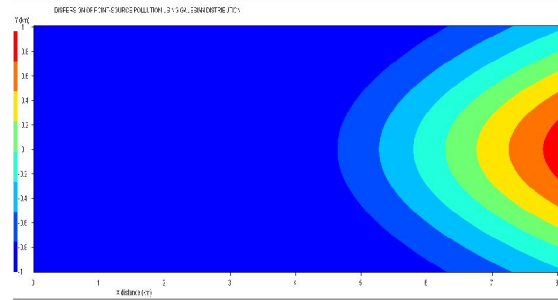


Fig. 6: Stable & Neutral Atmospheric Condition at 5m/s Wind Speed.

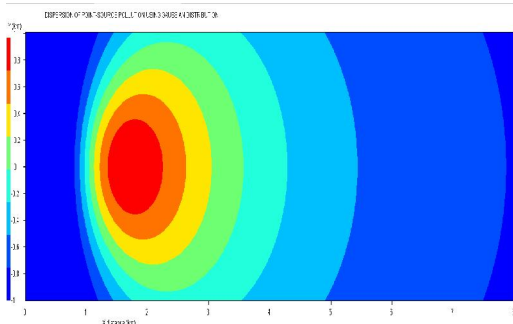


Figure 3: Very Unstable Atmospheric Condition at 3m/s Wind Speed.

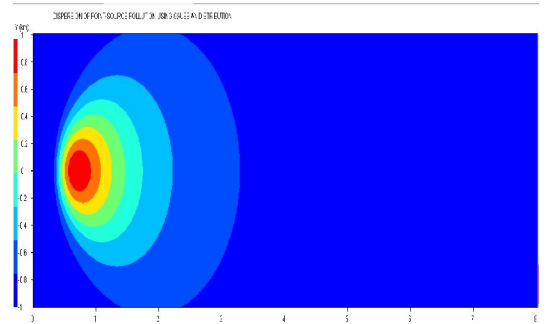


Figure 7: Very Unstable Atmospheric Condition at 8m/s Wind Speed.

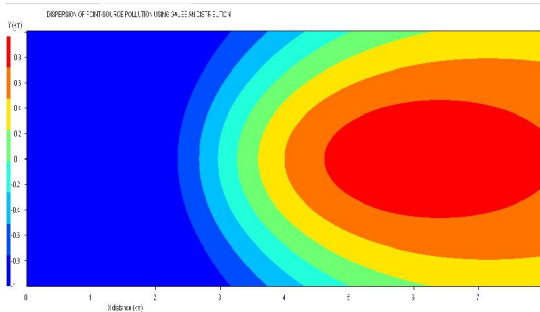


Figure 4: Slightly Unstable Atmospheric Condition at 3m/s Wind Speed.

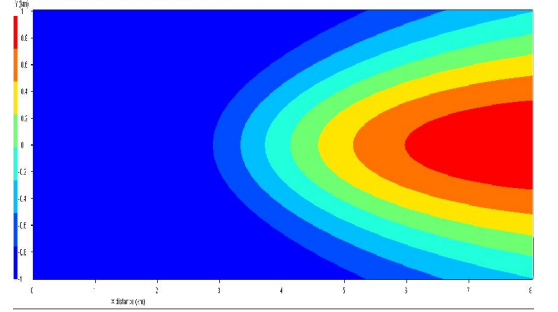


Figure 8: Stable Atmospheric Condition at 8m/s Wind Speed.

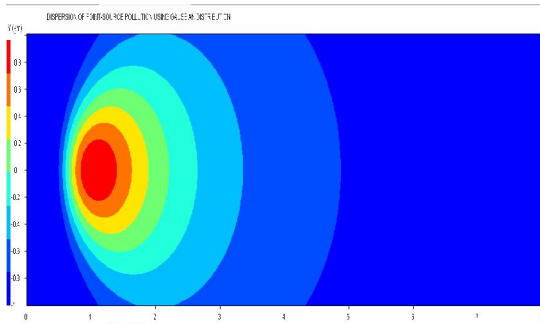


Fig. 5: Very Unstable Atmospheric Condition at 5m/s Wind Speed.

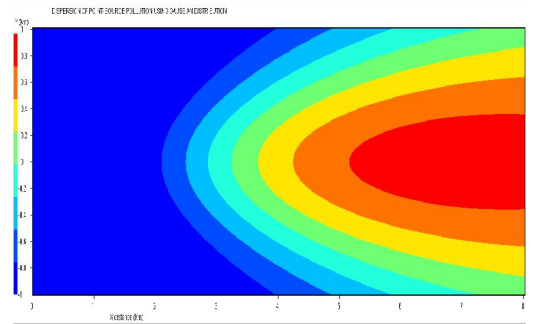


Figure 9: Neutral Atmospheric Condition at 8m/s Wind Speed.

4. Discussion

Field measurements show that the average wind speed in Idu Obosi is about 3 m/s. Extreme winds can be observed during squalls and storms. The built-up area of the settlement begins at 300m from the flare point and luminous glare from the flare is felt at all times from every position in the settlement. The trajectory of Idu Obosi relative to the flare is illustrated in Figure 10. The choropleths in Figures 2 - 9 show that the entire Idu Obosi Town is well within the maximum impact range of 8 km obtained from the modelling outputs of this study for all

atmospheric dispersion situations.

This study clearly demonstrates that meteorological factors assist in predicting the behavior of plumes that contain pollutants i.e., plume rise, transport and dispersion in the atmosphere. The dominant wind speed direction in the study area is south-westerly, meaning that pollutants will be transported to the north and north-eastern directions, except by night when it may reverse due to land breeze and during the dry (*Harmattan*) season when the northeast trade wind persist.

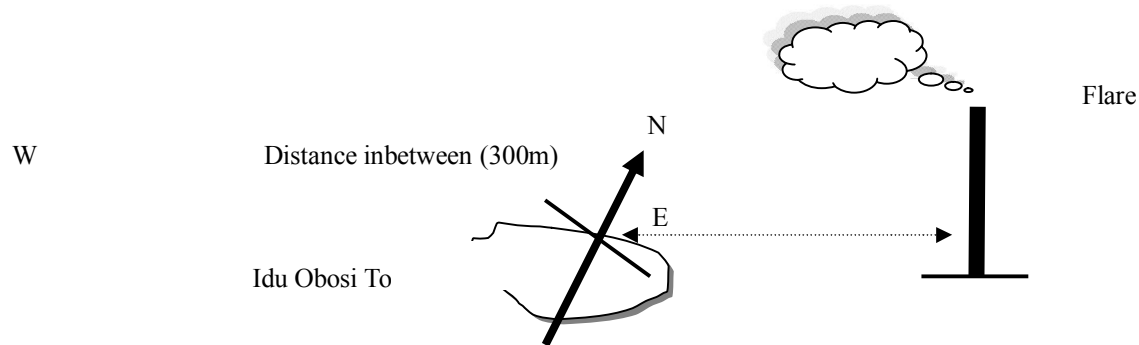


Figure 10: Trajectory of Idu Obosi to the Flare

The processing of non-associated gas or re-injection is more expensive than flaring. Gas flaring, as a wanton wastage of valuable resources, is necessarily linked with poverty, as utilization of the gas, which is otherwise flared, could improve the lots of the people. That is why, in furtherance of its poverty reduction policy, the World Bank Group, in active collaboration with the Government of Norway, commenced a global campaign for gas flaring reduction. The campaign, dubbed: *Global Gas Flaring Reduction Public-Private Partnership Initiative* (GFRPI) was launched formally at the World Summit on Sustainable Development (WSSD), Johannesburg, South Africa, on August 30, 2002. The aim of GFRPI, according to the World Bank press release issued at the formal launching, is “to support national governments, development agencies, and the petroleum industry in their efforts to reduce the environmentally damaging flaring and venting of gas associated with the extraction of crude oil.” The initiative was put forward during a June 2001 Oslo Seminar hosted by Ann Kirsten Sydney who was then the Norwegian Minister for International Development. Subsequently, the initiative was informally launched by the Conference of the Parties (COP-7) under the United Nations Framework Convention on Climate Change (UNFCCC) in Marrakesh, Morocco. On April 15-16, 2003 another GFRPI conference was held at Oslo, Norway, where the stakeholder consultation phase of the initiative was concluded. Nigeria was among 25 other countries that attended the conference.

Gas flaring reduction activities are aimed at capturing the gas produced at the oil extraction source and channelling it to more useful outlets including power generation in industries and for use in households. The GFRPI enables private investment in pipelines and other infrastructure that makes this “capturing” possible. Already, the GFRPI has been working on specific gas flaring reduction projects in Russia, Indonesia, and Nigeria to demonstrate how carbon credit trading instituted by the Kyoto Protocol can improve the viability of gas flaring reduction projects. Other key activities of the partnership include improving legal and regulatory framework for investment in flaring reductions, improving international market access for gas and provision of technical assistance to develop domestic markets for the harnessed gas, and promote local small-scale use of gas. The main focus of the initiative would be Africa, and the Americas. The initiative, it seems, could also support other global initiatives geared towards addressing energy security especially for Nigeria and other developing countries (Malumfashi, nd).

5. Conclusions

The findings from this study have shown that

gas flaring in Nigeria impact nearby settlements and may cause economic loss. Significant levels of emissions can emanate from a gas flare site with strong concentration within the vicinity of the source. The spread of these emissions in the atmosphere at any point in time depend on the effects of meteorological agents i.e., wind speed, wind direction, air temperature, relative humidity, rainfall, intensity of turbulence and mixing and atmospheric stability. The application of the AirWare Modelling software involves significant certainties that suggest a confidence in emission concentration impacts, on its wide use in assessing environmental problem and air pollution control. From the analysis it could be inferred that pollutants concentration would be greatest for receptors very close to emission sources (300m— 1km) and better for receptors far away under unstable conditions due to turbulent factors. Also pollutants concentration under the neutral and stable conditions will be better at receptors close to the emission sources and worse at receptors far away from emission sources. This could be rife in the neutral conditions when an external force like the wind carries pollutants to ground level unpredictably. It should be noted that stack elevation and emission rates of pollutants can also play a role in bringing pollutants to ground level receptors. The taller the stacks and the lower the emission rates of pollutants, the better the dispersion, and vice-versa.

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Microbiological And Nutritional Evaluation Of Water Melon Juice (*Citrullus lanatus*)

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Abstract: Studies were conducted on different samples of water melon juice (fresh water melon juice with sugar (FWMJS), fresh water melon juice without sugar (FWMJWS), refrigerated water melon juice with sugar (RWMJS) and refrigerated water melon juice without sugar (RWMJWS). The result of the investigation obtained showed that the highest bacteria load of 5.3×10^6 cfu/ml, fungal count of 1.2×10^6 cfu/ml and yeast count of 1.0×10^6 cfu/ml were recorded in RWMJUS after 15 days of storage. The identification process revealed that microorganisms such as *Escherichia coli* (20%) *Staphylococcus epidermidis* (16%) *Saccharomyces cerevisiae* (12%) and *Aspergillus niger* (4%) were implicated. The nutritional analysis showed that FWMJWS have the highest % crude protein (0.71), ash (0.10), and moisture content (69.75). However the RWMJS contained the highest quantities of Ca (0.51mg/100g), K (1.31mg/100ml), Na (0.26mg/ml), P (0.156mg/100ml) Fe (0.30mg/100ml) Zn (0.018mg/100ml) and Mg (0.012mg/100ml) similarly the quantities of Ca (0.51 mg/100g) and Mg (0.012 mg/100g) in FWMJS were the same with that of RWMJS. Study therefore concluded that fresh water melon juice was more susceptible to microbial attack compared to water melon juice fortified with sugar.

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Key words: water melon juice, Microbiology, nutritional, sensory evaluation, refrigeration.

1. Introduction

Water melons are consumed fresh, leading to the rejection of water melons that have any visible defect (Williams 2007). All foods, even when properly packaged, undergo biochemical, physical, and other changes that can affect their quality and safety (Sam Saguy and Micha Peleg, 2009). Low temperature slows down the growth of microorganisms and the rate of chemical changes in food which can cause food spoilage (Anon, 2005).

Water melon (*Citrullus lanatus*) was described by Roger (2006) as *Citrullus lanatus* and is reported to contribute to the proper functioning of the kidney. Pulp chemical composition has been reported as having 91.5% moisture, 0.2% protein, 0.1% fat (reported as ether extracts) and 0.25% total ash (Uddin and Nanjundaswamy, 1982). Another study (Taper et al., 1985) found that watermelon pulp yield was 57.2% and it was composed of 91.2% moisture, 0.69% protein, 0.48% fat, and 0.3% ash.

The different types of spoilage which are common in fruit drinks are ropiness, rot, discoloration, sliminess, putrefaction, whiskery and fermentative spoilage (Parry and Pasway, 1984).

Microbial and other form of spoilage may be delayed or prevented by various methods of preservation, such methods help to retain the nutritive value of the product, extend shelf- life and keep it safe for consumption (Singleton, 1997). Water melon is a

fruit with high moisture content (Erukainure et al., 2010) and this characteristic makes it highly susceptible to microbial spoilage caused by gram positive bacteria which are very sensitive to low acidity (Mossel et al., 1995).

Mossels et al. (1988) reported that during cold storage, the shelf life of the product is determined by temperature, for example, the lag time for growth of *Listeria monocytogenes* at 10°C is 15 days while at 1°C the lag time is 3 days. It was further reported that at 10°C the generation time of the microorganism is 5-8h, while the generation time is between 62 and 131h at 1°C. Similarly a pH increase from 4.5 to 6.5 decreases the lag time from 60h to 5h.

However this research work is intended to provide information on the microbiological and nutritional evaluation of the different treated products of water melon juice.

2. Material and Methods

Procurement of Sample

Healthy ripe water melon fruit was purchased from Bodija market in Ibadan, Nigeria and transported to the laboratory for subsequent study.

Method of Extraction of Juice from water melon fruit

The fruit was washed with distilled water after which it was washed with 5% hypochloride solution and immediately rinsed again with distilled water. The whole fruit was cut longitudinally using a

sterile knife and edible portion was removed, cut into small pieces, transferred into a sterilized blender (Moulinex model) and blended until sufficient juice was produced. The entire slurry was transferred into a sterile muslim cloth to sieve off the particles. The clear liquid obtained was transferred into clean sterile airtight bottles.

Treatment of Fruit Juice

Five hundred milliliters of the fruit juice was dispensed separately into four sterile Five hundred milliliters Erlenmeyer flask which were airtight-sealed. Twenty grams of sucrose was added to the fruit juice in two of the airtight Five hundred milliliters Erlenmeyer flask while the fruit juices in the others were without sucrose. The four Erlenmeyer flasks were labeled accordingly and two of them were transferred into a refrigerator at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 15 days while the remaining two flasks were not refrigerated.

Isolation and identification of isolates

Isolation of microorganisms from the water melon juice samples was carried out by sampling at 2 days intervals for 15 days. The media used for isolation included MacConkey agar, Blood agar, Salmonella-Shigella agar, Mannitol salt agar, Yeast extract agar and Potato dextrose agar. The methods of Meynell and Meynell (1970) and Harrigan and Macane (1976) were employed for the serial dilution and pouring of plates respectively. Pure cultures of the isolates were obtained by repeated sub-culturing. The bacterial isolates were identified based on morphological and biochemical characteristics and with reference to Bergey's manual of systematic bacteriology (Sneath, 1986). The yeast isolates were identified using methods described by Sanni and Lonner (1993). The fungal isolates were identified based on macroscopic and microscopic appearance, and with reference to Funder, (1961) and Barnett and Hunter (1972).

Nutritional Analysis of the Fruit Juice

The crude protein, fat, ash, moisture and mineral composition contents were determined using the methods described by A. O. A. C. (2000).

Sensory evaluation of refrigerated water melon Fruit Juice

Sensory evaluation was conducted on the four water melon juice samples. The sensory evaluation panel used was nine undergraduate students of the Department of Microbiology University of Ibadan Nigeria who were regular consumers of water melon juice. The panelists were directed to rate the samples on the bases of appearance, flavor, aroma and overall acceptability. Nine-point Hedonic scale ranging from like very much (9 points), to dislike very much (1 point) were used as described by Larmond (1977). The results obtained were analyzed based on variance using one way ANOVA. Differences

between the means were sorted out using Duncan's multiple range test (Duncan, 1955).

3. Results

Table 1 shows the different microorganisms (bacteria, mould and yeast) present in water melon juice with sugar and without sugar stored at refrigerated temperature ($4 \pm 2^{\circ}\text{C}$) for 15 days. The result revealed that the highest microbial count was observed at 15 day in both the two samples of water melon juice. The bacteria count in water melon juice without sugar was 5.3×10^6 cfu/ml while 2.6×10^5 cfu/ml was recorded in water melon juice sample with sugar. Also the mould count was higher (1.2×10^6 cfu/ml) in the water melon juice sample without sugar while the mould count of 1.0×10^5 cfu/ml was recorded in the water melon juice sample with sugar. Similarly yeast count was higher (1.0×10^6 cfu/ml) in water melon juice without sugar than in water melon juice with sugar (8.0×10^4 cfu/ml).

Further identification of the microorganisms found in the refrigerated water melon juice samples revealed that *E. coli* had the highest percentage occurrence of 20% followed by *Klebsiella pneumonia* and *Staphylococcus epididermis* which showed 16% occurrence each and the least (4%) was observed in *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus ochraceus* and *Rhizopus oligosporus* (Table 2).

The highest percentage crud protein of 0.71 was recorded in fresh water melon sample without sugar while the least (0.67%) was noted in water melon juice sample with sugar. The result of the fat content showed that the highest percentage fat (0.05%) was seen in fresh water melon juice sample with sugar while the least was seen in water melon juice without sugar refrigerated for 15 days. There was no observable change in the content of the crude fiber in all the samples analyzed in this work. However, the highest ash content of 0.10 % was observed in fresh water melon juice sample without sugar and the least was observed in refrigerated water melon juice sample without sugar. The percentage moisture content of 69.75 was noticeable in fresh water melon juice sample without sugar while the least (60.80) was observed in refrigerated water melon juice sample with sugar. Refrigerated water melon juice sample without sugar stored for 15 days recorded the highest percentage Carbohydrate content of 99.24% while the least (98.69%) was observed in fresh water melon juice sample without sugar (unrefrigerated) (Table 3).

From the mineral composition analysis results potassium content was revealed to be the highest with 1.31 mg/100ml in refrigerated water melon juice with sugar while the least was noted in both fresh water melon juice without sugar and refrigerated

water melon juice without sugar (1.10 mg/100ml). This was followed by calcium showing a value of 0.51 mg/100ml in both fresh water melon juice sample with sugar and refrigerated water melon juice with sugar while the refrigerated water melon juice without sugar recorded the least calcium content of 0.46mg/100ml. However the comparative result showed that magnesium was the least (0.010mg/100ml) as seen in refrigerated water melon juice without sugar (Table 4).

The sensory evaluation result showed that the fresh watermelon juice with sugar was scored highest in terms of taste (7.8±0.00) and overall acceptability scoring (8.9±0.36) closely followed by fresh water melon juice without sugar which showed the highest score for colour and aroma recording 8.5±0.11 and 9.0±0.18 respectively while the refrigerated water melon juice without sugar stored for 15 days had the least score for colour and aroma (Table 5).

Table 1: Microbial load of refrigerated water melon juice samples

| Juice samples | | Day 1 | Day 3 | Day 5 | Day 7 | Day 9 | Day 11 | Day 13 | Day 15 |
|---------------------|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Juice without Sugar | Bacterial count (cfu/ml) | 1.8 x 10 ² | 1.4 x 10 ⁵ | 1.3 x 10 ⁶ | 2.1 x 10 ⁶ | 2.9 x 10 ⁶ | 3.7 x 10 ⁶ | 4.8 x 10 ⁶ | 5.3 x 10 ⁶ |
| | Mould count (cfu/ml) | 2.0 x 10 ¹ | 7 x 10 ³ | 3 x 10 ⁴ | 4.0 x 10 ⁴ | 6.0 x 10 ⁴ | 5 x 10 ⁵ | 8 x 10 ⁵ | 1.2 x 10 ⁶ |
| | Yeast count (cfu/ml) | 1.0 x 10 ¹ | 2.0 x 10 ³ | 2.0 x 10 ⁴ | 3 x 10 ⁴ | 5 x 10 ⁴ | 4 x 10 ⁵ | 7 x 10 ⁵ | 1.0 x 10 ⁶ |
| Juice with Sugar | Bacterial count (cfu/ml) | 5 x 10 ¹ | 6.0 x 10 ² | 9.5 x 10 ³ | 1.2 x 10 ⁴ | 4.9 x 10 ⁵ | 6.3 x 10 ⁵ | 9.5 x 10 ⁵ | 2.6 x 10 ⁵ |
| | Mould count (cfu/ml) | No Growth | 2.0 x 10 ¹ | 7.0 x 10 ² | 8.0 x 10 ² | 4.0 x 10 ⁴ | 6.0 x 10 ⁴ | 8.0 x 10 ⁴ | 1.0 x 10 ⁵ |
| | Yeast count (cfu/ml) | No Growth | 1.0 x 10 ¹ | 2.0 x 10 ² | 4.0 x 10 ² | 2.0 x 10 ⁴ | 3.0 x 10 ⁴ | 5.0 x 10 ⁴ | 8.0 x 10 ⁴ |

Table 2: Percentage occurrence of microorganisms in refrigerated water melon juice

| Microorganisms | | Number | % of Occurrence |
|----------------|-----------------------------------|--------|-----------------|
| Bacteria | <i>Klebsiella pneumonia</i> | 4 | 16% |
| | <i>Eschericia coli</i> | 5 | 20% |
| | <i>Proteus vulgaris</i> | 3 | 12% |
| | <i>Staphylococcus epididermis</i> | 4 | 16% |
| Fungi | <i>Aspergillus niger</i> | 1 | 4% |
| | <i>Aspergillus flavus</i> | 1 | 4% |
| | <i>Aspergillus ochraceus</i> | 1 | 4% |
| | <i>Rhizopus nigrican</i> | 2 | 8% |
| | <i>Rhizopus oligosporus</i> | 1 | 4% |
| Yeast | <i>Saccharomyces cerevisiae</i> | 3 | 12% |
| Total | | | 100% |

Table 3: proximate composition of different samples of watermelon juice

| Parameters Determined | Fresh without sugar (FWMJWS) | Fresh with sugar (FWMJS) | With Sugar Refrigerated For 15 days (RWMJS) | Without Sugar Refrigerated For 15 days (RWMJWS) |
|-----------------------|------------------------------|--------------------------|---|---|
| % Crude protein | 0.71 | 0.67 | 0.70 | 0.68 |
| % carbohydrate | 98.69 | 98.77 | 99.19 | 99.24 |
| % fat | 0.041 | 0.05 | 0.03 | 0.02 |
| % crude fibre | 0.02 | 0.02 | 0.02 | 0.02 |
| % ash | 0.10 | 0.08 | 0.06 | 0.04 |
| % moisture content | 69.75 | 66.83 | 60.80 | 68.75 |

Table 4: Mineral composition (mg/100ml) of different samples of watermelon juice

| Parameters Determined | Fresh without sugar (FWMJWS) | Fresh with sugar (FWMJS) | With Sugar Refrigerated For 15 days(RWMJS) | Without Sugar Refrigerated For 15 days(RWMJWS) |
|-----------------------|------------------------------|--------------------------|--|--|
| Ca | 0.48 | 0.51 | 0.51 | 0.46 |
| K | 1.10 | 1.25 | 1.31 | 1.10 |
| Na | 0.021 | 0.025 | 0.026 | 0.020 |
| P | 0.147 | 0.153 | 0.156 | 0.147 |
| Fe | 0.24 | 0.27 | 0.30 | 0.27 |
| Zn | 0.010 | 0.014 | 0.018 | 0.015 |
| Mg | 0.011 | 0.012 | 0.012 | 0.010 |

Table 5: Sensory evaluation result of the different water melon juice samples

| Samples | Taste | Colour | Aroma | Overall acceptability |
|--|-----------|-----------|-----------|-----------------------|
| Fresh watermelon juice without sugar(FWMJWS) | 5.4±0.06b | 8.5±0.11d | 9.0±0.00d | 7.7±0.22c |
| Fresh watermelon juice with sugar(FWMJS) | 7.8±0.05d | 7.5±0.16c | 8.7±0.92c | 8.9±0.36d |
| Refrigerated watermelon juice without sugar stored for 15 days(RWMJWS) | 6.3±0.04c | 7.0±0.18a | 6.0±0.88a | 7±.0±0.44b |
| Refrigerated watermelon juice with sugar stored for 15 days(RWMJS) | 5.0±0.01a | 7.2±0.15b | 6.1±0.75b | 6.8±0.53a |

4. Discussion

From the study conducted on different samples of water melon juice, it was discovered that bacteria such as *Eschericia coli*, *Proteus vulgaris*, *Klebsiella sp*, *Staphylococcus epidermidis* and fungi such as *Aspergillus niger*, *Aspergillus flavus*, *A. ochraceus*, *Penicillium sp*, *Rhezopus sp*, *Fusarium spp* and *Sacchromyces cerevisiae* are contaminant implicated in the fresh water melon juice with sugar and without sugar refrigerated at $4 \pm 2^{\circ}\text{C}$ and stored for 15 days.

E. coli and *Klebsiella* species had been earlier reported to be isolated from water melon juice (Nwachuhwa et al., 2008) while Buchet (1995) reported that *E. coil* are found to contaminate fruit and vegetables. In addition, the ability of these organisms to survive in acidic juices at both ambient and refrigerated temp (4°C) and low pH value had been documented (Nestes et al., 2001).

The microbial load increased from day 1 to 15th day of storage in both sugar and non sugar fortified water melon juice. It was observed that the increase was higher in the water melon juice without sugar than the sugar fortified water melon juice sample. The occurrence might be due to the fortification of the water melon juice with sugar which serves as a curing agent for the juice (Mikey, 2012).

The dominance of *E. coli* in water melon juice samples observed in this study is an indication that *E. coli* might had invaded the juice from sources such as equipment, container, fruits skin and non-

compliance with hygienic rule/aseptic during juice extraction process.

The fresh water melon juice sample recorded the best proximate parameters. The lowest crude protein content observed in the stored water melon juice without sugar might be attributed to the storage effect under cool temperature. The microflora associated with the sample could have degraded the juice protein content under storage condition thereby resulting in low protein content. The observed high carbohydrate level in water melon juice fortified with sugar might be due to the fortification of the juice. The addition of sugar can even inhibit the microbial activities which can responsible for breakdown of carbohydrate for growth. The water melon juice without sugar refrigerated for 15 days reflected the lowest ash content. This occurrence can be adduced to reason such as the fermenting activities of the organisms (Omafuwbe et al., 2004). It could be inferred from this occurrence that a low concentration of phytate and oxalate content occurred with increased elemental minerals since these component are fractional constituents of ash (Bergheofer and Werzer 1986). Eka (1980) and Adebowale (1988) reported that low ash content can aid better growth performance and feed utilization efficiency and might also aid high amount of metabolisable energy, since ash is a measure of total inorganic matter in food.

The decrease in moisture content in water melon juice with sugar refrigerated for 15 days had been earlier documented by Yau et al. (2010). This observation might be caused by the fortification of the

juice with sugar inhibiting the growth of microorganisms which can utilize carbohydrate present in the water melon juice for respiration which create an unsuitable environment with low water activity for growth (David and Vermit 1989; Uzochukwu et al., 2000). High water content in foods has however been identified as a potential source of spoilage (Barber et al., 1988; Sanni and Ogbonna 1991).

The high content of calcium and potassium observed in water melon juice samples is important because calcium play significant role in cell regulation, maintainers of cell structure and cell differentiation process (Dominguez, 2004). Watermelon flesh contains 11 minerals and 19 vitamins, while the rind is dominant in vitamin C, providing 2 percent of the recommended daily amount (Lee 2011). Since watermelon has a high water content, its juice is a natural diuretic and may help to cleanse the kidneys and bladder of impurities (Lee 2011).

Francis (1995) stated that color influences other sensory characteristics, which subsequently account for food acceptability, choice, and preference. The sensory evaluation result revealed that the fresh melon juice with sugar recorded the highest scored in teams of taste and overall acceptability. Colour is the most obvious change that occurs in many fruits during storage (Yau et al., 2010). In addition, microorganisms such as bacteria, yeast and mould implicated in spoilage of fruits drink caused reduction in organoleptic and quality of the substance which makes them unacceptable to consumers (Curiale 1998; Jideani and Jideani 2006). Results from this study indicate that fresh water melon juice was more susceptible to microbial attack compared to water melon juice fortified with sugar and decreased in nutritional content was noted in the stored water melon juice.

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关键词: 弦论 符号动力学 环面 自旋 超对称

一、弦论实用符号动力学与毕氏定理

吴新忠博士说, “超弦”之弦, 其实不是直线或圆形轨道之弦, 而是 3 维空间中额外维中的振荡, 如同一个细圆柱的圆圈内部的振荡, 不是圆柱振荡成为波浪线。所以玻尔轨道理论不能叫量子弦。对! 这话是正确的, 目前西方的弦论就是这样定义的。

例如湖南科技出版社 2012 年 12 月出版的丘成桐、史蒂夫·纳迪斯的《大宇之形》一书, 是一本帮助我们解读弦论、弦学、弦图中的空间、维度、曲率等重要概念的一本难得的好书。它正是这样权威定义的。但这种权威定义的背后, 《大宇之形》一书在开篇就提到一个事实, 即我们说的商高定理或毕达哥拉斯定理 $a^2+b^2=c^2$ 的“弦”, 从我们常见的 3 维空间延伸到额外维空间, 仍然是适用的。

丘成桐教授的权威说法是: “在我看来, 毕氏定理是几何学最重要的叙述。它不但在计算二维平面的习题作业或是中学课堂上的三维题目是解题关键, 对于高深的高维数学, 如计算卡拉比空间中的距离, 或者解爱因斯坦的运动方程式, 也同等重要。毕氏定理的重要性源自于, 我们可以用它算出任何维度空间里, 任何两点之间的距离。而且, 正如我在本章一开始说的, 几何和距离有密切的关系, 这就是为什么毕氏定理几乎在一切几何问题里都是核心角色。”

丘成桐教授的学生刘克峰教授先生在《丘成桐与卡拉比猜想 60 年》一文中说, 王者到来, 从证明了卡拉比猜想那一刻起, 丘成桐一跃而成为一个伟大的数学领袖, 领导了几何学近四十年的辉煌, 他代表了数学与超弦理论的一个时代。但同在中国出生, 同在美国深造的高级学者, 王令隽和张操这

对朋友与丘成桐和刘克峰这对师生, 在对前沿科学的共识上针锋相对。前沿科学研究大数据如何处理? 王令隽和张操这对朋友, 与丘成桐和刘克峰这对师生, 产生的资料有很多差别。这种差别, 如果说弦理论有错的话, 也只是在上世纪后半叶, 西方有些创建弦论学术地位高得吓人的理论家们和其追随者们, 把弦论、弦学、弦图的学派研究变得日益狭隘化。

但正是这种狭隘化加上数学的生涩, 王令隽教授的指责是: 超弦理论由格林和施瓦兹于上世纪八十年代提出, 这一理论需要十维空间, 其中六维“额外维度”卷曲成尺寸在普朗克长度(10 的负 43 次方米)的线段。超弦理论的问题是, 它给不出任何一个可以为实验检验的物理量。同时, 至少有五种不同的超弦理论相互竞争; 虽然 1995 年威滕引进了第十一维空间, 于是“超弦”的线段就变成了“超膜”。威滕猜想这五种不同的十维超弦理论, 有可能是同一个十一维“超膜理论”的不同表现形式; 这对五种不同的超弦理论至少是一个安慰, 但理论物理不能仅仅是理论家们追求某种数学美, 或者方程式“大统一”的数学游戏。经典力学和牛顿的引力理论对机械工业、建筑业、天文学、空间科学提供了理论基础; 热力学为工业革命提供了理论基础; 经典电动力学为电力工业、无线电通信、电子技术、电脑和网络技术提供了理论基础。这也是物理学界和整个社会重视理论物理研究, 重视基础科学的原因。

联系现实世界, 问题并不在于王令隽说的弦论是玩弄数学美、数学游戏。丘成桐心里非常明白, 他说: 回归现实世界, 物理学的标准模型是有史以来最成功的理论之一, 其中描述了各种物质粒子。弦论当然也要描述粒子的性质, 因此问题是如何将

卡拉比-丘流形和粒子整合在一起。这与王令隽不同。王令隽以骂为主。王令隽是张操教授在美国留学时的老同学，张操给吴水清会长的信中说：王令隽是从中国科学院理论物理研究所1979年派往美国的留学生，以后长期在田纳西大学物理系当教授。

改革开放前中科院理论物理研究是我国层子模型研究的大本营，王令隽虽然不愿再谈他追随的层子研究，但从他给当前“走错了路”的物理学界指的回头的路，不难看出他的层子学术的本行。他说：将核力分为弱相互作用和强相互作用两个基本相互作用力是错误的。中子不是“夸克”的组合。最基本的粒子是质子和电子。而丘成桐说的回不了路指的是如何将卡拉比-丘流形和粒子整合在一起。在《大宇之形》一书225页中，丘成桐教授甚至说：“弦论学家与他们的数学同仁们（即使是具备几何分析高度洞识能力的数学家）花了几十年在卡拉比-丘国度探险后，却发现自己回不了家，回不到现实物理学的领域（也就是标准模型）”。我们把这称为《大宇之形》丘成桐猜想。对此，著名弦论镜公式提出者坎德拉斯说：“世上也许还有其他的可能性”。

因此如果还说差别，王令隽类似厚古薄今，丘成桐类似厚今薄古。那么以把自然界看成是一个统一的系统，围绕着这个自然界古今的自然科学也是一个统一的系统；不同只类似是“子系统”之间的不同。即用弦论、弦学、弦图来覆盖古今的自然科学研究，只是“子系统”之间的不同，没有“王者”，只有“和谐”。

即最早额外维研究的卡鲁扎和克林第五维微小圈路径的是弦论，标准模型联系杨-米尔斯方程最先研究的SU(2)规范场纤维丛路径的是弦论，威滕式弦论学家引入卡拉比-丘流形最核心的甜甜圈（二维环面）构造路径的是弦论。那么反之，用这种“弦学统一论”，就不难理解“弦论实用符号动力学”，是如何把数学生涩的卡拉比-丘流形和粒子整合在一起的。

1、符号动力学是研究符号动力系统的学科，源远流长，但作为动力学系统一般理论的一个分支，起源于动力系统的抽象拓扑理论的研究，而系统性研究则始于20世纪初。之后，符号动力学发展成为各态历经理论的核心，特别是20世纪30年代符号动力学用于变分学和微分几何中，从20世纪60年代起，逐渐在应用于一维映射的研究过程中得到发展和完善。斯梅尔研究的马蹄映射，就是一个可用符号动力系统能很好描述的典型。由于这种映射的迭代过程的特征，使它成为经典的混沌系统，因此符号动力系统也被视为混沌系统的原型；

进而还将符号动力系统的运动特征，作为混沌的描述并成为混沌的一种严格的数学定义。

再说符号动力学系统，是最简单的动力学系统，那里的“点”是序列，动力学是序列移位。这种系统的状态均可表示为有限个符号的无穷序列，而由任一状态点引出的运动轨道，可由表示该状态的无穷序列通过简单的移位规则来确定。许多复杂动态系统均可经过变换等价于这类系统，从而可通过对比较简单的符号动力系统的分析来研究一般动力系统的行为。这种方法特别在混沌等复杂行为的研究中占有重要地位。

继说实用符号动力学，是采用粗粒的定性方法，建立映射动力学和符号动力学间的联系，全局性地把握整体动力学。实用符号动力学是研究粒子动力系统动力学行为的一个重要工具，在生物学、化学、工程和物理学等研究领域提出的众多实际模型中，人们发现在刻画其复杂性时往往要涉及高维符号动力系统的理论与方法，特别是二维的对于同一符号空间下不同的连续映射，如果能找到同胚映射使其能建立拓扑共轭关系，则可实现这些映射的拓扑共轭分类。而属于同一类下的不同映射具有相同的动力学性质，可以看作是同一个系统。由此联系的弦论实用符号动力学，没有这么生涩。

2、弦论实用符号动力学在相同之中的不同，是不像王令隽教授一味指责弦论错了、弦论是间接实验、弦论没有用。其实弦实用符号动力学作为科学技术，是要发挥解放和发展生产力的作用，为中华民族的伟大复兴作出贡献。因此它坚定地指出目前流行的弦理论类似流行的符号动力学、实用符号动力学一样，没有错。实用方面，也和前沿科学的实际运用如量子物理和量子信息研究方面的量子点单光子源、高速度量子计算机；远距离量子通信的多光子纠缠态、量子存储和量子中继技术、量子密钥分发和量子态隐形传输等都能挂上钩。当然西方弦论数学上的生涩，也是不言而喻的。

例如弦理论中一个最基本的研究对象是卡拉比-丘流形。复三维的卡拉比-丘流形在弦理论中非常重要，它们代表着弦理论所需要的我们目前无法看到的四维时空之外的六维空间。弦理论断言，有了这神秘的六维空间，就有了万有理论。数学中所谓的流形，是指可以描述任何可以用局部平坦空间所覆盖的物体。在1976年，丘成桐先生证明了著名的卡拉比猜想，此猜想断言，任何第一陈类为零的特殊流形，叫作紧凯勒流形，都具有里奇平坦的度量，这一类流形现在被称为卡拉比-丘流形。而这里的陈类是以陈省身先生的名字命名的一种深刻的几何不变量，由陈先生在上世纪四十年代所发现。通过弦对偶，人们找到了实三维流形的拓扑几何与复三维流形的复几何之间的惊人联系。很多困

难的数学计算,在转化到实的三维空间后变得异常简单。而实三维和四维空间中的一些意想不到的联系,也通过复三维的卡拉比-丘流形被发现。

陈省身、杨振宁、丘成桐是三位伟大的华人科学家,他们作为中国人在弦论中的贡献,可以说是世界需要中国弦学,中国也需要融入世界。陈省身的陈-韦伊理论和陈-赛蒙斯理论,杨振宁的杨-米尔斯方程和杨-巴克斯特方程,丘成桐的卡拉比-丘流形,正质量猜想的证明等都有划时代的意义。弦论学家们已经成功地把陈-赛蒙斯、杨-米尔斯理论等,视同为弦理论的一部分。通过弦对偶,人们发现了许多与纽结不变量、黎曼面模空间等有关的惊人而美妙的数学公式。1986年弦论学家威滕,用陈-赛蒙斯理论构造出了纽结不变量,即著名的琼斯不变量。随后数学家用量子群重新构造了纽结与三维流形的不变量,这样陈-赛蒙斯不变量就可以通过量子群来构造。

3、陈省身、杨振宁、丘成桐等三位伟大的中国人及其他人的追随者扁整的数学物理没有错,但本文不是向大众介绍这类生涩的数学。而沿着自然界是统一系统,弦论、弦学、弦图既是古典今世自然科学一脉相承又是分散描述构成的统一系统的思想,在不改动欧几里德对点的定义的情况下,再补充三条公设建立的弦论符号动力学系统:

- (1) 圈与点并存且相互依存。
- (2) 圈比点更基本。
- (3) 物质存在有向自己内部作运动的空间属性。

这是什么意思?丘成桐教授说,毕氏定理我说是“相传”出自于他,仿佛对定理的著作权有所怀疑,幸运的是,欧几里德迥异于毕达哥拉斯,身后留下几何《原本》。欧几里德在这部巨著里所建立的,不只是几何学,而是一切数学的基础,它严格遵守了一种现今称为欧几里德的方法。这里再以毕氏定理为例,据我国《周髀算经》卷上最早记载,约公元前1066年的西周开国时期,周公与大夫商高讨论勾股测量对话,就提到勾股定理的特例“弦图”用于工程的测量。勾股定理是初等几何著名定理之一,指若一直角形的两直角边为 a , b ,斜边为 c ,则有 $a^2+b^2=c^2$,用几何的形式来解释,那就是直角三角形直角边上的两个正方形的面积和等于斜边上正方形的面积。

因中国古代称直角三角形的直角边为勾和股,斜边为弦,故此定理称为勾股定理。但数学史上普遍认为勾股定理是毕达哥拉斯(约公元前580~公元前500年)首先提出的,所以很多数学书上把此定理称为毕达哥拉斯定理。实际在毕达哥拉斯之前,除我国之外,古代的埃及人、巴比伦人,甚至希腊人,都已经知道了勾股定理。因为中国在商高

时代(公元前1100年)就已经知道“勾三股四弦五”的关系,这远早于毕达哥拉斯,因此有人主张毕氏定理应该称为商高定理。毕达哥拉斯曾提一组勾股数的正整数解: $a=2n+1$, $b=2n^2+2n$, $c=2n^2+2n+1$,其特点是斜边与其中一股的差为1。柏拉图也给了另一组公式: $a=2n$, $b=n^2-1$, $c=n^2+1$,此时斜边与其中一股之差为2。但它们都不是方程式 $a^2+b^2=c^2$ 的所有解。全部解的公式为: $a=m^2-n^2$, $b=2mn$, $c=m^2+n^2$,其中 m , n 是互质且一奇一偶的任意正整数,且 $m>n$ 。即勾股数又称商高数,它有无数组,这是有一定规律的。严格遵守的推理证明如下:三角形ABC是为直角三角形,

$$\begin{aligned} \because a^2+b^2 &= (m^2-n^2)^2+4m^2n^2 \\ &= m^4-2m^2n^2+n^4+4m^2n^2 = m^4+2m^2n^2 \\ &+n^4 = (m^2+n^2)^2 = c^2 \\ \therefore \text{三角形ABC是为直角三角形, } c \text{ 为斜边。} \end{aligned}$$

二、弦论实用符号动力学与自旋结构

欧几里德对点的定义众所周知,但为什么还要在此之下增加三条公设呢?

原因是所谓“超弦”之弦“不是直线或圆形轨道之弦,而是3维空间中额外维中的振荡,如同一个细圆柱的圆圈内部的振荡,不是圆柱振荡成为波浪线”之说,在西方的弦论及其追随者中是混乱的。所以我们要把约公元前1100年的商高时代的商高定理或后来的毕达哥拉斯定理 $a^2+b^2=c^2$,与今天的弦论、弦学、弦图紧紧地联系在一起。

1、上海科技教育出版社2008年出版的吴新忠博士等翻译的曹天予教授的《20世纪场论的概念发展》一书,讲奇点有两种智慧:一是环面没有奇点。这类似亏格。甜甜圈的环面有一个孔洞,亏格为1;球面没有孔洞,亏格为0;反之,球面上有2个奇点,而环面上没有奇点。二是环面那个孔洞的中心是奇点。但丘成桐的《大宇之形》并不受此智慧限制,他把微积分中不光滑不连续的直线拐点,也看作是奇点。说明各人研究的子系统不同,一种定义或公设在某种严格的意义上,也是可扩容放开一些。

2、西方弦论、弦学、弦图讲的振动与自旋没有分开,例如湖南科技出版社2012年出版的格林的《宇宙的结构》一书第380页图12.4最初的几种振动模式,画的就是振荡成为波浪线式的振动。这种情况即使在圆圈式的曲线上,也是能映射一个细圆柱的切面的圆周边圈线上的振荡,和圆柱整长方向简化为细线的波浪线振荡的。分设成三个子系统各自去表述,圆周边圈线上的自旋与振动可像蒋迅莫比乌斯齿轮链传动。

1) 公设增设的第1条(1)圈与点并存且相互依存,还可对应闭弦和开弦。由此的杆线弦及试管

弦、管线弦及套管弦等 4 种结构对应作纤维看，也是并存且相互依存的。再映射暗物质和暗能量作的超伴子或场粒子等，联系运用桶、流体、搅拌棒以及泰勒桶、泰勒涡柱，泰勒球、绕流球等作大量子论计算，可解答两暗的定量分布。

继此来分析西方的弦论、弦学、弦图的振动模式和自旋模式，有含混的地方，还有弦的振动模式在圆周边圈线上的振荡次数，可以从 1 到无穷多。所以格林也承认将弦的振动模式与已知粒子对应起来，的确并非易事。这也类似卡拉比-丘流形的洞孔，可以从 1 到无穷多，丘成桐也承认将弦的卡拉比-丘流形模式与已知粒子对流起来，也的确并非易事。其次，弦论实用符号动力学增设的第 1 条

(1) 圈与点并存且相互依存，还可以把弦的振动模式，看成类似卡西米尔效应的平板振荡类型；那么约公元前 360 年古希腊哲人柏拉图在《蒂迈欧斯篇》中着迷的“柏拉图立体”的五种正多面体，也可以和今天的弦论、弦学、弦图紧紧地联系在一起。卡西米尔平板振荡效应在量子领域也是成立的。以正立方体的三对“平板”作参照，建立的量子色动化学，为实验检验弦论、弦学、弦图打开了大门。如果把柏拉图太阳系模型式的正多面体的“面”更换为“洞”，即亏格，实际正多面体就成为“X”链式弦图质量谱公式中的量子数。即也许和柏拉图正多面体的孔、边、角数相关。

2) 公设增设的第 3 条 (3) 物质存在有向自己内部作运动的空间属性，可在数学和物理学的各个层面，与联系弦论的额外维、扭缠、轨形拓扑、卡拉比-丘流形等进行对话。丘成桐教授说：棘手之处在于弯曲空间中，在流形上逐点移动时，每段切向量的测量在变；黎曼引入度规计算切向量的长度，二维情况度规是一个 2×2 矩阵， n 维情况度规是一个 $n \times n$ 矩阵，尽管如此它仍然极为依赖毕氏定理，只是把它推广到非欧几何的情况而已。可见勾股弦、玻尔轨道量子弦也适用弦论，而不是被排斥的。

由于非欧几何的时空，不再是之前我们所认为的局限和平坦的，这是将每一点展开之后都是一个 6 维的卡拉比-丘流形；即在我们所熟知的时空中每一点都隐藏着一个 6 维的卡拉比-丘流形，它的关键词是卡拉比-丘紧致化。这里的紧致化，不单纯是球面，更意味着是复杂的是缠结、扭缠、洞穿、轨形拓扑操作。可见第 3 条增设作为联系弦论、弦学、弦图的桥梁从来就不是单行的，你也永远不会对此感到乏味。

3) 摆平了振动和卡拉比-丘流形，再来说公设增设的第 2 条 (2) 圈比点更基本，这是弦论实用符号动力学的重型着眼处。它与卡鲁扎-克林第五维微小圈、卡拉比-丘流形弦论、杨-米尔斯方程

标准模型规范场等三者之间，搭配得天衣无缝，是因为环面被各子系统的数学家、物理学家玩弄、扁整等常常面目全非。丘成桐先生也不例外。

3、例如《大宇之形》中，对环面有多少改头换面的标准说法呢？丘成桐讲到数学家高斯的高斯曲率和内禀几何，谈环面是两个主曲率的乘积，这似乎提示量子曲率应该是高斯曲率类似的多元性，而不是“神曲”说的只有一种曲率打天下。

1) 亏格为 0、1、2、3... 的曲面，亏格指的是其中的洞数。

2) 《大宇之形》后记，丘成桐说是要“每天吃个甜甜圈，想想卡拉比-丘流形”。3) 卡鲁扎-克林“多出”的一个隐藏维度，是开科学严格研究额外维的先河。

4) 一个甜甜圈形的曲面可以是完全“平坦”的高斯曲率为 0，因为可以把一张纸卷成筒状，然后再把纸筒的两端接起来。这种操作也叫轨形拓扑；也如莫比乌斯带等。

5) 曲线缩短流，即把不自交的封闭曲线变成圆，且不会产生缠绕或打结。

6) 普拉托问题，原始的是以简单封闭曲线为边界的曲面。还如拂落转换等。

7) 第一陈氏类是 0，指环面的流动没有奇点。还有凯勒度量、非凯勒度量等等。

8) 贝堤数区分拓扑类型，甜甜圈面的一维贝堤数是 2。

9) SYZ 猜想，二维卡拉比-丘流形是环面，构成环面的子流形是一圈圈圆。反之，整个空间（即环面）则是这些圆的联集。其实这说的就是线旋。

10) 通量场用力线思考，像磁力线一样，弦论的通量场力线朝向的是不可见的六维紧致内在空间。其实这也说的就是线旋。等等，不是很专业的高级学者很难懂。

4、从弦论实用符号动力学的角度看，以上对环面的研究都很有深度，是搞专业的人所必须具备的知识。众所周知环面的特点是对称；但它如能作自旋，更有超对称性，这事很少有人知道。自旋联系数学的群论，是杨-米尔斯方程规范场到标准模型搞出所有基本粒子的必经之路。群论的数学虽不是很复杂，但对大学文化以下的人来说，还是有点生涩。群论的符号动力学或实用符号动力学，最基本的类似排列组合，这是大学文化以下的人都比较熟悉的，也较直观好验证。下面的弦论实用符号动力学，就是对大学文化以下的人都比较熟悉、直观，好验证的方法，去学基本粒子物理学之路。

1) 人类创造了各式各样的方程，也创造了各式各样的解法，例如 20 世纪人类在社会实践和对自然科学的研究，建立了多种的数学方程和解法，真可谓走进了方程村，走进了方程林。其中著名的

牛顿力学方程、麦克斯韦电磁场方程、爱因斯坦广义相对论方程、薛定谔量子力学方程、杨振宁规范方程，以及大统一方程、超大统一方程、超弦方程和混沌、孤波、分形等一类非线性科学方程，都涉及能相和形相的统一问题。而能相与形相的统一，又在于要找到统一的相图，而环面正是它们的首要之一。

各式各样的方程，各式各样的解法，它们的全域数学性，也都体现了一种时间的多环路或空间的多环路。事物也就是这种空间多环路和时间多环路对称破缺的表现。反之，从这种多时空环路出发，也就可以发现统一各式各样方程和解法的端倪。如果数学本身是一种物理简并，解题方法、手段、规则也是一种简并，那么即使各种各样物体的形状千差万别，它们的能相的简并模式，也都可以归结为是类圈体自旋的环面或极限环的分岔、周期、倍周期、准周期、拟周期、拉伸、压缩、折叠等张力所决定。

这里涉及到重新认识能相和形相的虚与实、有与无问题。一般来说，实的东西能以形状、图像描述，但虚的东西并不是一定不存在，而是指难以描述它的形状、图像，只能用变换、代换的图相、模型描述。例如人体与思维，在一段时间，某人的形态不会有太大的变化，但思维却是多种多样的，难以用图像描述，但总会是和人类社会实践活动多环路有关，因此总可以归入多环路的某些方面。类此，数学方程也是一种虚与实结合的模式、图相表达；特别是对于一些轨迹、能线、力线信息的演化方程，更能进一步转化为一种多环路的统一图相、模式来加以理解，即类似于思维的多环路时空描述。

这不奇怪，因为各式各样能描述事物形态、能态的数学方程，本身就来自人的思维，人类思维的花朵是与多环路相通的；当然也不是所有思维表达的数学模型，都是多环路的，它们都还必须进行细致的数学定位。但多环路确实有很宽的统一性，作为多环路的生成元，从点的“势阱”、“势垒”的拓扑性出发，圈与点都是必备选择的，就类似虚与实、有与无的二相一样。然而从牛顿力学、相对论、量子力学建立以来，到今天的非线性科学，虽然发展和完善了很多数学工具，但都没有捅破能与形如何统一这一点。它们虽然也涉及到了圈圈、点点的许多方面，精细到了圈圈、点点的许多方面，但都没有把自旋像笛卡儿用三个直角坐标解构或建构空间那样，用面旋、体旋、线旋来解构或建构。

因此当代科学仍面临有补遗、补漏或补正的任务，即当代科学中正确的东西，我们应当继承和发扬；当代科学中还没有的东西，或不准确的东西，要进行补遗、补漏或补正。其次，物质是可以联系具像而能伸发性的客体。物质存在有向自己内部作

运动的空间属性，这实际是指物质并不存在向自己内部作运动的先验约束条件；我们目前观察到的那些约束，仅是物质在运动、演化过程中才产生的。并且用物质存在有向自己内部作运动的空间属性这条公设，也可以证明圈比点更基本，进而如果把它贯穿到数、理、化、天、地、生等各门科学领域，还可以得出很多新奇的结论和潜在的应用性。

例如，对自旋的解构或建构可注意到一种自然全息：锅心沸水向四周的翻滚对流；地球磁场北极出南极进的磁力线转动；池塘水面旋涡向下陷落在四周升起的这类现象，如果把它们缩影抽象在一个点上，它类似粗实线段轴心转动再将两端接合的旋转。这种原始物理的认识加上对称概念，使我们对自旋、自转、转动有了语义学上的区分，设旋转围绕的轴线或圆心，分别称转轴或转点，现给予定义：

(1) 自旋：在转轴或转点两边存在同时对称的动点，且轨迹是重叠的圆圈并能同时组织起旋转面的旋转。如地球的自转和地球的磁场北极出南极进的磁力线转动

(2) 自转：在转轴或转点的两边可以有或没有同时对称的动点，但其轨迹都不是重叠的圆圈也不能同时组织起旋转面的旋转。如转轴偏离沿垂直线的地陀螺或迴转仪，一端或中点不动，另一端或两端作圆圈运动的进动，以及吊着的物体一端不动，另一端连同整体作圆锥面转动。

(3) 转动：可以有或没有转轴或转点，没有同时存在对称的动点，也不能同时组织起旋转面，但动点轨迹是封闭的曲线的旋转。如地球绕太阳作公转运动。

2) 根据上述自旋的定义，类似圈态的客体我们定义为类圈体，那么类圈体应存在三种自旋，现给予定义，并设定弦论实用动力学符号：

面旋(A、a)指类圈体绕垂直于圈面中心的轴线作旋转。如车轮绕轴的旋转。

体旋(B、b)指类圈体绕圈面内的轴线作旋转。如拨浪鼓绕手柄的旋转。

线旋(G、g；E、e；H、h)指类圈体绕圈体内中心圈线作旋转。如地球磁场北极出南极进的磁力线转动。线旋一般不常见，如固体的表面肉眼不能看见分子、原子、电子等微轻粒子的运动，所以它能联系额外维度和紧致化。

由此线旋还要分平凡线旋(G、g)和不平凡线旋(E、e；H、h)。

不平凡线旋是指绕线旋轴圈至少存在一个环绕数的涡线旋转，如莫比乌斯体或莫比乌斯带形状。同时不平凡线旋还要分左斜(E、e)、右斜(H、h)。因此不平凡线旋和平凡线旋又统称不分明自旋。反之，面旋和体旋称为分明自旋。

三、实用符号动力学整合粒子与对称

1、杨-米尔斯方程规范场到标准模型搞基本粒子要用到类似的黎曼度规，卡拉比-丘流形到弦论搞基本粒子也要用到类似的黎曼度规。原因伟大的数学家黎曼 1854 年创立的黎曼几何，60 年后被爱因斯坦推导到了广义相对论，用来解释宇宙的创生及其演化。130 年后被超弦学家推导到了十维几何，用来企图统一物理的所有定律。此外，黎曼的两大成果——黎曼度规张量和黎曼切口也给三旋研究以巨大的启示，现先来讲黎曼度规引发的三旋符号度规。

1) 黎曼度规的秘密在于把空间拆成一些矩形块，每一个矩形块与一种不同的力相对应。用这种方法，通过把各种自然力安排成像拼图板块一样的度规张量就能描述它们了。这是用高维空间统一自然规律的一种数学表达。三旋吸收了黎曼这一思想而又不同的地方是：三旋从可观测的世界看到了众多的物体或系统，可以分解为动力学部分的能相 Ω 和非动力学部分的形相 ϕ ； Ω 类似不同的力， ϕ 类似每一个矩形块； ϕ 不但可以同 Ω 相对应，而且如果 ϕ 的形态选择得足够的“黑”，还可以使 ϕ 与 Ω 同一。

俗话说：万物有形，万物有能，万物有灵。如果有足够“黑”的度规，就可以使三者同一，达到能形耦合，能形虽各有频率，也可能形交换，能形变换，即会有能化形，形化能的情况出现。这如数学发现的勾股弦论，即： $a^2+b^2=c^2$ ，在三维空间中它表述为立方体中相邻三边的平方和等于对角线的平方，即 $a^2+b^2+c^2=d^2$ 。黎曼从著名的勾股弦论出发，建立古今世宏观微观统一的弦论，把这个公式推广到 n 维中的超立方体的对角线：设一个 n 维立方体，若 a, b, c, ... 是这个“超立方体”的边长，且 z 是这个“超立方体”的对角线长度，则 $a^2+b^2+c^2+d^2+\dots=z^2$ 。

即虽然我们头脑中不能想象出一个 n 维立方体，但是却很容易写出它的边和对角线的关系的公

面旋.....体旋.....平凡线旋.....左不平凡线旋.....右不平凡线旋
 正反.....正反.....正、反.....正、反.....正、反
 A、aB、b.....G、g..... E、e.....H、h

 A: AB.....
 a: aB.....
 B:
 b: Ab、ab.....

 G: AG、BG...aG、bG....ABG、AbG、aBG、abG
 g: Ag、Bg、ag、bg.....ABg、Abg、aBg、abg
 E: AE、BE、aE、bE.....ABE、AbE、aBE、abE

式。类圈体的三旋虽然难于做出实体模型，但广东省计算机专家邱嘉文先生博客已为我们做出了三旋动画视频。黎曼认为空间既可以是平坦的，也可以是弯曲的。如果是平坦的，那么两点之间直线最短，平行线永不相交，三角形三内角之和等于 180 度。但推导到具有“正曲率”像皮球那样的球面时，这些面上的平行线就会相交，而且三角形的三个内角之和可以超过 180 度。同时曲面也可以有“负曲率”，如马鞍形的或喇叭形的表面，在这些面上，三角形三内角之和小于 180 度。

2) 如果用类似黎曼的想象力来看三旋，我们会首先想到像法拉弟看到的电磁场。电磁场是占有一个三维空间域，在空间任何一点，麦克斯韦方程就是一组描述这一点磁力线或电力线的数。而黎曼是将这组数用来描述空间在这一点被挠曲或弯曲的程度。这个数组被称为黎曼度规张量。在四维空间中每一点的度规张量需要 16 个数来描述。

- $g_{11} g_{12} g_{13} g_{14}$
- $g_{21} g_{22} g_{23} g_{24}$
- $g_{31} g_{32} g_{33} g_{34}$
- $g_{41} g_{42} g_{43} g_{44}$

这些数字可以排成 4x4 的方阵，这些数中的 6 个实际上是多余的，因此说度规张量是 10 个独立的数。四维空间黎曼度规张量矩阵只描述了中性的点，而三旋是包括了点的阴性与阳性的 ϕ 和 Ω 。如果用类似黎曼度规符号建构三旋度规，根据排列组合和不相容原理，三旋可以构成三代共 62 种自旋状态，即需要在每一点引进 62 个“数”。而三旋的静态是 10 个 (A、a; B、b; G、g; E、e; H、h)，它们类似卡拉比-丘流形弦论的需要十维空间，或 10 个维度或维数；其中六维 (G、g; E、e; H、h) 代表卷曲成紧致化的额外维度的线段，可以包容在 10x10 的方阵中。为便于分类和分析共性，我们采用弦论实用符号动力学的统一给予符号刻划的方法，先来看它们的对称与超对称联系：

e: Ae、Be、aE、bE.....ABe、Abe、aBe、abe
 H: AH、BH、aH、bH... ABH、AbH、aBH、abH
 h: Ah、Bh、ah、bh.....ABh、Abh、aBh、abh

2、以上的弦论实用符号动力学三旋符号排列分类，还可以单动态 A、a；B、b；G、g；E、e；H、h 再作 10×10 的矩阵的对角线排列，这里就不具体作了。总之，从以上的环面三旋度规令人惊讶是，它的含线旋的三元排列组合符号数，完全对应标准模型规范场理论和实验检验得出的除质量希克斯玻色子外的 24 种基本粒子，即 6 种夸克， e 、 μ 、 τ 等 3 种轻子， ν_e 、 ν_μ 、 ν_τ 等 3 种中微子，8 种胶子，1 种光子，1 种引力子，1 种玻色子 Z^0 ，以及 W^+ 和 W^- 玻色子合并为玻色子的 W^\pm 。而含线旋的二元排列组合符号数，也是 24 种，也正符合标准模型规范场理论认为这 24 种基本粒子，都有超伴粒子的观点。由于环面的线旋的引入，以上弦论实用符号动力学具有三大特点：

1) 24 种含线旋的三元排列组合符号，代表的额外维度和紧致化非常强烈，原因线旋是含有孔洞的通量场，用力线或纤维丛思考，按此三元排列组合符号作自旋运动，它们的力线或纤维丛洞穿环面中心孔的缠绕、纽缠，在自然的自旋的一个周期过程中，就已经非常自然地造就出卡拉比-丘流形，这就解决了生成卡拉比-丘流形的操作问题。

2) 同时也解决了原先生成卡拉比-丘流形有无限多的问题，如原先有上万种。

3) 为了研究和计量，这 24 种含线旋的三元排列组合符号自然自旋生成的卡拉比-丘流形，可以从它们的生成元环面的大圆上任意取一“点”作标记考察，这个点的轨迹实际成为计量这个特定的卡拉比-丘流形上的流线，而且这个特定流线还是可以转换为纽结拓扑理论来计算，即可以用琼斯纽结多项式来描述。同理，含线旋的二元排列组合符号数自然自旋生成的 24 种卡拉比-丘流形，也是如此，而且琼斯纽结多项式更简单些。而不含线旋的二元排列组合符号的那 4 种卡拉比-丘流形，也可具有额外维度和紧致化，但它们由于没有力线或纤维丛洞穿环面中心孔的缠绕、纽缠，所以较易开放或发散。

4、由于线旋能联系额外维度和紧致化，也许这正是它们和代表质量希克斯玻色子的区别，即希克斯粒子不是没有自旋而是没有线旋。那么希克斯粒子到底是多少种呢？

1) 面旋(A、a)和体旋(B、b)实际代表的是我们平常认知的三维空间和一维的时间，这也是质量能出现在三维空间或四维时空的道理。如果质量

希克斯玻色子也有超伴粒子的话，那么一种就是二个，二种就是四个。在弦论实用符号动力学的三旋符号排列分类中，除开含线旋的二元排列组合符号数外的只剩下四个，说明弦论实用符号动力学的观点认为质量希克斯玻色子是 2 个或 2 种，那么实验检验得出质量希克斯玻色子是多少个或多少种呢？

2) 欧洲核子研究中心简称欧核中心(CERN)，是在联合国教科文组织倡导下创立于 1954 年 9 月的一个规模最大的国际性的实验组织，其宗旨是供欧洲国家在纯科学性和基础性的亚核研究及相关研究领域进行合作，有关实验及理论研究成果将公开发表以供更广泛的利用。2012 年 7 月 4 日欧核中心发布它的大型强子对撞机(LHC)的两个实验合作组 ATLAS(超环面仪器)和 CMS(紧凑缪子线圈)分别发现了两种疑似希格斯玻色子或称“上帝粒子”的新粒子：即 CMS 探测器探测到的质量为 $125.3 \pm 0.6 \text{ GeV}$ 的新粒子，ATLAS 探测到的质量为 126.5 GeV 的新粒子。说明这实际已经证明了弦论实用符号动力学的观点。因为弦论实用符号动力学的观点不是今天才提出来的。

3) 早在上世纪 60 年代弦论实用符号动力学三旋符号排列分类已经在我国出现，但由于它和当年的层子模型潮流不相同，这种众所周知的原因直推迟到上世纪 80 年代初的改革开放科学春天的到来，才在北京 1982 年的《潜科学》杂志第 3 期，以《自然全息律》为题发表公开圈态自旋面旋和线旋等研究；也由此能在 1983 年 9 月内蒙古集宁市召开的首届全国生物全息律研讨会上，公开我们的研究历程。半个世纪过去，弦论实用符号动力学作为统一自旋粒子与超对称之桥已见雏形。

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Queueing Theory in Practice

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Abstract: This paper will take a brief look into the Stochastic modeling of queueing theory along with examples of the models and applications of their use. The goal of the paper is to provide the reader with enough background in order to properly model a basic queueing system into one of the categories we will look at, when possible.

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Keywords: Stochastic Process, Exponential Distribution, Poisson Process

Queueing theory is considered to be a branch of operations research. It constitutes a powerful tool in modelling and performance analysis of many complex systems, such as computer networks, telecommunication systems, call centres, flexible manufacturing systems and service systems. Recently, the queueing theory including queueing systems and networks arouses mathematicians', engineers' and economics interests.

Queueing theory evolved originally out of an investigation of problems dealing with the design of telephone systems. Now, some 70 years later, we are witnessing a tremendous accumulation of theoretical results for "idealized" systems that apparently have not been as effective in dealing with other types of real-life problems. Queueing theory differs from other mathematical techniques of Operations Research in that it does not deal with optimization models. Rather, it utilizes mathematical analysis to determine the system's measures of effectiveness such as the expected waiting time per customer and the facility's percentage of idle time. These measures are then used as data in the context of an optimization (cost) model for determining the system's capacity. The obstacles in applying queueing theory to practical problems occur both in modeling the system mathematically and in determining its optimum design parameters. This paper identifies the areas of application in terms of their amenability to analysis by queueing theory, and provides suggestions that can enhance the applicability of queueing models in real life.

A stochastic process is a family of random variables X where t is a parameter running over a suitable index set T . (Where convenient, we will write $X(t)$ instead of X .) In a common situation, the index t corresponds to discrete units of time, and the index set is $T = \{0, 1, 2, \dots\}$. In this case, X , might represent the outcomes at successive tosses of a coin, repeated responses of a subject in a learning experiment, or successive observations of some characteristics of a certain population. Stochastic processes for which $T =$

$[0, c)$ are particularly important in applications. Here t often represents time, but different situations also frequently arise. For example, t may represent distance from an arbitrary origin, and X , may count the number of defects in the interval $(0, t]$ along a thread, or the number of cars in the interval $(0, t]$ along a highway. Stochastic processes are distinguished by their state space, or the range of possible values for the random variables X by their index set T , and by the dependence relations among the random variables X .

Events and Probabilities

Let A and B be events. The event that at least one of A or B occurs is called the union of A and B and is written $A \cup B$; the event that both occur is called the intersection of A and B and is written $A \cap B$, or simply AB . This notation extends to finite and countable sequences of events. Given events A_1, A_2, \dots , the event that at least one occurs is written $A_1 \cup A_2 \cup \dots \cup_{i=1} A_i$ the event that all occur is written $A_1 \cap A_2 \cap \dots \cap_{i=1} A_i$. The probability of an event A is written $P_r(A)$. The certain event, denoted by Ω , always occurs, and $P_r(\Omega) = 1$. The impossible event, denoted by ϕ , never occurs, and $P_r(\phi) = 0$. It is always the case that $0 \leq P_r(A) \leq 1$ for any event A .

Events A, B are said to be disjoint if $A \cap B = \phi$; that is, if A and B cannot both occur. For disjoint events A, B we have the addition law $P_r(A \cup B) = P_r(A) + P_r(B)$. A stronger form of the addition law is as follows: Let A_1, A_2, \dots , be events with A_i ; and A_j ; disjoint whenever $i \neq j$.

Then $P_r \left(\bigcup_{i=1}^{\infty} A_i \right) = \sum_{i=1}^{\infty} P_r (A_i)$. The addition law

leads directly to the law of total probability:

Random Variables

Most of the time we adhere to the convention of using capital letters such as X, Y, Z to denote random variables, and lowercase letters such as x, y, z for real numbers. The expression $(X \leq x)$ is the event that the random variable X assumes a value that is less than or equal to the real number x. This event may or may not occur, depending on the outcome of the experiment or phenomenon that determines the value for the random variable X. The probability that the event occurs is written $\Pr \{X \leq x\}$. Allowing x to vary, this probability defines a function

$$F(x) = P_r(X \leq x), \quad -\infty < x < +\infty$$

called the distribution function of the random variable X.

Exponential, Moments and Poisson Probability Distributions:

The *mean* (or the expectation) of a discrete random variable is defined by

$$E(X) = \sum nP(x)$$

Equivalently, the mean of a continuous random variable is defined by

$$E(X) = \int_{-\infty}^{\infty} x f(x) dx$$

The exponential distribution with parameter λ is given by $\lambda e^{-\lambda t}$ for $t > 0$. If T is a random variable that represents interarrival times with the exponential distribution, then $P(T \leq t) = 1 - e^{-\lambda t}$ and $P(T > t) = e^{-\lambda t}$.

This distribution lends itself well to modeling customer interarrival times or service times for a number of reasons. The first is the fact that the exponential function is a strictly decreasing function of t. This means that after an arrival has occurred, the amount of waiting time until the next arrival is more likely to be small than large. Another important property of the exponential distribution is what is known as the no-memory property. The no-memory property suggests that the time until the next arrival will never depend on how much time has already passed. This makes intuitive sense for a model where we're measuring customer arrivals because the

customers' actions are clearly independent of one another.

The Input Process:

To begin modeling the input process, we define t_i as the time when the *i*th customer arrives. For all $i \geq 1$, we define $T_i = t_{i+1} - t_i$ to be the *i*th interarrival time. We also assume that all T_i 's are independent, continuous random variables, which we represent by the random variable A with probability density $a(t)$. Typically, A is chosen to have an exponential probability distribution with parameter λ defined as the arrival rate, that is to say, $a(t) = \lambda e^{-\lambda t}$.

The Output Process:

Much like the input process, we start analysis of the output process by assuming that service times of different customers are independent random variables represented by the random variable S with probability density $s(t) = \mu e^{-\mu t}$. We also define μ as the service rate, with units of customers per hour. Ideally, the output process can also be modeled as an exponential random variable, as it makes calculation much simpler.

Birth-Death Processes:

We define the number of people located in a queuing system, either waiting in line or in service, to be the state of the system at time t . At $t = 0$, the state of the system is going to be equal to the number of people initially in the system. The initial state of the system is noteworthy because it clearly affects the state at some future t . Knowing this, we can define $P_{ij}(t)$ as the probability that the state at time t will be j , given that the state at $t = 0$ was i . For a large t , $P_{ij}(t)$ will actually become independent of i and approach a limit π_j . This limit is known as the steady-state of state j .

Conclusion: This paper gives a general look at the queuing theory. Presented queuing With the knowledge of probability theory, input and output models, and birthdeath processes, it is possible to derive many different queuing models, including but not limited to the ones.

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欧核中心既发现上帝粒子又发现超对称 —— 非线性希格斯粒子数学讨论 (12)

王用道

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摘要: 粒子物理迎来革命时刻, 但21世纪的今天, 欧核中心发现了希格斯粒子和超对称, 却不敢承认它, 或许在相当长一段时间内也不敢承认它, 为什么?

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关键词: 电子 量子数 希格斯场 大量子弦论

光电效应是光波连续说和物质原子不连续说之间冲突的战场, 19世纪末20世纪初一批伟大的科学家, 如赫兹、密立根、普朗克、爱因斯坦等, 他们虽然已经亲自做出了伟大的科学发现, 如发现了革命性的量子数和光量子概念, 但都不敢承认或相当长的一段时间里不敢承认。这种事例同样发生在21世纪的今天: 欧核中心是世界上独一无二最大的高能物理研究机构, 使用的是世界上独一无二最大的高能粒子对撞设备, 做出了如今世界上独一无二的最大的科学发现, 发现了希格斯粒子和它的超对称, 但也不敢承认或许在相当长的一段时间里也不敢承认。

为什么? 我们有何依据说既发现上帝粒子又发现超对称? 且看以下分解。

一、电子粒子超对称的量子化之路

科学发达到今天, 要观察到希格斯粒子, 也来之不易, 或代价不菲。如欧洲核子研究中心简称欧核中心 (CERN), 它的粒子物理实验室中, 数千名研究人员与造价高达55亿美元的大型强子对撞机 (LHC) 的原子加速器相伴, 借助 ATLAS 和 CMS 两台巨型粒子探测器发现了希格斯粒子也没有勇气承认。这不奇怪, 重庆出版社2012年出版翻译的[英]曼吉特·库马尔的《量子理论》一书中, 就讲过类似的情况。

1、1887年赫兹在实验中首先无意中观察到了光电效应, 但对这个全新的现象, 他拿不出任何解释, 却错误的认为仅限于使用紫外光的情况。到1900年著名物理学家普朗克提出了伟大的量子解释, 但到1909年和1913年时, 他仍然认为, 量子之说只是在物质与辐射进行交换过程中才有必要; 包括所有电磁辐射, 并不是以量子构成的, 它只是在与物质交换能量的时候, 表现得像量子。

1) 1905年爱因斯坦虽然进一步提出了具体的光子解释, 但爱因斯坦本人在他的这篇论文

中, 也只是说光“表现得”它像由量子构成的一样。库马尔评论说, 这是因为爱因斯坦想表达的, 决不仅仅是一个“启发性的观点”, 他梦寐以求的是一个羽翼丰满的理论。所以到1922年他被授予迟来的1921年诺贝尔物理奖时, 虽然奖给他的是1905年的光子解释, 但授奖解说词是他关于光电效应描述的公式法则。这还是由于有密立根, 坚持不懈地用了10年功夫测试爱因斯坦1905年的那个光子解释所做的那些实验, 再想忽视爱因斯坦的光电方程的有效性已经变得很困难了。但密立根虽然用实验证实了光子解释, 然而到1923年他由此获得诺贝尔物理奖时, 在他自己得出的数据面前, 也不愿意接受作为其前提基础的光子和光子假说。他说这个方程所建立的物理理论基础, 是完全站不住脚的。

2) 同理, 即使2012年的诺贝尔物理奖, 授予希格斯和欧核中心因既发现上帝粒子又发现超对称, 那么欧核中心也会像如今一样犹豫: 不能确信既发现了上帝粒子又发现超对称的。因为这像伟大的科学家赫兹、密立根、普朗克、爱因斯坦, 像伟大的科学发现光子和光子一样, 在他们用实验证实希格斯场公式 $E=m^2h^2+Ah^4$ 得出的自己的数据面前, 也许他们仍然觉得希格斯在1964年表达的质量起源的希格斯场, 如希格斯海是通过施加“阻力”而速度减少来构成基本粒子的各种实现物质的质量的观点, 仅仅是一个“启发性的观点”, 而不是人们梦寐以求的是一个羽翼丰满的理论。事实也是这样, 自希格斯推出希格斯场理论的近50年来, 主流科学家们对希格斯场理论并没有多大改进, 连一个减少基本常数的物质族质量谱公式也没有搞出来; 和玻尔-卢瑟福的电子能级核式弦图模型影响相比, 是比不上的。甚至连伽莫夫也不如; 伽莫夫还能在卢瑟福“原子对撞机”类似的实验基础上, 搞出量子隧道效应理论。

3) 卢瑟福的“原子对撞机”是用 α 粒子探索原子的内部结构, 但在研究铀一类放射性物质的 α

衰变时，碰到一个问题： α 粒子是带两个正电荷的粒子，在距原子核中心 3×10^{-12} 厘米处，库仑力将形成一个高达 20MeV 的势垒，这个库仑势垒将阻止核内的任何 α 粒子向外射出，因为由计算得出的 α 粒子的能量，大大地小于这一势垒的高度。但是， α 粒子却能源源不断地从铀核发射出来，这怎么可能呢？这个卢瑟福觉得难以解释的现象，后来却被伽莫夫悟出了玄机：伽莫夫将这种微观世界的势垒穿透现象，叫做量子隧道效应。隧道效应成功地解释了 α 衰变，成为量子力学研究原子核的最早成就之一。而早在卢瑟福搞“原子对撞机”实验之初，卢瑟福和他的学生玻尔，就相继挖空心思地搞出核式弦图那样的电子行星般，绕核转动模型，和把围绕原子核运动的电子轨道半径能级，看成是只能取某些分立数值的角动量子化、量子数的理论。

2、退一步说，即使希格斯和欧核中心的科学家比得上像玻尔和卢瑟福一样的伟大和英明，但玻尔和卢瑟福最初的核式弦图的理论和模型，也是可以修正的。与此相比，难道希格斯和欧核中心的科学家，他们最初搞出的希格斯粒子理论和模型不可以修正？库马尔的书中讲述了前者的这个修正过程，他说的道理是：“需要是发明之母”。

1) 例如，玻尔的围绕原子核运动的电子轨道半径能级，只能取某些分立数值的角动量子化理论的原子模型，是利用被释放出来的 X 射线的频率来确定原子核中的电荷的。由此，1910 年索迪提出，从化学上无法区分的放射性元素，即他称的“同位素”，只是同一种元素的不同形式，应该归在元素周期表中的同一个格子里。但这种想法，与周期表中已有的元素组织排列规则相违。

因为，已有的元素是按照原子重量的升序排列的。其次，莫斯莱发现，从钙到锌之间每一种元素，随着所轰击的元素越来越重，所释放出来的 X 射线的频率也相应提高。由于每种元素都会产生出它自己独一无二的一组 X 射线光谱线，而且元素周期表中相邻元素之间的 X 射线光谱线都非常相近，以此为据，莫斯莱预测还应存在原子序数为 42、43、72 和 75 这几种尚未找到的元素。后来这四种元素都找到了。这说明玻尔的量子化原子的分立能级、分立轨道是光谱线来源的理论和模型还不完善。

2) 因为即使玻尔的量子化原子理论成功，但对不止一个电子的原子来说，它所提供的答案就不能与实验相符。只要有一条多出的新光谱线，即使引入某项新定的规则，也不能解释。即玻尔的量子数模型也要面对质疑，这就不用说希格斯和欧核中心科学家的希格斯质量模型，还没有一个量子数量子化的理论或图示，这难道不会面对质疑？

特别是 1892 年，经过改进的实验设备，显示氢元素光谱线中，红色的阿尔法线和蓝色的伽马线

等巴尔末线，都根本不是单线条。这两种线，每种都一分为二。这些线到底是不是真正的双线，那 20 多年中，一直悬而未决。

3) 但玻尔无法用他的量子化原子模型来解释上面那种一分为二的“精细结构”时，索末菲站出来修正了。他取消玻尔把电子限定为，只沿着原子核周围的环形轨道的限制，改为允许电子沿椭圆形轨道运动。由此，即从玻尔的圆对称，走到了被作为索末菲的椭圆超对称中的一个特殊类型，圆形电子轨道只是所有可能的量子化椭圆轨道中的一个亚类而已。由此看，玻尔模型中的对称量子数 n ，只是规定了一个稳定态，即一个允许的环形电子轨道，以及相应的能量层级。其中 n 的值，还决定了特定环形轨道的半径。但是要对于一个椭圆形进行定义，就需要两个数。

于是索末菲引入了 k 这个量子数，来对椭圆形轨道的形状进行量子化。在椭圆形轨道所有的形状中， k 决定了当 n 是某一个特定值时，都有哪些形状是可以有的。

3、但这时，索末菲的量子化量子数超对称的道路并没有完。在索末菲的超对称的量子化量子数模型中， n 只是主量子数，它决定 k 所能具有的各种值。例如，如果 $n=1$ ，那么 $k=1$ ；当 $n=2$ 时，则 $k=1$ 和 2；当 $n=3$ 时，则 $k=1$ 、2 和 3；在已知 n 的值情况下， k 就等于从 1 开始的每一个整数，直到并包括 n 本身的值。可见这下单个电子运动轨道的自由度有多么大。而且只是当 $n=k$ 时，它的轨道才永远都是正圆形。

1) 如此，氢原子处于 $n=2$ 的量子态时，它唯一的一个电子可以要么处于 $k=1$ 的轨道，要么处于 $k=2$ 的轨道。当 $n=3$ 的状态时，这个电子可以占据三种轨道中的任何一个：即 $n=3$ 且 $k=1$ ，椭圆； $n=3$ 且 $k=2$ ，椭圆； $n=3$ 且 $k=3$ ，正圆。由此联系欧洲大型强子对撞机里的瞄准仪的吸纳装置产生的粒子碎片雨，可想那里的各种夸克和希格斯粒子等等的各种基本粒子的运动轨迹，虽然多样，也是有量子化量子数的规律可循的。我们的网文《统一基本粒子系和原子系弦学之桥》里，用希格斯海巴拿马运河船闸-马蹄形链式量子数轨道弦图，就作过探讨。这后面再说。

总之，在玻尔模型中 $n=3$ 就只是一个正圆形轨道，但在索末菲修改过的超对称的量子化原子中，就有三种可允许的轨道。这些多出来的稳定态，也就可以解释巴尔末系列中光谱线一劈为二的现象。而且索末菲为了说明光谱线分裂问题，还借助沿椭圆轨道运动的电子朝原子核方向运行时，速度会提高，从而导致电子的质量增加一个非常小的能量变化。在 $n=2$ 的状态下， $k=1$ 和 $k=2$ 的两条轨道上的能量是不同的，因为 $k=1$ 是椭圆形，而 k

=2 则是正圆形的。能量的这点差别，就产生了两种能量层级，因此就有两条光谱线。而在玻尔的对称模型中，只预测出了其中的一个。

2) 但玻尔-索末菲的对称-超对称的量子化原子，还是不能解释下面的塞曼的磁场效应和斯塔克的电场效应等另外两个现象。

塞曼效应指 1897 年塞曼发现，在一个磁场中，单独一条光谱线分裂成了若干条不同的线或者部分；但一旦把磁场关掉，分裂现象就消失了。1913 年斯塔克又发现，当把原子放在电场中时，单独一条光谱线也分裂为好几条光谱线。玻尔-索末菲的对称-超对称的量子化原子理论不能解释的原因，是因为他们开初所想象的轨道，不论是正圆形的还是椭圆形的，都是铺在同一个平面上的。当索末菲后来试图解释塞曼效应时，他意识到，轨道的运行方向是一个至关重要的环节，但却被疏漏了。

在磁场中，电子可以选择更多的允许轨道，这些轨道都指向磁场的各个方向。于是索末菲引入他所称的“磁”量子数 m 来把那些轨道的方向进行量化。在已知一个主量子数 n 的值的条件下， m 的值只能在 $-n$ 到 n 的范围之内。例如 $n=2$ ，那么 m 就可以有如下几个值： $-2, -1, 0, 1, 2$ 。索末菲搞的这种对电子运行轨道方向的量子数，称作“空间量子化”，这也是一种超对称，并且于 5 年后的 1921 年通过实验得到确认。

3) 索末菲的超对称是不得已，才引入的两个新的量子数 k 和 m 的。由此有人也解释了斯塔克效应，认为它是由于存在电场，能量层级之间的间隔发生变化而产生的。这样一来，能态就是分别用三个量子数 n, k 和 m 在表示。由此联系希格斯场产生各种夸克的质量值的 6 个算式中，有 (1×1) 和 (1×1) 、 (1×2) 和 (1×2) 、 (1×1) 和 (1×2) 、 (2×5) 和 (2×2) 、 (2×3) 和 (4×4) 、 (3×3) 和 (3×4) 等量子化配对的超对称组合，也类似不得已而设置首部量子数 S 、尾部量子数 W 和生殖量子数 f 一样。希格斯粒子超对称量子化之路的这种不得已，也属“需要是发明之母”。

二、上帝粒子超对称的量子化之路

研究希格斯粒子的超对称，我们经历过从核式弦图到链式弦图的两个阶段。

吴新忠博士说，质量谱公式，有点像开普勒的柏拉图正多面体太阳系模型，其实是对称性的内在结合，但考虑动态细节，一般是行不通的；用各种粒子的实测质量去试探，很难确定其参数。而所谓真空撕裂，我不太相信是宇宙大爆炸初期希格斯粒子海洋的粒子跃迁，而是基本粒子内部尚未观察到的内禀空间的折叠突变过程，质量倾角，可能就是内部折叠的一些角度。粒子碰撞会改变某些粒子内禀空间的折叠方式，于是就观察到新粒子了。吴新

忠的争论，实际他没有看到我们求质量谱公式中的主量子数过程。

因为探讨希格斯场与质量起源，首先要说明的是，希格斯场生成各种夸克的质量，与夸克生成质子和中子等粒子的质量是不同的。这种不同，类似说你是人，但你是从你父母亲生出来的，与人是从猿变成来的不一样。这是两个层次。人从父母亲生出，指的是现代层次；类似宇宙起源大爆炸时的空间撕裂，是起源层次。

现代层次如《三旋理论初探》一书说：把质量看成图形的映像，联系黎曼切口平面摩擦撕裂映像的希格斯粒子，这种希格斯玻色子一旦产生，寿命会非常短，人们无法直接观察到，只能通过探测希格斯玻色子衰变成的其他粒子，间接获得其线索。

起源层次标准模型说得很明白：它说夸克是一个标准的点粒子，是不可再分的。它是有质量的，这在实验中已经发现了。如果要解释它的质量，就需要假设有希格斯粒子的存在。这个希格斯粒子实际上就是一种对世界如何生成的猜想，不是说它必须要存在。

假如夸克以下有更深层次的存在，那就不需要希格斯粒子了；如果它有下一层，那就有下一层粒子的质量和结合能，也就可以解释夸克的质量了。即假如夸克有下一层结构的话，就不需要希格斯粒子来提供能量了。现在理论认为，在宇宙大爆炸的时候存在希格斯场，产生的夸克与希格斯粒子相互作用，就获得了质量。有了质量后，才可以演变成现在这样的宇宙。这是需要希格斯粒子的。这实际说的是“有生于无”。因为空间是真空，本来是个“无”；如果是极小的 0 点，就是没有东西的。但实验证明空间能撕裂，只不过它要很高的能量。所以这实际是一种镜对称，即无限小，实际是配合着无限大，类似无限小分数的倒数。正是从这里开始把质量联系玻尔-卢瑟福的核式弦图的。

1、玻尔-卢瑟福的核式弦图求解光谱线公式，首先要解决主量子数 n 。联系质量谱公式的主量子数 N ，实际类似日本小林诚和益川敏英，基于卡比博的一次“分代”思想，而提出在强相互作用中存在有三次“分代”的思想。但我们中国的“三旋理论初探”研究，分类排出物质族基本粒子质量谱主量子数 $N=1, 2$ 和 3 ，不是基于或参照卡比博、小林诚和益川敏英的思想。众所周知，撕裂可联系断裂力学，有裂纹分类。

1) 断裂力学研究裂纹，可以使用材料力学、弹性力学、塑形力学的知识，分析裂纹如何形成、扩展以及如何发生断裂。这里因涉及夹杂等材料结构缺陷，裂纹应具有不确定性。以薄板材为例，按裂纹的一种几何分类方法，裂纹可抽象化分成深埋裂纹、表面裂纹和穿透裂纹等 3 类。但这其中的每

一类也很复杂。以穿透性裂纹为例，裂纹从板的左边到板的右边，它所受的又可以有很多种。如有上下张开撕裂的张开型裂纹；前后推开撕裂的滑开型裂纹；左右错位撕裂的撕开型裂纹等三种。

2) 张开型裂纹为 I 型裂纹、滑开型裂纹为 II 型裂纹、撕开型裂纹为 III 型裂纹是从通俗命名过度到了学术命名。即裂纹的分类：表面裂纹、深埋裂纹、穿透裂纹，是从裂纹发生的位置、几何形状上定义的，而 I 型，II 型，III 型是着重从受力特征上定义的。

这两种定义是从不同的角度对裂纹的分类；其次，I，II，III 型裂纹都是对穿透型裂纹而言的；再次，I 型裂纹是正应力破坏；II 型，III 型裂纹是剪应力破坏；但是 III 型裂纹的剪应力和 II 型裂纹剪应力方向不同，II 型裂纹平行于裂纹扩展方向，III 型裂纹则垂直于裂纹扩展方向。同样条件下，哪种裂纹的破坏性最强呢？

在工程实际中，结构的受力方式是非常复杂的，复合裂纹的情况也太多。然而联系质量起源，到底要裂纹虚拟什么？这里要裂纹虚拟的是弦，是能量、质量，是希格斯粒子，即裂纹弦其大小是质

量荷的大小。裂纹弦并不意味着单个粒子或单个作用，而是通过裂纹弦的不同的振动模式，表示粒子谱系列作用的统一。对于某种振动模式，这种振动模式可用诸如质量、自旋之类的各种量子数来刻画。裂纹弦的基本思想是每一种裂纹弦的振动模式，都携带有一组量子数，而这组量子数与某类可区分的基本粒子是相对应的。这样，我们就联系上夸克；而且从体会上面的 I、II、III 型裂纹弦的划分中，也可逐步来设想夸克粒子质量谱计算公式的分代等问题。

3) 我们先是以玻尔-卢瑟福的核式弦图的三个同心圆来图示夸克质量谱系列的一组裂纹弦，这类似求解光谱线公式和复合裂纹弦应力断裂公式的相结合一样。这里希格斯海也像能量层级的弦梯；这架希格斯弦海梯子的最低一个梯级为 $n=1$ ，这时电子处于第一轨道弦，这就是最低能量的量子弦态。对氢原子来说，最低能量希格斯梯海能量层级态称为“基态”。如果电子占据着除 $n=1$ 以外的任何其他轨道弦，那么这个原子就被称为处于“激发态”。这就是：

$$\lambda = M \quad (1-1)$$

$$\lambda = b[m^2/(m^2 - n^2)] = b[m^2/(m^2 - n^2)] \operatorname{tg} \theta = b[m^2/(m^2 - n^2)] \operatorname{tg} 45^\circ \quad (1-2)$$

$$\lambda = b[m^2/(m^2 - n^2)] = b[m^2/(m^2 - n^2)] \operatorname{tg} 45^\circ = M \quad (1-3)$$

现在如果夸克质量谱计算公式，按基本粒子系质量 M 与原子系波长 λ 等价的巴尔末公式来计算，即带上量子数多项式 $[m^2/(m^2 - n^2)]$ ，公式应为

$$M = G \operatorname{tg} N \theta + H = \lambda = b[m^2/(m^2 - n^2)] \operatorname{tg} 45^\circ = G[m^2/(m^2 - n^2)] \operatorname{tg} N \theta + H, \text{ 即}$$

$$M = G[m^2/(m^2 - n^2)] \operatorname{tg} N \theta + H \quad (1-4)$$

$$3 \text{ 个方程联立组合是: } M_1 = G[m_1^2/(m_1^2 - n_1^2)] \operatorname{tg} N_1 \theta + H \quad (1-4-1)$$

$$M_2 = G[m_2^2/(m_2^2 - n_2^2)] \operatorname{tg} N_2 \theta + H \quad (1-4-2)$$

$$M_3 = G[m_3^2/(m_3^2 - n_3^2)] \operatorname{tg} N_3 \theta + H \quad (1-4-3)$$

以上 (1-4-1、2、3) 中 $m_1=1, m_2=2, m_3=3; n_1=0, n_2=0, n_3=0$ ，所以具体为：

$$M_1 = G[1^2/(1^2 - 0^2)] \operatorname{tg} \theta + H \quad (1-4-4)$$

$$M_2 = G[2^2/(2^2 - 0^2)] \operatorname{tg} 2 \theta + H \quad (1-4-5)$$

$$M_3 = G[3^2/(3^2 - 0^2)] \operatorname{tg} 3 \theta + H \quad (1-4-6)$$

以上 3 式中的 $[1^2/(1^2 - 0^2)] = 1; [2^2/(2^2 - 0^2)] = 1; [3^2/(3^2 - 0^2)] = 1$ ，都等于 1。这是因为如果把核式弦图质量起源的表叙面，硬要投影到巴尔末公式的波长的表叙面，质量谱被作为波长谱的一个新系列，那么它是量子数 n 的基态为 0 的特例，在 $\operatorname{tg} n 45^\circ$ 和 $\operatorname{tg} N_3 \theta$ 这两种正切函数同时存在的情况下是互不相容的。因为质量起源还有巴拿马运河船闸-马蹄形链式量子数轨道弦图（简称“链式弦图”）。所以在核式弦图中，夸克质量谱计算公式从以上可得出的是：

$$M_1 = G \operatorname{tg} \theta + H \quad (1-4-7)$$

$$M_2 = G \operatorname{tg} 2 \theta + H \quad (1-4-8)$$

$$M_3 = G \operatorname{tg} 3 \theta + H \quad (1-4-9)$$

4) 以上核式弦图的质量谱计算公式，分代量子数 $N=1, 2$ 和 3。在我们 1996 年发表前，确实还没有想到链式弦图。当时公开发表的实验数据也不多，但要检验我们的物质族基本粒子质量谱计算公式时，也确实能查到 6 种夸克质量的最理想数据上夸克 u 、粲夸克 c 、顶夸克 t 、下夸克 d 、奇夸克 s 和底夸克 b 等的质量

分别为：约 0.03Gev、约 1.42Gev、约 174Gev、约 0.06Gev、约 0.196Gev 和约 4.295Gev 等。用（1-4-7、8、9）方程组来计算以上 6 类夸克，有 8 组 3 个方程联立求解 θ 、G 和 H，合理的排列组合是四个系列。但这四个系列的两组排列组合也许都合理，然最终得出的结果是：上夸克 u、粲夸克 c 和顶夸克 t 是一组，与下夸克 d、奇夸克 s 和底夸克 b 是另一组相结合。由 $M_1=Gtg\theta+H$ 、 $M_2=Gtg2\theta+H$ 、 $M_3=Gtg3\theta+H$ 等 3 个方程联立求解 θ 、G 和 H，由实验数据反求的结果，第一组和第二组各自的 θ 、G 和 H 等基本常量值分别是：

第一组的上、粲、顶夸克为： $\theta=29^\circ 52'$ 、 $G=1.22$ 、 $H=-0.671$

第二组的下、奇、底夸克为： $\theta=29^\circ 27'$ 、 $G=0.124$ 、 $H=-0.01$

上夸克 u： $M_1=Gtg\theta+H=1.22\times tg29^\circ 52'-0.671=0.03\text{Gev}$

粲夸克 c： $M_2=Gtg2\theta+H=1.22\times tg59^\circ 44'-0.671=1.42\text{Gev}$

顶夸克 t： $M_3=Gtg3\theta+H=1.22\times tg89^\circ 36'-0.671=174\text{Gev}$

下夸克 d： $M_1=Gtg\theta+H=0.124\times tg29^\circ 27'-0.01=0.06\text{Gev}$

奇夸克 s： $M_2=Gtg2\theta+H=0.124\times tg58^\circ 54'-0.01=0.196\text{Gev}$

底夸克 b： $M_3=Gtg3\theta+H=0.124\times tg88^\circ 21'-0.01=4.295\text{Gev}$

这个情况，虽然裂纹弦的基本实体质量荷能联系希格斯粒子，但还类似处于玻尔-索末菲的对称-超对称的量子化原子阶段；这个阶段他们还是不能解释塞曼的磁场效应和斯塔克的电场效应等现象。而我们的核式弦图质量谱计算公式已不能解答 21 世纪能查到的多组公开发表 6 种夸克质量的数据。例如，2008 年 4 月出版的[英]安德鲁·华生的《量子夸克》（下称华著）；2010 年 7 月出版的陈蜀乔的《引力场及量子场的真空动力学图像》（下称陈著）；2012 年 4 月出版的[美]布赖斯·格林的《宇宙的结构》（下称格著），提供的上夸克 u、粲夸克 c、顶夸克 t、下夸克 d、奇夸克 s 和底夸克 b 等的质量分别是：华著为：约 0.004Gev、约 1.3Gev、约 174Gev、约 0.007Gev、约 0.135Gev 和约 4.2Gev 等。陈著为：2~8Mev、1.3~1.7Gev、137Gev、5~15Mev、100~300Mev、和 4.7~5.7Gev 约 4.2Gev 等。格著为：0.0047Gev、1.6Gev、189Gev、0.0074Gev、0.16Gev 和 5.2Gev 等（下称格林夸克质量）。

2、从核式弦图跨进链式弦图，物理基础是客观存在的，例如前者类似圆周运动，后者类似直线运动。其次，时空撕裂产生质量，从希格斯场公式的基础是希格斯海“度规格子”出发，把撕裂温并为“船闸”模型。希格斯海“度规格子”和类似长江三峡大坝的“船闸格子”或巴拿马运河的“船闸格子”是可以相通的。这样，希格斯粒子变成类似希格斯海“船闸”中的拖船、驳船、锚泊船或起重吊船。这样就出现了对称和超对称两类质量谱生存模具：对称型如长江三峡大坝船闸模具，船闸存在于长江中段；超对称型如巴拿马运河船闸模具，它类似运河两端进出都有三座三级船闸。

1) 这里虚拟希格斯粒子的拖船、驳船、锚泊船或起重吊船，如果是起重吊行为，还可以进一步设想希格斯粒子是两个配对的起重吊量差不多的起重机，安置在船闸河道的两岸，共同来吊起抽开船闸的闸门，或者是共同来吊起比它们单独一个起重吊量船大得多的“顶夸克船”。这是一种超对称，如此，它密切涉及到顶夸克。

但已知华著是约 174Gev，陈著是 137Gev，格著是 189Gev，只有华著的约 174Gev 与质量谱计算公式 $M_3=Gtg3\theta+H=1.22\times tg89^\circ 36'-0.671=174\text{Gev}$ 的结果相似。

但问题还不仅在于核式弦图的质量谱计算公式，不能算出陈著和格著值。

更大的问题是，与巴尔末公式减少基本常量数的量很大相比，核式弦图质量谱计算公式减少基本常量数也很有限。这里有一个相同的事实，即巴尔末公式是在已知一批光谱线数据的情况下才寻找规律的，我们的质量谱计算公式，也是在已知 6 种夸克类似华著的数据的基础上寻找的规律。不同的是，原子结构理论模型发展史，和基本粒子结构理论模型发展史是不同的。从巴尔末时代到玻尔时代，各种原子结构模型中，无论是实体结构还是壳体结构，都是一样的把原子视为球体。即使认为原子结构的行星模型不正确，如分子光谱告诉分子中的电子运动、核间的振动以及分子绕质心的转动之间的关联并不十分密切，但还是要将原子看作是球体。为什么呢？

2) 这是近代原子结构量子力学模型的建立经历的四个阶段决定的。A) 1803 年的道尔顿的原子模型，原子是微小的实心球体，这也巴尔末时代的水平，所以当时的巴尔末公式还有量子数说。B) 1903 年的汤姆逊的原子模型，原子是一个球体，正电荷均匀分布在整个球内，仍然是巴尔末时代的水平。C) 1911 年的卢瑟福原子模型，卢瑟福是汤姆逊的学生，但卢瑟福做的粒子散射实验，开始突破前人的水平，提出了一种新的原子结构模型，即“行星模型”。D) 1913 年的玻尔电子分层排布模型，这是玻尔把光谱线巴尔末公式覆盖在卢瑟福的行星模型上，这是将量子数概念引入核式弦图，它包含了定态假设、跃迁假设和轨道量

子化假设，而这与原子线状光谱不连续的实验事实相符。原子中的电子在具有确定半径的圆周轨道上绕原子核运动，不辐射能量。在不同轨道上运动的电子具有不同的能量（E），且能量是量子化的，轨道能量值依 $n(1, 2, 3, \dots)$ 的增大而升高， n 称为量子数。而不同的轨道则分别被命名为 $K(n=1)$ 、 $L(n=2)$ 、 $N(n=3)$ 、 $O(n=4)$ 、 $P(n=5)$ 。当且仅当电子从一个轨道跃迁到另一个轨道时，才会辐射或吸收能量。如果辐射或吸收的能量以光的形式表现并被记录下来，就形成了光谱。玻尔的原子模型很好的解释了氢原子的线状光谱，但对于更加复杂的光谱现象却无能为力。但索末菲的超对称量子化量子数 n 、 k 和 m ，推进了玻尔的认识。

3) 核式弦图的质量谱计算公式也不是无中生有。如果把原子核拆分成自由核子，就要对体系做数值等于结合能的功，表明核子间有相互作用，而且是很强的，这种力不可能是库仑力，也不可能是磁力，更不可能是万有引力。这种核子间特有的强相互作用力就是核力。核力很强，它比库仑力大 100 倍。核子不能无限靠近，即核力除表现为引力之外，在某些情况下表现为斥力。大体上核子间的距离，在 $0.8 \sim 1.5$ 费米（1 费米）之间表现为引力；小于 0.8 费米表现为斥力，大于 $4 \sim 5$ 费米时核力急剧下降，几乎消失；大于 10 费米时，核力消失。

1964 年希格斯在这类实验事实的基础上，提出质量起源的希格斯场模型。同年，盖尔曼在坂田模型的基础上，提出夸克模型的强子图像：强子是指由 3 个夸克组成的质子、中子等，以及由两个夸克组成的介子。与夸克同时出现并连接夸克对之间的力，称为“强力”。此后量子色动力学兴起，夸克还有了颜色对称性。

与此同期，南部阳一郎在“靴理论”认为所有的强子都是互为组成部分的基础上，提出的强子的弦模型，认为弦的不同振动模式，正对应着不同强子的类型，即强子的弦模型可和量子色动力学的夸克强子模型对应，且图像类似 3 根碰头的裂纹弦。

与此同期，还有彭罗斯提出的自旋网络方法对强子描述的扭量理论模型。彭罗斯的扭量理论模型类似克利福德平行线分层翻转，我们称为“扭量球”，它同超弦理论一样，试图用连续性数学和不连续的拓扑数学连续化企图，来统一自然界所有相互作用。例如，代替量子力学粒子的波函数，可用一扭量或多扭量分批描述各类粒子；这个由各种圆形成的构形，是空间 S^3 上克利福德平行线构形。

而据沈致远先生透露，目前弦论的创立者威滕，已采用彭罗斯的扭量理论，在将弦论的 11 维时空（10 维空间加 1 维时间）减为较易对付的 4 维。

3、以上是 20 世纪后半叶到现在基本粒子量子物理模型建立呈展的四大板块。

拜建军先生说，超弦理论与圈量子引力做为理论物理学的两大重要分枝，在量子引力研究领域及其课题中视为最具有发展前途的理论。但对于研究量子引力的国际主流物理学家中，没有一个中国人的尴尬境地；对于国内相关研究随波逐流者比比皆是，又做如何感想？可以肯定的说，将中国深厚的哲学底蕴，灵活运用于此领域中会大有作为。其实拜建军的话，典型地代表了目前相当大的一部分中国人的通病。

1) 加来道雄在《物理学的未来》一书中说，预测未来或发展科学技术的方法，第一是，凡尔纳和达芬奇之所以拥有先见之明和深远的洞察力，是他们成功中的事实，无可争辩地告诉我们，这是要经常地去寻找站在时代前面做实验和建构模型的第一线的第一流科学家，和他们讨论有关看法，这样才能收集和掌握到大量反映当前时代伟大科学发现的资料。第二是，要抓住自然界中驱动整个宇宙的 4 种基本的力，因为 4 种力和自然界的基本规律已经基本知晓，预计这些规律不会有新的重大变化。

由此可见，如果说研究量子引力的国际主流物理学家中，少有中国主流科学家（因为还有丘成桐、田刚等人），和国内相关研究随波逐流者或骂家比比皆是，这不怪别人，只怪我们自己。这就是拜建军说，中国有深厚的哲学底蕴，会大有作为。因为即使中国有深厚的哲学底蕴，那也只是过去的辉煌，不是现在的辉煌。二是哲学底蕴，面对的真理只是过去的实践与事实；而科学技术面对的是，反映当前站在时代前面第一线做的实验发现的事实与真理。这一点是决定性的，这与哲学不同。什么是中国梦？归根结底是体制梦。体制梦归根结底是知晓物质结构梦。这就是为什么上世纪五、六十年代，毛泽东主席要亲自领导和发动物质无限可分说的世界科学大战，因为他要领导中国人民和中国科学界的将帅们向中国梦冲刺。这是一次流芳万古的伟大尝试。

这场“中国梦”的深远教育意义，是毛泽东同志以身作则，告诉中华儿女的世世代代的子孙们，中国梦归根结底的分水岭，是要哲学底蕴还是要前沿科学的实验事实？但我国的国情，还缺乏具有大量做大型强子对撞机实验类似的人力和财力。然而没有大型强子对撞机的设备和实验，可以派人参与到国际的合作中；没有人为的大型强子对撞机的设备和实践，但我国有 8 级以上的大地震，这是自然大型强子对撞机类似制造的微型小黑洞的爆炸。然而也许近几代中国人中，明白的不多，所以毛泽东主席才以不唯书、不唯上的大无畏精神，反其意开辟了改革开放与科学春天的大方向。

这就是为什么中国今天第三部门有普通公民自己掏钱研究前沿科学，和主流骂家云集（第一部门指政府掏钱研究科技，第二部门指企业掏钱研究科学技术）。也正是由于有这种奇怪而现实的组合，才有不认识研究量子引力的主流物理学中，有不少自主攀登科学高峰的中国人，以及为什么他们没有实验设备也能赶上国际主流研究。

2) 以“三旋理论初探”为例，从上世纪 60 年代开始，为了调和希格斯、盖尔曼、南部一郎、彭罗斯等 20 世纪后半叶到现在基本粒子量子物理模型建立呈展的四大板块，这里采用了弦论实用符号动力学来整合的方法。它在不改动欧几里德对点的定义的情况下，补充了三条公设：(I) 圈与点并存且相互依存；(II) 圈比点更基本；(III) 物质存在有向自己内部作运动的空间属性。这样就使得自旋、自转、转动有了语义学上的区分，例如设旋转围绕的轴线或圆心，分别称转轴或转点，现给予定义：

(1) 自旋：在转轴或转点两边存在同时对称的动点，且轨迹是重叠的圆圈并能同时组织起旋转面的旋转。如地球的自转和地球的磁场北极出南极进的磁力线转动

(2) 自转：在转轴或转点的两边可以有或没有同时对称的动点，但其轨迹都不是重叠的圆圈也不能同时组织起旋转面的旋转。如转轴偏离沿垂线的陀螺或迴转仪，一端或中点不动，另一端或两端作圆圈运动的进动，以及吊着的物体一端不动，另一端连同整体作圆锥面转动。

(3) 转动：可以有或没有转轴或转点，没有同时存在对称的动点，也不能同时组织起旋转面，但动点轨迹是封闭的曲线的旋转。如地球绕太阳作公转运动。

根据上述自旋的定义，类似圈态的客体我们定义为类圈体，那么类圈体应存在三种自旋，现给予定义，并设定弦论实用符号动力学的区分符号：

面旋(A、a) 指类圈体绕垂直于圈面中心的轴线作旋转。如车轮绕轴的旋转。

体旋(B、b) 指类圈体绕圈面内的轴线作旋转。如拨浪鼓绕手柄的旋转。

线旋(G、g; E、e; H、h)指类圈体绕圈体内中心圈线作旋转。如地球磁场北极出南极进的磁力线转动。线旋一般不常见，如固体的表面肉眼不能看见分子、原子、电子等微轻粒子的运动，所以它能联系额外维度和紧致化。由此线旋还要分平凡线旋(G、g)和不平凡线旋(E、e; H、h)。不平凡线旋是指绕线旋轴圈至少存在一个环绕数的涡线旋转，如莫比乌斯体或莫比乌斯带形状。同时不平凡线旋还要分左斜(E、e)、右斜(H、h)。因此不平凡线旋和平凡线旋又统称不分明自旋。反之，面旋和体旋称为分明自旋。

3) 弦论实用符号动力学系统是一种虚拟，但又类似群论，有严格的编码规则，即有规律可循。它能直观对应希格斯、盖尔曼、南部一郎、彭罗斯等四大板块中的概念与图像，如广东省计算机专家邱嘉文先生博客做出的三旋动画视频、北师大特聘的海归计算机专家蒋迅先生博客作出的类似三旋联系波粒二象性能级轨道的“莫比斯齿轮”动画视频。由此，用类似黎曼度规符号建构三旋度规，根据排列组合和不相容原理，三旋可以构成三代共 62 种自旋状态，即可在时空每一点引进 62 个“数”。而三旋的单动态是 10 个 (A、a; B、b; G、g; E、e; H、h)，它们类似卡拉比-丘流形弦论需要的 10 维空间，或 10 个维度或维数；其中 6 维 (G、g; E、e; H、h) 代表卷曲成紧致化的额外维度的线段，可以包容在 10×10 的方阵中。为便于分类和分析共性，我们采用弦论实用符号动力学的统一给予符号刻划的方法，先来看它们的对称与超对称联系：

面旋.....体旋.....平凡线旋.....左不平凡线旋.....右不平凡线旋

正反.....正反.....正、反.....正、反.....正、反

A、a.....B、b.....G、g.....E、e.....H、h

.....
A: A B.....

a: aB.....

B:

b: Ab、ab.....

.....
G: AG、BG...aG、bG...ABG、AbG、aBG、abG

g: Ag、Bg、ag、bg.....ABg、Abg、aBg、abg

E: AE、BE、aE、bE.....ABE、AbE、aBE、abE

e: Ae、Be、ae、be.....ABe、Abe、aBe、abe

H: AH、BH、aH、bH...ABH、AbH、aBH、abH

h: Ah、Bh、ah、bh.....ABh、Abh、aBh、abh

4) 以上弦论实用符号动力学的三旋符号排列分类, 还可以单动态 A、a; B、b; G、g; E、e; H、h 再作 10×10 的矩阵的对角线排列, 这里就不具体作了。总之, 以上的环面三旋度规令人惊讶是, 它的含线旋的三元排列组合符号数, 完全对应标准模型规范场理论和实验检验得出的除质量希克斯玻色子外的 24 种基本粒子, 即 6 种夸克, e、 μ 、 τ 等 3 种轻子, V_e 、 V_μ 、 V_τ 等 3 种中微子, 8 种胶子, 1 种光子, 1 种引力子, 1 种玻色子 Z^0 , 以及 W^+ 和 W^- 玻色子合并为玻色子的 W^\pm 。而含线旋的二元排列组合符号数, 也是 24 种, 也正符合标准模型规范场理论认为这 24 种基本粒子, 都有超伴粒子的观点。

其次, 由于线旋能联系额外维度和紧致化, 这正是它们和代表质量希克斯玻色子的区别, 即希克斯粒子不是没有自旋而是没有线旋。那么希克斯粒子到底是多少种呢?

面旋(A、a)和体旋(B、b)实际代表的是三维空间和一维的时间, 这也是质量能在三维空间或四维时空普及的道理。如果质量希克斯玻色子也有超伴粒子的话, 那么一种就是二个, 二种就是四个。在弦论实用符号动力学的三旋符号排列分类中, 除开含线旋的二元排列组合符号数外的只剩下四个, 说明弦论实用符号动力学的观点认为质量希克斯玻色子是 2 个或 2 种, 即 AB、aB 或 Ab、ab, 其中一组为超对称。

三、调和超对称量子数上帝粒子路

众所周知, 在标准模型中存在 28 个基本常量。这是一个非常大的数字。因为基本常量是一个出现在自然定律中而且无法被计算的量, 只能通过实验来测定。所以一直有不少人试图减少基本常量的数目, 但迄今为止没有取得任何成功。28 个基本常量中包括有电子、u 夸克和 d 夸克等稳定粒子的质量, 和不稳定粒子由 w 和 z 玻色子, μ 和 τ 轻子、3 个中微子, 4 个重夸克 s、c、b、t 等的质量以及携带的类似精细结构常数的自由参数、混合角和相位参量等, 都要求人类实验给出。

质量谱计算公式 $M = Gt\gamma N^\theta + H$ 运用裂纹弦或“船闸”模型的顺次模数、基角、参数等 14 个主要新参量来计算总共 61 种的夸克、轻子和规范玻色子的质量。虽然它们先要实验测量或设定, 但这 14 个新参量的数目比 28 个基本常量中包括的稳定与不稳定夸克、轻子和规范玻色子的质量, 以及它们携带的类似精细结构常数的自由参数、混合角和相位参量等的总数目少一点, 也就减少了 28 这个数字的总量, 但是还比不赢巴尔末公式运用的勾股数。索末菲的超对称量子数是在玻尔的主量子数 n 基础上, 引入的新的两个量子数 k 和 m, 解释了塞曼效应, 由此也启发了对夸克质量谱公式能否在弦图上做文章。由于已经有从裂纹弦核式弦图延伸到巴拿马运河船闸链式弦图的想法, 要分类排出夸克质量谱量子数, 这也类似巴拿马运河当局那套复杂管理规则的设计。

1、但为什么要把巴拿马运河船闸链式弦图从直线型变为马蹄形链式弦图呢?

这里要说明, 无论是直线、射线型链式弦图还是马蹄形、U 型链式弦图, 都是一种对希格斯场生成质量机制的部分简略的抽象, 至于为什么一定要加进马蹄形或 U 型, 这是时空“囚陷曲面”机制所决定的。丘成桐教授的《大宇之形》一书中说, 早在 20 世纪 60 年代, 霍金和彭罗斯借由几何学和广义相对论定律, 证明了极度弯曲、光线无法逃脱的囚陷曲面的存在。他们设想有一个普通的二维球面, 它的整个表面同时放出光芒。此时, 光线会向内和向外发散。向内的光线所形成的曲面, 面积会急剧减小, 到球心时缩小成一点; 而向外光线的曲面面积则会逐渐增大。但如果是囚陷曲面则不然, 无论是向内或向外移动, 曲面面积都会减小。不管朝哪个方向走, 你都被困住了, 根本没有出路。原因就是囚陷曲面的定义: 是巨大的正均曲率使它再弯回来的。

1) 这个道理类似想象在球面上, 以北极为起点的大圆, 离开北极后它们会彼此拉开, 但因为球面曲率是正的, 最后大圆会开始敛聚, 最终聚焦在南极上。正曲率就有这种聚焦效应。这和丘成桐教授证明的卡拉比猜想有点类似, 即空间没有物质, 有些地方也会发生时空弯曲效应。丘成桐说卡拉比猜想的这些空间, 现在通称为卡拉比-丘空间, 这是卡拉比透过颇为复杂的数学语言作的表述, 其中涉及到克勒流形、里奇曲率、陈类等等, 看起来跟物理沾不上边, 其实卡拉比抽象的猜想翻过来可变为广义相对论里的一个问题: 即能否找到一个紧而不带物质的超对称空间, 其中的曲率非零, 即具有重力? 即它要求要找的时空, 具有某种内在的对称性, 这种对称, 物理学家称之为超对称。丘成桐说他花了差不多三年, 不仅证明指出封闭而具重力的真空的存在性, 而且还给出系统地大量构造这类空间的途径。

2) 这个证明涉及广义相对论中的正质量猜想。这个猜想指出, 在任何封闭的物理系统中, 总质量/能量必须是正数。丘成桐和舒恩利用了极小曲面, 终于把这猜想证明了。卡拉比猜想证明存在的空间, 在弦论中担当有重要角色, 原因是它们具有弦论所需的那种超对称性。如威滕、斯特罗明格等弦学大师认为, 弦论中那多出来的 6 维空间的几何形状, 是卷缩成极小的空间, 就是卡拉比-丘空间。弦论认为时空的总数为 10, 其中 4 维时空是我们熟悉的, 此外的 6 维暗藏于 4 维时空的每一点里, 我们看不见它, 但弦论说它是存在的。

弦论还进一步指出，卡拉比-丘空间的几何还决定了我们宇宙的性质和物理定律。如哪种粒子能够存在？质量是多少？它们如何相互作用？甚至自然界的一些常数，都取决于卡拉比-丘内空间的形状。

因为利用狄拉克算子来研究粒子的属性，透过分析这个算子的谱，可以估计能看到粒子的种类。时空具有 10 个维数，是 4 维时空和 6 维卡拉比-丘空间的乘积。因此，当运用分离变数法求解算子谱时，它肯定会受卡拉比-丘空间所左右。卡拉比-丘空间的直径非常小，则非零谱变得异常大，这类粒子只会在极度高能量的状态下才会出现。

3) 而这所有的一切，正是前面三旋弦论实用符号动力学具有的三大特点能解释的：

例如 24 种含线旋的三元排列组合符号，正是在代表额外维度和紧致化的强烈。原因是线旋含有孔洞的通量场，用力线或纤维丛思考，按此三元排列组合符号作自旋运动，它们的力线或纤维丛，在洞穿环面中心孔时的缠绕、纽缠，即使在自旋的一个自然的周期过程中，就已经非常自然地造就出卡拉比-丘流形，这就解决了生成卡拉比-丘流形的操作问题；并且同时也解决了卡拉比-丘流形原先存在的三大疑难问题。

例如，这 24 种含线旋的三元排列组合符号，自然自旋生成的卡拉比-丘流形，可以从它们的生成元环面的大圆上任意取一“点”，作标记考察，这个点的轨迹实际成为计量这个特定的卡拉比-丘流形上的流线，因为这个特定流线还可以变换为纽结拓扑理论来计算，即可以用琼斯纽结多项式来描述。同理，含线旋的三元排列组合符号，自然自旋生成的 24 种卡拉比-丘流形，也是如此，而且琼斯纽结多项式更简单些。

这也就是弦论和标准模型追求的除开希格斯粒子外的基本粒子的超对称表达。

反之，希格斯粒子和它们的超对称，就正对应不含线旋的三元排列组合符号的那 4 种卡拉比-丘流形。它们虽然也可具有类似额外维度的紧致化，但由于没有力线或纤维丛洞穿环面中心孔的缠绕、纽缠，所以纽结的能量和质量较易开放或发散。

4) 由此，三旋弦论实用符号动力学解答了希格斯场论、弦论和卡拉比-丘流形之间的自然联系。但为什么三旋弦论实用符号动力学的同一个的符号标记，例如同一个的符号标记的夸克，有多种质量的实验实测数据呢？类似的问题是，同一种或同一类的如 24 种含线旋的三元排列组合符号，或 24 种含线旋的三元排列组合符号数，或 4 种不含线旋的三元排列组合符号，表面上它们的符号相差不大，为什么它们之间的质量实验实测数据相差却非常之大、非常之多呢？

2、符号动力学，或实用符号动力学，或弦论实用符号动力学，或三旋弦论实用符号动力学，之所以含“符号”，因为它们只是在用符号，对研究系统中的客体进行编码、命名或标志，而不是在用符号解释实在客体的真实性质。当然在有些符号的编码规律或依据的图像中，有一部分性质也许和研究对应的客体的真实性质，有一定联系；但更多的是，对于类似夸克的质量多样性的表现，类似与光谱线的环形核式弦图是用量子数来表达一样，也是在用类似索末菲的超对称多元性量子数在分配。

在寻找分配给巴拿马运河船闸马蹄形链式的弦图中，用类似索末菲的超对称多元性量子数来讨论夸克的质量谱计算公式，巴拿马运河、船闸以及马蹄形链式弦图并不是希格斯场的真实抽象，也不是夸克粒子的形态的真实抽象，而是对它们所属质量机制具有的客观性质作的部分简略的抽象，我们称为“大量子弦论”。巴拿马运河连通大西洋和太平洋，船闸和码头分属在运河的两端，这提供了一部分超对称多元性量子数的理想。而马蹄形链式弦图的大量子弦论，则更真实细化了这里超对称多元性量子数的理想。

1) 事情始于知道一组 6 种夸克质量的数据情况下，作寻找夸克质量谱计算公式的。

我们设想所有经过正规渠道报导的多组数据，都是实验实测的真实数据；而作为在一个相同系统用相同方法实验实测的真实数据，是唯一准确的一组数据，那么它们是一定有规律可循的。这个规律假设用的是马蹄形链式弦图的夸克质量谱计算公式，由类似索末菲的超对称多元性量子数的经验可知，即使主量子数相同，但由于轨道形状量子数 k 和磁量子数 m 或轨道运行方向空间量子数不同，光谱线的波长也不相同，那么同一个道理，如果报导提供的一组 6 种夸克质量的实验实测的真实数据中，有一个或少数个不符合多数个遵循的相同量子数认定方法寻找出的质量谱公式计算的结果，我们不能说这一个或少数个真实数据错了，而是说可能被不相同系统用不相同方法实验实测的真实数据混进来了。即我们不是否定这一个或少数个的数据不存在，而是存而待论，用符合多数个遵循的相同量子数认定方法寻找出的质量谱公式计算的结果，来代替。

例如，2012 年格林《宇宙的结构》一书提供的上夸克 u 、粲夸克 c 、顶夸克 t 、下夸克 d 、奇夸克 s 和底夸克 b 等的质量分别为：0.0047Gev、1.6Gev、189Gev、0.0074Gev、0.16Gev 和 5.2Gev，就有这类情况。其中出入大的是顶夸克 t 我们算出的是 202Gev。

2) 这是总结马蹄形链式弦图的夸克质量谱计算公式的研究和分析，才得出的多元性超对称量子数质量谱公式的；它对应的正切函数的 $\angle \theta_n$ 的角度分数值 θ_n 公式：

$$\theta_n = \theta fS \pm W^2 \quad (2-1)$$

式中 $\theta = 15'$ ，称为质量基角。f 称为质量繁殖量子数， $f=6^2$ 或 6^0 。S 称为首部量子数，W 称为尾部量子数； $S=n \times m$ ， $W=m \times n$ ，但大多数时候 $S \neq W$ ，少数时也可 $S=W$ ；其中 $m=1, 2, 3, 4, 5$ ， $n=1, 2, 3, 4$ 。由此格林夸克质量谱公式为：

$$M = G \operatorname{tg} \theta_n = G \operatorname{tg} (\theta f S \pm W^2) \quad (2-2)$$

由于 $G=1\text{Gev}$ ，上式可写为 $M = \operatorname{tg} (\theta f S \pm W^2)$ 。这样超对称量子数夸克质量谱公式只需要用一个质量基角常量 $\theta = 15'$ ，就可以求出格林夸克质量谱中的 6 个夸克质量值。设 G 为质量单位符号， $G=1\text{Gev}$ ，下面是我们的验算：

$$\text{上夸克 } u: M_1 = G \operatorname{tg} (\theta f S \pm W^2) = \operatorname{tg} \theta_1 = \operatorname{tg} 16' = \operatorname{tg} 0^\circ 16' = 0.0046\text{Gev}$$

$$\text{下夸克 } d: M_2 = G \operatorname{tg} (\theta f S \pm W^2) = \operatorname{tg} \theta_2 = \operatorname{tg} 26' = \operatorname{tg} 0^\circ 26' = 0.0076\text{Gev}$$

$$\text{奇夸克 } s: M_3 = G \operatorname{tg} (\theta f S \pm W^2) = \operatorname{tg} \theta_3 = \operatorname{tg} 544' = \operatorname{tg} 9^\circ 4' = 0.16\text{Gev}$$

$$\text{粲夸克 } c: M_4 = G \operatorname{tg} (\theta f S \pm W^2) = \operatorname{tg} \theta_4 = \operatorname{tg} 3495' = \operatorname{tg} 58^\circ 15' = 1.6\text{Gev}$$

$$\text{底夸克 } b: M_5 = G \operatorname{tg} (\theta f S \pm W^2) = \operatorname{tg} \theta_5 = \operatorname{tg} 4716' = \operatorname{tg} 78^\circ 36' = 5.0\text{Gev}$$

$$\text{顶夸克 } t: M_6 = G \operatorname{tg} (\theta f S \pm W^2) = \operatorname{tg} \theta_6 = \operatorname{tg} 5384' = \operatorname{tg} 89^\circ 44' = 202\text{Gev}$$

可见除开顶夸克 t 外，其余的 3 个误差都在小数点以下，说明格林提供的数据系统性程度高，这与他收集的数据时间最近有关。

3) 超对称破缺的量子数如何表达？根据设计出的超对称破缺的“船闸”链式弦图，虽然可以有多种，但这类类似如果运河和两端船闸的实体一旦修好，这是不能变更的类似的常识。所以可以变更的量子数，类只能是码头的编码编号，即可动的只能是量子数。那么具体到格林夸克质量这些量子数，是如何分类和布局的呢？下面是我们对格林夸克质量谱正切函数角度值分拆的多项式的其中的一组过程，它是有规律的：

$$\text{上夸克 } u: 15 = 15 (1 \times 1) + 0 \approx 15 \times 6^0 \times (1 \times 1) + (1 \times 1)^2 = 16$$

$$\text{下夸克 } d: 17 = 15 (1 \times 1) + 2 \approx 15 \times 6^0 \times (1 \times 2) - (1 \times 2)^2 = 26$$

$$\text{奇夸克 } s: 545 = 545 (1 \times 1) + 0 \approx 15 \times 6^2 \times (1 \times 1) + (1 \times 2)^2 \approx 544$$

$$\text{粲夸克 } c: 3480 = 545 \times (2 \times 3) + 210 \approx 15 \times 6^2 \times (2 \times 3) + (4 \times 4)^2 \approx 3496$$

$$\text{底夸克 } b: 4747 = 545 \times (3 \times 3) - 158 \approx 15 \times 6^2 \times (3 \times 3) - (3 \times 4)^2 \approx 4716$$

$$\text{顶夸克 } t: 5382 = 545 \times (2 \times 5) - 477 \approx 15 \times 6^2 \times (2 \times 5) - (2 \times 2)^2 \approx 5384$$

以上各式中后面的两对乘积多项式，是否有和巴耳末公式的量子数多项式相似的规律呢？按有规律相似的情况，对格林夸克质量谱中 6 个夸克的质量值，配对航道归口，分解成的含有量子数字的多项式为：

$$(15-6-0-1-1-1-1) \text{ 上夸克 } u = 15 \times 6^0 \times (1 \times 1) + (1 \times 1)^2 \quad (3-1)$$

$$(15-6-0-1-2-1-2) \text{ 下夸克 } d = 15 \times 6^0 \times (1 \times 2) - (1 \times 2)^2 \quad (3-2)$$

$$(15-6-2-1-1-1-2) \text{ 奇夸克 } s = 15 \times 6^2 \times (1 \times 1) + (1 \times 2)^2 \quad (3-3)$$

$$(15-6-2-2-5-2-2) \text{ 顶夸克 } t = 15 \times 6^2 \times (2 \times 5) - (2 \times 2)^2 \quad (3-4)$$

$$(15-6-2-2-3-4-4) \text{ 粲夸克 } c = 15 \times 6^2 \times (2 \times 3) + (4 \times 4)^2 \quad (3-5)$$

$$(15-6-2-3-3-3-4) \text{ 底夸克 } b = 15 \times 6^2 \times (3 \times 3) - (3 \times 4)^2 \quad (3-6)$$

以上分拆的 6 个式中的数字，有很强的全息性。如上式前面括号内的那些量子数字，即常量 f 和量子数字 N、m、n 等四个数，类比玻尔的量子能级理论，类比巴耳末公式中的常量和量子数，马蹄形链式弦图中的常量和量子数字的意义是什么呢？

首先“15”作为质量轨道圆弦基角 θ 这个共同的常量数角度分数，能确定下来，即 $\theta = 15'$ 。第二，“6”和 0 与 2，作为粒子夸克的共同数目类似一个繁殖系数，也能确定下来。那么剩下的数代表的量子数符号的什么意义呢？是格林夸克质量对称破缺的巴拿马运河船闸-马蹄形链式弦图的摆布和链式轨道弦图量子数多项式摆布的性质；它们对应以上 6 个格林夸克质量谱正切函数角度值分拆的多项式反映的性质。

4) 众所周知，分析计算光谱线波长量子数多项式，是离不开弦图的；同样，要分析计算夸克质量谱，求证合理的量子数多项式，也是离不开弦图。但符号编码的复杂性和数字计算的复杂性，还在于具体到每个夸克的计数时，因为在链式弦图的所在位置都不一样，需要确定唯一的链式弦图。这里给出的是：马蹄形不管蹄口左右向平行摆放，还是蹄口上下向竖直摆放，摆放形式即使不同，但只要是能合理，都是马蹄形链整体如全息式“U”型的分形图示。现以马蹄形磁铁蹄口向下摆放为例，这是以三个大小不同的马蹄形磁铁，蹄口向下的重叠摆放，但又稍有变化。

因为有大级和小级之分，其中又有内外之分；其次这里的大级和小级整体“U”型类似双航道，按质量大小从开端到终端，是分成三级码头层级，设其类似轨道空间方向量子数的层级编码符号为 n 。如将上夸克 u 和下夸克 d 构成的一个小马蹄形，称为 1 号马蹄形，它的蹄口向下摆放，作为整体“U”型的一边磁极， $n=1$ 。

而作为马蹄形全息的再延伸，是将称为 2 号马蹄形的奇夸克 s 与顶夸克 t 构成的一个最大的马蹄形，和称为 3 号马蹄形的粲夸克 c 与底夸克 b 组成的另一个次大的马蹄形，两者蹄口向下，并重叠起来，再把它们各自下端一边的磁极，如奇夸克 s 和粲夸克 c 联接到 1 号马蹄形的弯背处，作为整体“U”型与 1 号马蹄形合成的这一边的磁极的接口， $n=2$ 。整体“U”型另一边的磁极，是底夸克 b 在内，顶夸克 t 在外的竖直平行摆放， $n=3$ 。其次，属于整体“U”型，设其类似磁极量子数的编码符号为 m ，由此，上夸克 u 、下夸克 d 、奇夸克 s 和粲夸克 c 等是同为磁极的大级，因此这 4 个是同起 $m=1$ ；而底夸克 b 和顶夸克 t 作为另一磁极的大级，是同起 $m=2$ 。

另外，上夸克 u 和下夸克 d 层级同起 $n=1$ ；奇夸克 s 和粲夸克 c 层级同起 $n=2$ ；底夸克 b 和顶夸克 t 层级同起 $n=3$ ，但在这三个同属大级和小级之分的层级方位量子数中，各自两个夸克由于所属位置还有内外之分，上夸克 u 、奇夸克 s 和顶夸克 t 等，是同起属于大级和小级之分方位量子数在整体“U”型的外层的磁量子数，同起 $m=1$ ；下夸克 d 、粲夸克 c 和底夸克 b 等，是同起属于大级和小级之分方位量子数在整体“U”型的内层的磁量子数，同起 $m=2$ 。即作为整体“U”型的一边磁极，1 号马蹄形上夸克 u 、下夸克 d 和“U”型全息式分形图的交叉点奇夸克 s 和粲夸克 c ，另一边的磁极是底夸克 b 、顶夸克 t 。

其次，整体“U”型外在的四端点上夸克 u 、下夸克 d 、底夸克 b 、顶夸克 t ，组成的四端点，按它们之间的质量大小排列，这又类似轨道空间方向量子数的层级编码 n ，即对这种不连接的 4 个端点按质量大小，它们的空间方向层级量子数 n 分别 $n=1、2、3、4$ 。但是将这 4 个端点和中间的交点，归属大级极点或码头，这类似磁极量子数 m ，即它们分别是 $m=1、2、3、4、5$ ；即按质量大小和码头层级，中间交点的奇夸克 s 和粲夸克 c 的类似磁极量子数 m 同起 $m=3$ ，4 个端点的 4 个夸克的类似磁极量子数 m 分别为 $m=1、2、4、5$ 。可见一种夸克的量子数不是不变，而且可以是相同或不相同。

以上磁极量子数 m 和方位量子数 n ，也许会把问题弄复杂化。但以上 $(3-1、2、3、4、5、6)$ 等 6 式中，各个配对中里的第一项首部量子数 $S(1 \times 1)、(1 \times 2)、(1 \times 1)、(2 \times 5)、(2 \times 3)、(3 \times 3)$ 等 6 对组合，其 $S=n \times m$ ；以及各个配对里的第二项尾部量子数 $W(1 \times 1)、(1 \times 2)、(1 \times 2)、(2 \times 2)、(4 \times 4)、(3 \times 4)$ 等 6 对组合，其 $W=m \times n$ ，这里 S 和 W 中的那些数字，也确实是这样配合来的。

3、如此算出格林夸克质量相同系统用相同方法实验实测唯一准确的这组数据，通过其顶夸克 t 质量是 202Gev，就可开始估量希格斯粒子的质量了。

希格斯粒子是英国物理学家希格斯预言的粒子，他假设其是物质的质量之源，其他粒子是在希格斯粒子构成的“海洋”中游弋，受其作用而产生惯性，最终才有了质量。但问题有两点，一是希格斯粒子的超对称认定，二是希格斯粒子的自旋认定。

1) 超对称性被称之为 SUSY，最早日本物理学家宫沢弘成在 1966 年首次提出超对称理论，他当时是为了补充标准模型中的一些漏洞。超对称理论的最简单描述就是，除了我们所熟知的亚原子粒子外，还存在超对称粒子，它描述了费米子和玻色子之间的对称性，认为每种费米子都应有一种玻色子与之配对，反之亦然。这种理论可帮助解释，为何宇宙中“看不见”的暗物质，远比我们能观察到的物质多得多。

检验超对称性的实验，目前是在欧核中心的 LHCb 设备上进行的，这是安装在大型对撞机环路中的 4 台大型探测设备之一。在实验中，欧核中心试图以前所未有的精度观察 B 介子的衰变情况；如果超对称粒子真存在，那么 B 介子的衰变频率将要比它们不存在的情况下高得多。除此之外，如果超对称粒子存在，它们的物质，和反物质版本粒子衰变时表现的差异，也应当要更大一些。因为在美国费米实验室质子-反质子对撞机得到的结果，似乎暗示 B 介子的衰变确实受到超对称粒子的影响，因此需要某种证实或澄清。然而欧核中心在对数据进行深入分析之后，认为 LHCb 实验未能找到超对称粒子存在的间接证据；而且在这之前，LHC 的另外两台大型探测器，也未能探测到超对称粒子。但这是否就能宣布超对称理论的死刑呢？不能。

我们说的希格斯粒子超对称，是指前面三旋弦论实用符号动力学表明的，代表质量希格斯玻色子的 $AB、aB$ 或 $Ab、ab$ 这两组符号，其中一组为另一组的超对称。这吻合 LHC 实验已经发现质量为 $125.3 \pm 0.6 \text{ GeV}$ 与 126.5 GeV 的疑似希格斯粒子或称“上帝粒子”的新粒子。其中代表超对称的那组没有被发现，问题是如何认知环量子的自旋定义。我们说希格斯粒子和其它亚原子粒子的区别，不是没有自旋，而是没有线旋。

其次，在大量子弦论分析的类似巴拿马运河船闸-马蹄形链式弦图的抽象中，希格斯能级梯海的“度规格子”类似长江三峡大坝的“船闸格子”或巴拿马运河的“船闸格子”，如此希格斯粒子可变换为类似希

格斯海中的拖船、驳船、锚泊船或起重吊船。这里要虚拟希格斯粒子超对称的是起重吊行为，这可以设想希格斯粒子是两个配对的，起重吊量差不多的起重机，它们安置在船闸河道的两岸。事实上，类似的这种超对称，有马约拉纳费米子可参照，该粒子会作为它们自己的反物质并湮灭它们自己。

但 2012 年由荷兰物理学家和化学家组成的研究小组，已经提出了马约拉纳费米子以准粒子形式存在的可靠证据。这些马约拉纳费米子作为电子群，它们相互行为像单个粒子。希格斯粒子是一种独特的玻色子，是否以准粒子形式存在，也会像马约拉纳费米子有奇特的超对称呢？其实，如果说超对称粒子存在，B 介子的衰变频率将要比它们不存在的情况下高得多；它们的物质，和反物质版本粒子衰变时表现的差异更大，这已经是 LHCb 实验的事实。如原来设想的只是一种没有差异的希格斯准粒子，现在发现的是有差异的两个希格斯准粒子，这难道不是 LHCb 实验找到超对称粒子存在的间接证据？至于认定类似 B 介子的衰变频率，其介子的组成是两种夸克。

2) 夸克是什么东西？在南部阳一郎的弦论和盖尔曼的夸克论的等价中，介子类似两根碰头的裂纹弦。在量子弦论中，最简单的弦图是一个微小的环圈，天下所有的基础粒子都是由这种环圈的客体振动或自旋产生类似音乐一样生成的。但目前除三旋弦论实用符号动力学的研究外，物理学界并没有对环量子自旋的严格定位，只有对球量子自旋的一般定位，所以目前物理学家们要试图确认疑似的希格斯新粒子的自旋这项基本属性，还缺乏拓扑物理的共识。

但从前面的三旋符号动力学给予的统一符号刻划，24 种含线旋的二元排列组合符号，和 4 种不含线旋的二元排列组合符号，从数学的排列组合知识上，它们只是属于“组合”，不属于“排列”。《三旋理论初探》一书中证明，由于同样多的字母符号，排列比组合的字母序列型多得多，具体对应到基本粒子的自旋，这是在一个周期中按类似字母的顺序作不同自旋先后排序在起动，在夸克就表现为量子色动力学的“颜色”；另外这里还所谓的“冗余”码，等等。

总之，三旋符号动力学是把数学的群论和编码学结合在一起的应对物理自旋的一门科学。所以研究 B 介子的衰变频率，也需要三旋弦论实用符号动力学的探索。据陈国明先生讲，中国参加欧核中心 CMS 和 ATLAS 发现质量为 $125.3 \pm 0.6 \text{ GeV}$ 与 126.5 GeV 的粒子的实验，在 CMS 组中，全世界有 30 多个国家的 3000 多位科学家参加，中国参与的团队是中科院高能所和北大，总共 30 多人，在人数中占到了 1% 的样子；在参加的一些物理分析中，中国小组在区分信号和本底噪音这一关键技术，提供了自己的方法，使得数据分析的灵敏度，比之前最好的美国组的方法还提高了 3%。但对于自旋，不知中国小组有没有提供三旋弦论实用符号动力学的研究意见。

如果在 CMS 组中，是从球量子自旋在作一般的定位，这里自旋虽然也是所有亚原子粒子非常重要的特性，决定了它与其它粒子相互作用的方式；如分析“疑似希格斯粒子”的一个自旋值似乎为零，又似乎自旋值为 2 的结果无法被排除。这可以看出没有弄通环量子自旋弦论。因为他们说，如果最后确定其自旋为 2，那么这将意味着是一种此前未曾预料到的新粒子，虽然这种可能性目前看来正在变得越来越小。另外又说，ATLAS 探测器的数据已经检测到，这种疑似希格斯粒子衰变为两个质子的现象，这在意味着某些新的物理原理。其实对于三旋弦论实用符号动力学的“大量子弦论”看来，这一切也难否定欧核中心既发现了希格斯粒子又发现了超对称。

3) 2012 年第 7 期《环球科学》杂志发表《粒子物理学迎来革命时刻》的文章，撰文的是兹维·伯恩 (Zvi Bern)、兰斯·J·狄克逊 (Lance J. Dixon) 和戴维·A·科索维尔 (David A. Kosower) 等三位科学家。他们说，大型强子对撞机里的粒子碰撞时发生了什么，他们发明的么正方法就能知晓。其实对探测器中捕获到的撞击、散射、交换、吸引、排斥、衰变和湮灭的基本粒子或粒子碎片雨，他们的文章并没有说清如何能发现希格斯粒子又发现超对称。

也许世界上大多数人看粒子碰撞时的粒子碎片雨，感觉其轨迹都是复杂或杂乱。但从前面三旋符号动力学大量子弦论研究的调和超对称量子数看来，却类似放礼炮的烟花烟火飞舞，是有规律可循的。例如烟花厂家里的顶级烟花烟火设计技师，从看烟花烟火释放的外源性弦丝、弦粒、弦线雨的光谱色泽，就知道在礼炮烟花烟火中，加添了些何种的化学元素原子。类比 LHC 探测器，测粒子就是测弦，测弦就是测粒子。

我们生活在中国，但对长江三峡大坝船闸的数据并不了解，只是在用作大量子弦论的科普。能知巴拿马运河大坝船闸的数据，是因为《南方周末》2012 年 6 月 21 日发表的《巴拿马运河》一文有过报道：巴拿马运河船闸可供进靠的船舶极限为长 292 米、宽 32.2 米、吃水 12.04 米。这里船闸的尺码极大地改变了世界的造船业，业界把 32.2 米宽且 292 米长的船称为巴拿马极限型，成为造船工程师的首选。这是一幅生动的希格斯场、希格斯机制、希格斯粒子和其他基本粒子质量起源的类似写照。

由此用对撞机寻求证明的希格斯王国，不再神秘。这并不是说希格斯粒子可有可无，而是说类似巴拿马的船闸每级闸门至少要修多宽？多长？才是巴拿马极限型类似的基本粒子大质量。因为基本粒子中的庞然大物，与被精确地塞进为它特制的容器是一致的。

以此把所有 24 种的夸克、轻子和除希格斯玻色子以外的规范玻色子等基本粒子，类似对应船只，那么修的大坝的船闸闸门，要照应也才合适，这就可知希格斯船闸的极限型。由此可以把巴拿马比作希格斯王国，巴拿马运河的船闸限定大船的机制与希格斯王国生成大量子弦的机制连接，这就不难知道始于 137 亿年前的宇宙大爆炸。

4) 前面已验证过格林夸克质量谱系统中质量最大的顶夸克 t 为 202GeV ，作为希格斯运河船闸可供进靠的大量子弦的极限“长度”，为 202GeV 类似的质量；这个“船闸”的尺码，极大地打造了基本粒子物理王国，被称为希格斯场机制，成为打造“上帝粒子”的首选。目前欧核中心的希格斯王国模拟实验， $125.3 \pm 0.6 \text{ GeV}/c^2$ 为 CMS 发现的质量，而 ATLAS 发现的质量为 126.5GeV ，取它们各自的质量的一半（各占概率的 50%），那么综合希格斯粒子的质量准确值为：

$$(125.3 + 126.5) \times 50\% = 125.9 \text{ (GeV)} \quad (4-1)$$

接下来该怎么办呢？因为这个 $125.9\text{GeV}/c^2$ 的希格斯粒子质量，似乎与顶夸克的验证质量为 $202\text{GeV}/c^2$ 是矛盾的。这是一个类似的“谷仓内的标枪悖论”，即希格斯粒子质量的大小，小于“希格斯船闸”可供进靠的大量子弦的极限“长度”，是悖论。但解决这个悖论，反而能为 ATLAS 和 CMS 两个研究团队接下来该怎么办，提供了一个方向：

因为依据顶夸克的质量，寻找希格斯粒子质量打开的判据，是大型强子对撞机将它产生时的速度，达到光速的 83%，就可一锤定音。“谷仓内的标枪悖论”，据上海科技教育出版社 2010 年出版的查尔斯·塞费的《解码宇宙》一书介绍，它是个早已闻名和已经研究解决了的悖论。塞费分析它的关键点类似，希格斯王国的“宪法”对测量或观察执行的密码，是爱因斯坦相对论的两个假设。虽然这个希格斯王国在 137 亿年前的宇宙大爆炸初始，就已完成了它的使命，但质量“宪法”没变。塞费说，相对性原理和光速不变原理两个假设有许多离奇的结果，但该理论却有着完美的对称性。观察者或许对长度、时间、质量以及许多其他基本实物各抒己见，但与此同时，所有的观测者都是正确的。塞费用具体数据解说“谷仓内的标枪悖论”：想象有一名短跑运动员能以光速 80% 的速度快跑，他是手持一根 15 米长的标枪，向着一座 15 米长的谷仓跑去。

这座谷仓有一个前门和一个后门。一开始，谷仓前门开着，后门关着。观测者原地不动，坐在屋顶椽架上测量，由于奔跑者米尺的相对论性效应，他实际测量到这根 15 米长的标枪缩短了，只有 9 米。而固定不动的谷仓，仍然保持它原来的 15 米的长度。塞费说：“正如爱因斯坦的理论所说，信息即实在。如果我们的精确测量仪器获取了关于标枪的信息，这些信息显示标枪是 9 米长，那么它就是 9 米长——不必考虑一开始时它有 15 米长”。我们不想重复塞费在书中从各个角度论证他的这个正确结论。丹尼尔·肯尼菲克出版的《传播，以思想的速度》一书中，也重复了对“谷仓内的标枪悖论”类似塞费得出的分析：短跑运动员与屋顶椽架上的观测者对事件的顺序意见不一致，解决这个悖论与时间有关。我们习惯于独立地在空间或在时间中测量，但实际存在一个描述两扇门关闭之间信息传播需要时间的时空区域，它兼有空间的和时间的两个方面。

5) 具体联系到 ATLAS 和 CMS 两个研究团队，是在人工实验室里重新“复活”大爆炸时期的希格斯王国和希格斯运河的船闸，以寻获希格斯粒子的踪迹。但这里，时间顺序是被颠倒了，然而爱因斯坦的理论告诉这却有着完美的对称性。

我们用类似巴拿马运河船闸模型的大量子弦论，解释希格斯粒子是一种理论上预言的能解释其他粒子质量起源的新粒子，这类似从薛定谔猫到彭罗斯的薛定谔团块，假设宇宙大爆炸的撕裂，质量变化有类似轮船在船闸的位移，是用在不同落差的分段的数学分析，来解释的。当然也还有类似玻尔-索末菲的超对称量子化量子数 n 、 k 和 m 交织等，用这种基于链式弦图的质量谱公式，才验算出顶夸克的质量为 202GeV 的。

但我们说 $125.9\text{GeV}/c^2$ 为今天希格斯粒子的质量，不是把它比作大爆炸时期的希格斯运河的船闸，而是与顶夸克调换了一个角色，成了希格斯巨轮，顶夸克的质量反而成了船闸的长度。而且根据前面塞费的谷仓内的标枪悖论分析，还应把希格斯运河的船闸与谷仓调换，成为“希格斯谷仓”，那么顶夸克的质量成了谷仓的长度，希格斯粒子也被再调换为短跑运动员和标枪的组合。设希格斯粒子在对撞机里“跑”的速度为 v_x ，质子速度为 v_z 。虽然大型强子对撞机有能力将质子流加速到光速的 99.99%，但已知顶夸克的质量是约质子质量的 200 倍，希格斯粒子也比质子的质量大，且由质子生成，希格斯粒子速度 v_x 自然比质子速度 v_z 是光速的 99.99% 还小。那么希格斯粒子的速度 v_x 是光速的多少呢？根据塞费对谷仓内的标枪悖论提供的数据：短跑运动员以光速 80% 的速度向着一座 15 米长的谷仓跑去，他手持的 15 米长的标枪缩短为只有 9 米。

如果塞费说的准确，因相对性原理和光速不变原理的信息真实效应适用于“希格斯谷仓”，其对应比例是：

$$\begin{aligned} & (\text{标枪的测量长度/谷仓长度}) : \text{运动员速度} = \\ & \text{等于} (\text{希格斯粒子质量/顶夸克质量}) : \text{希格斯粒子的速度 } v_x, \text{ 即:} \\ & (9/15) : 0.80 = (125.9/202) : v_x \quad (4-2) \\ & v_x = (0.80 \times 0.62) \div 0.6 = 0.5 \div 0.6 = 0.83 \text{ (光速)} \end{aligned}$$

即这个希格斯粒子速度 v_x 为光速的 83%，是已知实验数据的理论反推。实验“重演”的过程是欧核中心在建造的能量强大的大型强子对撞机设备里面，有能力将质子流加速到光速的 99.99%，使两束高能质子流进行加速、对撞。以每 10^{12} 次的质子对撞，才可能产生一次希格斯粒子。困难的是它一旦产生，就转瞬即逝，衰变成光子和强子等其他粒子。目前 ATLAS 和 CMS 寻找该粒子最主要的过程，只是“抓住”希格斯粒子衰变产生的光子，反推它们会不会是希格斯粒子产生后又衰变出来的。遗憾的是，他们没有反推希格斯粒子的速度 v_x 。如果对撞机实验能测出希格斯粒子的速度 v_x ，与我们理论预测的 v_x 为光速的 83% 数据吻合，就应该说发现的新粒子是希格斯粒子能定下来。

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Bacteriological quality of street-vended Ready-to-eat fresh salad vegetables sold in Port Harcourt Metropolis, Nigeria

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ABSTRACT: Vegetables promote good health but harbor a wide range of microbial contaminants. To assess the microbial quality of street-vended ready-to-eat fresh vegetables, fourteen samples of cabbage and lettuce vegetable were purchased from different markets. Samples of salad vegetables were analyzed using standard bacteriological methods. The bacteria loads as reflected by the total aerobic count ranged from 3.1×10^5 to 7.8×10^5 CFU/g for cabbage and 3.1×10^5 to 6.9×10^5 CFU/g for lettuce. The total coliform counts ranged from 3.4×10^5 to 5.6×10^5 CFU/g for cabbage and 3.4×10^5 to 4.0×10^5 CFU/g for lettuce. The total Salmonella-Shigella counts ranged from no significant growth (0.0×10^5) to 3.6×10^5 CFU/g for cabbage and no significant growth (0.0×10^5) to 3.4×10^5 CFU/g for lettuce. A total number of twelve genera of bacteria were isolated and identified as *Staphylococcus* (7.6%), *Proteus* spp. (5.1%), *Bacillus* spp. (3.4%), *Shigella* spp. (2.5%), *Micrococcus* spp. (1.7%), *Pseudomonas* spp. (7.6%), *Enterobacter* spp. (1.7%), *Serratia* spp. (1.7%), *Citrobacter* spp. (2.5%), *Klebsiella* spp. (6.8%), *Salmonella* spp. (13.6%) and *Escherichia coli* (45.8%). This showed that *Escherichia coli* (45.8%) were most predominant, followed by *Salmonella* spp. (13.6%) while *Micrococcus* spp. (1.7%), *Enterobacter* spp. (1.7%) and *Serratia* spp. (1.7%) were least predominant. Since the vegetables are ready-to-eat and will not be subjected to heat treatment, it could be a source of food poisoning to consumers. However, regular inspections of food premises and education of food vendors has been recognised as one of the measures to ensure improvement of the quality of street foods. Thus, government should placed emphasis on educating vendors on simple preventive steps of keeping food hygienically safe.

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1. INTRODUCTION

Ready-to-eat (RTE) salads constitute an expanding food commodity nowadays served to these consumers (Carrasco *et al.*, 2010; Arvanityannis *et al.*, 2011; Adjrah *et al.*, 2013). Salad can be defined as a food made primarily of a mixture of raw vegetables and/or fruits (Uzeh *et al.*, 2009; Rajvanshi, 2010; Adjrah *et al.*, 2013). Vegetables can also be regarded as the edible component of plants, such components includes leaves, stalk, roots, tubers, bulbs, flowers and seed (ICMSF, 1998; Adebayo-Tayo *et al.*, 2012). These include those plants or plant part used in making soup or served as an integral part of main meal (Yusuf *et al.*, 2004). Vegetables are important protective food and highly beneficial for the maintenance of health and prevention of diseases (Adebayo-Tayo *et al.*, 2012). They contain valuable food ingredients which are essential for the proper function of the body. Vegetable contain various medicinal and therapeutic agent and are valued mainly for their high vitamin and mineral content (Adebayo-Tayo *et al.*, 2012). Studies have evaluated the association of fruit and vegetables consumption with

the reduction of risk of specific diseases (Hung *et al.*, 2004; Adebayo-Tayo *et al.*, 2012).

Fruits and vegetables carry microbial flora while passing from the farm to the table. The produce is exposed to potential microbial contamination at every steps including cultivation, harvesting, transporting, packaging, storage and selling to the final consumers, which may affect the health of consumers. Possible sources of these pathogens are soil, faeces, manure (both of human and animal origin), water (irrigation, cleaning), animals (including insects and birds), handling of the products harvesting and processing equipment, and transportation (Okonko *et al.*, 2008a,b,c,d). Most of raw vegetables such as cabbage and lettuce are normally consumed without being cooked, so the possibility of food poisoning exists (Aycicek *et al.*, 2006). Unfortunately, the increase in consumption has been correlated with the increase frequency of outbreak of illness associated with the raw fruits and vegetable. Previous investigations have shown that efficacy of washing and sanitizing treatment reduces microbial populations on fresh vegetables.

It is clearly evident that a large number of vegetables are a good source of antioxidants and phytonutrients, and have health protecting properties (Meng *et al.*, 2002; Heo and Lee, 2006; Vrchovska *et al.*, 2006; Adjrah *et al.*, 2013), to improve human well being. In contrast with these advantages, the salads containing raw vegetables may be unsafe, mainly because of the environment under which they are prepared and consumed (Taban and Halkman, 2011; Adjrah *et al.*, 2013) and also of the lack of personal hygiene (Martinez-Tomé *et al.*, 2000; Cuprasitru *et al.*, 2011; Adjrah *et al.*, 2013). These foods have been identified as vehicles of bacterial agents and generate food safety problems, especially gastroenteritis (Meng *et al.*, 2002; Adu-Gyamfi and Nketsia-Tabiri, 2007; Adjrah *et al.*, 2013). The incriminated microorganisms included *Pseudomonas* spp., *Xanthomonas* spp., *Enterobacter* spp., *Chromobacterium* spp., lactic acid bacteria, yeasts, less frequently *Aeromonas hydrophila*, and occasionally *Listeria monocytogenes* (Lavelli *et al.*, 2006; Adjrah *et al.*, 2013).

Frequent food borne diseases have been reported in Nigeria following the consumption of vegetables. Vegetable salads do not need to be heated before consumption, whereas, vegetables may act as a reservoir for many microorganisms (Beuchat, 2002). Therefore, RTE salads vegetables carry the potential risk of microbiological contamination due to the usage of untreated irrigation water or sewage, inappropriate organic fertilizers or inadequately composted manure, the harvesting, the handling, processing and distributing during the restaurant services (Taban and Halkman, 2011; Adjrah *et al.*, 2013). Previous research pointed out that vegetables produced in Lomé represent a microbiological risk for consumers (Adjrah *et al.*, 2011, 2013). The present study evaluates the bacteriological quality of street-vended ready-to-eat fresh salad vegetables commonly consumed in Port Harcourt metropolis, Rivers State, Nigeria.

2. MATERIALS AND METHODS

2.1. Collection and Processing of samples

A total of 14 randomly selected healthy and clean looking fresh salad vegetables were purchased from Choba market, Rumukoro market, Mile 3 market, Creek road and Alakahia market all in Port Harcourt, Rivers State, Nigeria. These samples were placed in separate sterile plastic bags and transported to the laboratory for bacteriological analysis. These vegetables were not locally cultivated in the state. Vegetables were surface sterilized by exposing them in 1 min 90% ethyl alcohol (BDH chemicals Ltd Poole England) and then 3 min to 1% sodium hypochlorite and then rinsed three times in sterile distilled water. Segments (3 - 5 cm) of tissues from the margins of the

vegetables were cut out with a sterile scalpel and placed on previously prepared media in Petri dishes and incubated at appropriate temperatures.

2.2. Enumeration, Isolation and Identification of Bacteria Isolates

The vegetable samples from different location were weighed and grinded using stomacher. Twenty-five grams of each homogenized sample was dispensed into a prepared 225 ml of normal saline. The content was shaken for homogenous mixture. Ten fold serial dilutions were used to prepare culture plates by pour plate method. About 0.1 ml of the 10^{-5} dilution of the samples from different location were pipetted out and pour plated using Plate Count agar (PCA), Nutrient agar (NA), MacConkey agar (MCA), Eosin Methylene Blue Agar (EMB) and Salmonella-Shigella agar (SSA) for total aerobic counts, total coliform counts and total Salmonella-Shigella counts. These plates were incubated at 37°C for 24-48 hours. The streak technique in the Nutrient agar was employed for bacterial colony purification. The discrete colonies from these subcultured plates and series of biochemical tests were done for proper characterization and identification. The bacterial isolates were also identified by comparing their characteristics with those of known taxa, as described by Jolt *et al.* (1994) and Oyeleke and Manga (2008).

3. RESULTS ANALYSIS

The results obtained for microorganisms associated with the street-vended ready-to-eat fresh salad vegetables are shown in Tables 1 to 2.

3.1. Enumeration of Isolates

Table 1 showed that the total viable counts for cabbage ranged from 3.1×10^5 to 7.8×10^5 CFU/g. It also showed that the total viable counts for lettuce ranged from 3.1×10^5 to 6.9×10^5 CFU/g (Table 1). Table 1 also shows the total coliform counts for vegetables (cabbage and lettuce). It showed that the total coliform counts ranged from 3.4×10^5 to 5.6×10^5 CFU/g for cabbage and 3.4×10^5 to 4.0×10^5 CFU/g for lettuce (Table 1). The total Salmonella-Shigella counts ranged from no significant growth (0.0×10^5) to 3.6×10^5 CFU/g for cabbage and no significant growth (0.0×10^5) to 3.4×10^5 CFU/g for lettuce. For cabbage samples, no significant growth of Salmonella-Shigella in samples C, D, E and F while for lettuce, no significant growth of Salmonella-Shigella was seen in samples C, D, F and G. No significant growth of coliforms was found in samples D and F of cabbage (Table 1).

Table 1: Microbial Loads of Isolates obtained from Vegetables

| Samples | Type | Total Viable Counts (CFU/g) | Total Coliform Counts (CFU/g) | Total Salmonella-Shigella Counts (CFU/g) |
|---------|---------|-----------------------------|-------------------------------|--|
| A | Cabbage | 6.6 x 10 ⁵ | 4.2 x 10 ⁵ | 3.2 x10 ⁵ |
| B | Cabbage | 7.8 x 10 ⁵ | 5.6 x 10 ⁵ | 3.6 x10 ⁵ |
| C | Cabbage | 3.1 x 10 ⁵ | 4.8 x 10 ⁵ | NSG |
| D | Cabbage | 5.8 x 10 ⁵ | 3.4 x 10 ⁵ | NSG |
| E | Cabbage | 6.9 x 10 ⁵ | 3.9 x 10 ⁵ | NSG |
| F | Cabbage | 5.7 x 10 ⁵ | 4.0 x 10 ⁵ | NSG |
| G | Cabbage | 7.3 x 10 ⁵ | 3.4 x 10 ⁵ | 3.1 x10 ⁵ |
| A | Lettuce | 6.6 x 10 ⁵ | 4.0 x 10 ⁵ | 3.4 x10 ⁵ |
| B | Lettuce | 3.1 x 10 ⁵ | 3.6 x 10 ⁵ | 3.4 x10 ⁵ |
| C | Lettuce | 5.4 x 10 ⁵ | 4.0 x 10 ⁵ | NSG |
| D | Lettuce | 5.2 x 10 ⁵ | NSG | NSG |
| E | Lettuce | 6.4 x 10 ⁵ | 3.8 x 10 ⁵ | 3.2 x10 ⁵ |
| F | Lettuce | 4.7 x 10 ⁵ | NSG | NSG |
| G | Lettuce | 6.9 x 10 ⁵ | 3.4 x 10 ⁵ | NSG |

Key: NSG- No Significant Growth

3.2. Isolation and Identification of Isolates

The bacteria isolated from vegetables were identified based on their cultural, morphological and biochemical characteristics as *Staphylococcus* spp., *Proteus* spp., *Bacillus* spp., *Shigella* spp., *Micrococcus* spp., *Pseudomonas* spp., *Enterobacter* spp., *Serratia* spp., *Citrobacter* spp., *Klebsiella* spp., *Salmonella* spp. and *Escherichia coli*.

3.3. Frequency of occurrence of Isolates

Table 2 shows the frequency of occurrence of bacteria associated with vegetables in Port Harcourt metropolis, Nigeria. It showed that *Escherichia coli* (45.8%) were most predominant bacterial isolates associated with vegetable samples used in this study. This was followed by *Salmonella* spp. (13.6%), *Enterobacter* spp. (1.7%), *Serratia* spp. (1.7%) and *Micrococcus* spp. (1.7%) were least predominant (Table 2). *Escherichia coli* were present in all the vegetables examined. *Enterobacter* spp., *Serratia* spp., *Micrococcus* spp., *Pseudomonas* spp., and *Citrobacter* spp. were only present in lettuce while *Bacillus* spp. was only present in cabbage (Table 2).

Table 2: Frequency of occurrence of Bacteria Associated with Vegetables in Port Harcourt Metropolis, Nigeria

| Isolates | No. (%) | Cabbage (%) | Lettuce (%) |
|------------------------------|-------------------|-----------------|-----------------|
| <i>Escherichia coli</i> | 54(45.8) | 43(79.6) | 11(20.4) |
| <i>Proteus</i> spp. | 6(5.1) | 4(66.7) | 2(33.3) |
| <i>Bacillus</i> spp. | 4(3.4) | 4(100.0) | 0(00.0) |
| <i>Staphylococcus aureus</i> | 9(7.6) | 5(55.5) | 4(44.5) |
| <i>Enterobacter</i> spp. | 2(1.7) | 0(00.0) | 2(100.0) |
| <i>Salmonella</i> spp. | 16(13.6) | 8(50.0) | 8(50.0) |
| <i>Serratia</i> spp. | 2(1.7) | 0(00.0) | 2(100.0) |
| <i>Klebsiella</i> spp. | 8(6.8) | 6(75.0) | 2(25.0) |
| <i>Micrococcus</i> spp. | 2(1.7) | 0(00.0) | 2(100.0) |
| <i>Pseudomonas</i> spp. | 9(7.6) | 0(00.0) | 9(100.0) |
| <i>Citrobacter</i> spp. | 3(2.5) | 0(00.0) | 3(100.0) |
| <i>Shigella</i> spp. | 3(2.5) | 2(66.7) | 1(33.3) |
| Total | 118(100.0) | 71(60.7) | 46(39.3) |

4. DISCUSSION

The present study evaluated the bacteriological quality of street-vended ready-to-eat fresh salad vegetables commonly consumed in Port Harcourt metropolis, Rivers State, Nigeria. The result showed that *E. coli* was most predominant (45.8%), followed by *Salmonella* spp. (13.6%) while *Micrococcus* spp. (1.7%), *Enterobacter* spp. (1.7%) and *Serratia* spp. (1.7%) were least predominant bacteria isolated from the salad vegetables examined. The incidence of bacteria in salad vegetables may be expected to reflect the sanitary quality of the processing steps and the microbiological condition of the raw product at the time of processing (Ngugen, 1994; Adebayo-Tayo et al., 2012). For almost 100 years, vegetables contaminated in the field have been recognized as a source of human infection and unless. Many of the viruses (Rosenblum et al., 1990), bacteria (Ho et al., 1986) and protozoan on vegetables which have caused food poisoning are derived from human faeces (Adebayo-Tayo et al., 2012). However, pathogenic microorganism of human origin may also be present in minimally processed vegetables as the minimal technological processing may be unable to remove the original contamination resulting from air, soil, water, insects, animals, workers, harvesting and transportation equipment (Adebayo-Tayo et al., 2012).

Bacteria most commonly found in vegetables generally involve *Pseudomonas* spp. and *Erwinia* spp. as coliforms and *Micrococcus* spp. (ICSMF, 1998). In this study, the bacteria isolated from vegetables were *Staphylococcus* (7.6%), *Proteus* spp. (5.1%), *Bacillus* spp. (3.4%), *Shigella* spp. (2.5%), *Micrococcus* spp. (1.7%), *Pseudomonas* spp. (7.6%), *Enterobacter* spp. (1.7%), *Serratia* spp. (1.7%), *Citrobacter* spp. (2.5%) *Klebsiella* spp. (6.8%), *Salmonella* spp. (13.6%) and *Escherichia coli* (45.8%). All the bacteria reported in this study had previously been isolated from vegetables in other studies, both in Nigeria and elsewhere (Dunn et al., 1995; Adebolu and Ifesan, 2001; Omemu and bankole, 2005; Tambekar and Mundhada, 2006; Uzeh et al., 2009; Yeboah-Manu et al., 2010; Rajvanshi, 2010; Halablab et al., 2011; Ameko et al., 2012; Odu and Akano, 2012; Adjrah et al., 2013). Halablab et al. (2011) reported that lettuce samples from the Bekaa Valley in Lebanon had *E. coli*, *S. aureus* and coliforms. In Rajvanshi (2010), all the samples of street vended salads in Jaipur City, India, carried gram positive as well as gram negative bacteria; and samples contaminated with certain pathogens were *Bacillus* (24.5%), *E. coli* (11.8%), *Pseudomonas* (11.8%), *Staphylococcus* (10.9%), *Enterobacter* (9.0%), *Streptococcus* (6.4%), *Klebsiella* (5.4%) and *Citrobacter* (3.6%) in their study (Rajvanshi, 2010; Ameko et al., 2012). Pathogens

identified by Yeboah-Manu et al. (2010) in their study were *E. coli*, *P. aeruginosa*, *K. pneumoniae*, and *Streptococcus* sp., but *S. aureus* was absent. In the Odu and Akano (2012) study on shawarma, *Proteus* spp. (22.7%) was the most predominant, followed by *Escherichia coli* (13.6%), *Bacillus* spp. (13.6%) and *Staphylococcus aureus* (13.6%). *Enterobacter aerogens* (9.1%), *Klebsiella* spp. (9.1%), *Serratia marcescens* (9.1%), and *Micrococcus* spp. (9.1%) were least predominant.

Pathogens such as *Bacillus cereus*, *Salmonella* and *Escherichia coli* are naturally present in some soil, and their presence on fresh vegetables is not rare (Odu and Akano, 2012; Adebayo-Tayo et al., 2012). Sufficient moisture, abusive temperature and adequate time will ensure a continuing increase in the bacteria population (Adebayo-Tayo et al., 2012). In the study by Adjrah et al. (2013), *Salmonella* spp. was not detected in any of the samples evaluated, but almost 25.0% of the samples were contaminated by *S. aureus*. In their study (Adjrah et al., 2013), the percentage of samples positive for indicator of food safety lack germs like total aerobic bacteria, total coliforms and thermotolerant coliforms were 100, 100 and 37.68 respectively; corresponding to conformity rates of 14.49, 11.59 and 81.16 respectively. In a study by Rajvanshi (2010), the percentage of salads vended on Jaipur City Street in India which were colonized by *S. aureus* was below 10.9%. In contrast, Feglo and Sakyi (2012) did not isolate *S. aureus* in any sample of salads collected in Kumasi (Ghana).

Cenci-Goga et al. (2005) pointed out that total aerobic bacteria count was a good indicator of food safety. Bacterial counts on street-vended ready-to-eat cabbage and lettuce exceeded the recommended World Health Organization (WHO, 1996) and International Commission on Microbiological Specifications for Food (ICMSF, 1998) standards of 10^3 CFU/g (for example, Log_{10} 3.0 CFU/g) (Amponsah-Doku et al., 2010; Ameko et al., 2012). This agrees with the results obtained in this study, where bacterial counts on all salad vegetable (cabbage and lettuce) samples exceeded Log_{10} 3.0 CFU/g. In this study, total viable counts were 3.1×10^5 to 7.8×10^5 CFU/g for cabbage and 3.1×10^5 to 6.9×10^5 CFU/g for lettuce. A similar study was carried out in Lagos by Uzeh et al. (2009) and the total aerobic bacteria count ranged from 3.3×10^3 to 5.9×10^6 CFU/g. Also, a previous study carried out by Odu and Akano (2012) shawarma showed higher TVC for aerobic mesophilic bacteria for all 3 locations and the home made samples used in their study. The total aerobic bacteria count in the Odu and Akano (2012) study were 1.1×10^6 CFU/g, 8.0×10^5 CFU/g, 9.0×10^5 CFU/g and 4.2×10^3 CFU/g respectively, with Elelenwo and GRA having the

highest TVC, while the total viable bacterial count for both Choba and home-made samples were the lowest (8.0×10^5 and 4.2×10^3 CFU/g).

In this study, total coliform counts were 3.4×10^5 to 5.6×10^5 CFU/g for cabbage and 3.4×10^5 to 4.0×10^5 CFU/g for lettuce. The same findings were reported by Hanashiro *et al.* (2005) in São Paulo for thermotolerant coliforms load. Total Salmonella-Shigella counts were 0.0×10^5 to 3.6×10^5 CFU/g for cabbage and 0.0×10^5 to 3.4×10^5 CFU/g for lettuce. The higher bacterial count observed for the vegetables examined in this study are similar to those obtained in other studies in Nigeria (Uzeh *et al.*, 2009; Bukar *et al.*, 2010; Adebayo-Tayo *et al.*, 2012; Ameko *et al.*, 2012; Odu and Akano, 2012). The total aerobic counts obtained in this study is lower compared to that reported by Kaneko *et al.* (2003) and Adebayo-Tayo *et al.* (2012), however, the total coliform counts were slightly higher than that reported by Kaneko *et al.* (2003), Odu and Akano (2012), and Adebayo-Tayo *et al.* (2012). Results of the microbiological analysis of raw mixed vegetable salads by Ameko *et al.* (2012) indicate that 20% of the vendors had the salads that they sold in the mornings with microbial loads in excess of 5×10^4 cfu/g, and this increased to 80% of the vendors in the afternoons. According to Amponsah-Doku *et al.* (2010), thermotolerant coliforms on lettuce varied from 2.3×10^3 to 9.3×10^8 CFU/g on farm, 6.0×10^1 to 2.3×10^8 CFU/g on market and 2.3×10^6 to 2.4×10^9 CFU/g at street-food vendor sites in Kumasi.

The results of this present study agree with those of Adu-Gyamfi and Nketsia-Tabiri (2007) and Ameko *et al.* (2012), where samples of vegetable salads, served with waakye, had higher levels of contamination. Aerobic mesophyllic counts of 6.9 and 7.6 and coliforms counts of 5.7 and 6.4 log₁₀ cfu/g, were obtained by Adu-Gyamfi and Nketsia-Tabiri (2007) for early and late morning samples, respectively. The mean bacterial counts reported in this study are lower than the values reported by Yeboah-Manu *et al.* (2010). In the Yeboah-Manu *et al.* (2010) study, mean microbial loads of 8.54 to 8.69 Log₁₀ CFU/g was reported for salad sold with waakye on and around the University of Ghana campus, and 6.41 Log₁₀ CFU/g from restaurants outside campus. A lot of factors may be responsible for these differences in the microbial loads reported by different authors. In the study by Yeboah-Manu *et al.* (2010), the salads had salad cream added to them and the salad was not heated. Salad cream contains egg yolk, which is a good medium for supporting microbial growth. In the study by Ameko *et al.* (2012), the salad samples used did not contain salad cream. This could account for the lower values of 4.16 Log₁₀ CFU/g reported in their study, compared to that of Yeboah-Manu *et al.* (2010).

According to Amoah *et al.* (2005 cited by Ameko *et al.*, 2012), lettuce from vegetable farms in Accra, irrigated with drain, stream and piped water, had faecal coliform levels exceeding common guidelines for food quality, irrespective of the irrigation water source. In their study (Amoah *et al.*, 2005), lettuce irrigated with piped water had significantly lower coliform concentrations than those irrigated with shallow well or stream water (Ameko *et al.*, 2012).

The high bacterial contamination observed in these salad vegetables examined in this study may be reflection of storage condition and how long these vegetables were kept before they were obtained for sampling. Refrigerator storage does not necessarily inhibit the growth of microorganisms since psychrophiles, such as *Alcaligenes* and *Pseudomonas* could survive refrigeration temperatures and in some cases even multiply (Samarajeeva, 2005; Ameko *et al.*, 2012). Bacteria on storage material may transfer to produce and cross contamination between produce is probable particular where produce are pre-washed with the same wash water by the vendor or processor. More importantly, bacteria on the vegetables may multiply over time depending on the storage condition especially those that are psychrotrophic. According to what was reported in previous studies elsewhere inside and outside Nigeria, the initial bacteria of stored produce may have been derived from contamination of air, soil, water, insects, animals, workers and harvesting and transportation equipments (Adebayo-Tayo *et al.*, 2012). Also, the densities of Lactic acid bacteria (LAB) in fruit and vegetable products usually range from 10^2 to 10^6 CFU/wound (Trias *et al.*, 2008; Adebayo-Tayo *et al.*, 2012).

The bacterial count obtained was high and these vegetables are usually consumed without heating thus there is the probability of consumers contracting pathogen if they get in contact with the vegetables. In a study by Trias *et al.* (2008), the highest concentrations of microorganisms were in ready-to-eat vegetables. This was due to the presence of cut surfaces, which allow higher nutrient availability (Ongeng *et al.*, 2006) and affects not only LAB but all the microbiota related to the fresh product (Badosa *et al.*, 2008; Trias *et al.*, 2008; Adebayo-Tayo *et al.*, 2012). The microbial population levels found in this study were in agreement with data reported for ready-to-eat salads in other studies (Trias *et al.*, 2008; Adebayo-Tayo *et al.*, 2012). A study by Amoah *et al.* (2007) indicated that fresh vegetables have become a normal part of fast food, served on the street, canteens and restaurants in Ghana. However, farming practices like use of contaminated irrigation water, application of manure and contaminated soils is the main source of lettuce contamination (Consultative Group on International Agricultural Research: CGIAR, 2011;

Ameko et al., 2012). An earlier study by Amoah et al. (2005) in Kumasi, Ghana indicated that 95% of lettuce samples from urban vegetable farms, irrigated with piped water, had faecal coliform levels, which were more than 1000/100 g lettuce (wet weight) and according to the International Commission on Microbiological Specifications for Food guidelines (1974), were classified as “undesirable” (Ameko et al., 2012).

There are several possible sources of bacterial contamination of street-vended ready-to-eat fresh salad vegetables (Ameko et al., 2012). Raw salad vegetables contamination occurs on the farm from the manure, irrigation water, contaminated hands of farmers (Centre for Food Safety, 2006), and from contaminated water used to wash the vegetables after harvest (Pavan da Silva et al., 2007; Ameko et al., 2012). The farmers may sell the vegetables at the farm, directly to the food vendors, or to market women who then sell them to the food vendors at the market (Ameko et al., 2012). If the raw vegetables are contaminated on the farm, it is highly possible that they would be consumed as such, because there is no step along the supply chain or during preparation, such as heating, for killing microorganisms (Centre for Food Safety, 2006; Ameko et al., 2012). In this study, bacterial contamination increased during the course of sale of the salad vegetables. The presence of the most frequently isolated index of food quality and indicators of faecal contamination such as *Escherichia coli*, *Enterobacter* spp. and *Salmonella* spp., is an indication of faecal contamination of the food as a result of possible unhygienic handling (Okonko et al., 2008a,b,c,d 2009a,b; Adebayo-Tayo et al., 2012) or contamination of the salad vegetables during processing or directly from source and this might have adverse effect on the health of the consumers (Okonko et al., 2008a,b,c,d, 2009a,b; Adebayo-Tayo et al., 2012).

According to Ameko et al. (2012), processing of raw vegetables into salads for sale creates conducive environments and opportunities for the multiplication of pathogenic microorganisms on the salads. In this present study, microbial contamination and counts of specific pathogens increased during sale, and the percentage of contaminated samples also increased during sale. This is because the salads still retain enough moisture to promote microbial growth, and also the natural protective covering on the leaves against the entry of microorganisms may have been lost during harvesting, storage, transport and processing (Samarajeewa, 2005; Ameko et al., 2012). The salad may also have undergone some fermentation during sale and the increased acidity may promote the growth of certain microbes such as *Bacillus cereus*, *Clostridium botulinum*, *Salmonella* sp. and *S. aureus*,

which grow well in optimal pH of 4.2 to 8.2 (Samarajeewa, 2005; Ameko et al., 2012).

The isolation of *Salmonella* spp., *Escherichia coli*, *Klebsiella* spp. and *Serratia* spp. from these salad vegetables poses food safety problem since they are all enterotoxigenic and cause gastroenteritis. Coliforms might appear every phase of preparation; a case was reported (Seo et al. 2010). *E. coli* are fecal contaminants which could be from the manure in the soil on the farm (Samarajeewa, 2005; Ameko et al., 2012). The detection of *E. coli* in this study showed poor hygienic standard in the handling of these salad vegetables or it could be also be from contamination during harvest. Presence of *E. coli* indicates recent contamination by faecal matter and possible presence of other enteric pathogens known to be causative agents of food borne gastroenteritis and bacterial diarrhea disease (Adebayo-Tayo et al., 2012).

The presence of other indicator organisms like *E. coli*, *Salmonella* spp., *Shigella* spp. and *Enterobacter* spp. in salad vegetable samples might be the result of possible contamination during sales or unhygienic handling of street-vended ready-to-eat vegetables. Other studies have also identified pathogens including *Salmonella* spp. on other street foods and their accompaniment in South Africa (Mosupuye and von Holy, 1999) and Zambia (Bryan et al., 1997). While *Salmonella* spp. causes salmonellosis and typhoid fever, *Escherichia coli* O157:H7 causes severe illness and deaths, especially among children in several countries (WHO, 2002). *Micrococcus* sp., *Staphylococcus* spp., *Salmonella* spp., and *Shigella* spp. from contaminated hands of food handlers may easily contaminate the vegetables (Samarajeewa, 2005; Ameko et al., 2012).

The presence of *Staphylococcus aureus*, a pathogenic organism of public health concern and significance in these vegetables might have contaminated the stored vegetables from source as a result of handling by farmers or retailers (Adebayo-Tayo et al., 2012). As widely reported, most strains of *Staphylococcus aureus* are known to be pathogenic due mostly to the heat stable enterotoxin they produce in direct relationship to their inoculum level (Adebayo-Tayo et al., 2012). Considering the notoriety of the resistance of *S. aureus* to methicillin, other penicillin and cephalosporins (Adebayo-Tayo et al., 2012), its detection in salad vegetable samples poses a lot of health risk to nourishment seeking consumers. Concerning *S. aureus*, its presence suggests poor hygiene practices of operators. Bezirtzoglou et al. (2000) reported that the contamination by food handlers is the most common mode of transmission of this germ. Burt et al. (2003) established that its contamination might have resulted

from man's respiratory passages, skin and superficial wounds which are his common sources.

Pseudomonas and *Bacillus* species are part of the natural flora and are among the most common vegetable spoilage bacteria. The spores of bacteria such as *Bacillus* spp., *Micrococcus* spp., etc, are carried in air and dust and if the food is not properly covered, these spores could settle on the food, and once nutrients are present, the spores can actively grow and thrive on the food (Ameko et al., 2012). The presence of *Bacillus* species in the two vegetables may be said to be due to environmental factor, the survival of *Bacillus* depend on several factor such as nature of the organism, resistance to the new environment and ability to form spores. Endospores of *Bacillus* are more resistance than their vegetable cell to harsh weather condition and even to antimicrobial treatments (Codex Alimentarius, 2007).

The contamination of salad vegetables examined in this study by pathogenic bacteria could also be as a result of poor handling practices in food supply chain, storage conditions, distribution, marketing practices and transportation (Effiuvwevwe, 2000; Okonko et al., 2008a,b,c,d, 2009a,b; Akinmusire, 2011; Akintobi et al., 2011; Adebayo-Tayo et al., 2012). Bacterial load of salad vegetables also increase with time during storage and this poses serious threat to consumers. Apart from the polythene bags, all the other containers (for example, sacks, open trays, baskets, and wooden-sieve net cages) do not protect the raw vegetables from dust and other forms of contamination from the environment during transporting from the source to the site of preparation. However, the exposure of the salad vegetables to the environment could lead to increased contamination. Improper handling and improper hygiene might lead to the bacterial contamination of salad vegetables and this might eventually affects the health of the consumers (Dunn *et al.*, 1995; Omemu and Bankole, 2005; Okonko *et al.*, 2008 a,b,c,d, 2009a,b; Mgbakor et al., 2011; Adebayo-Tayo et al., 2012). The condition of sales makes the vegetables predisposed to contamination especially as practiced Zaria where the source of water in the garden and in the market is questionable (Caron and Walker, 2004).

These street-vended ready-to-eat salad vegetables pose a risk to consumers because of the danger of food poisoning from microbial contamination (Food and Agriculture Organization (FAO), 2005; Ameko et al., 2012). According to Adjrah et al. (2013), the level of the microbial contamination of the ready-to-eat salads vegetables may present a potential health hazard to consumer. Certain fungi such as *Aspergillus*, *Fusarium*, and *Penicillium* spp. as commonly occurring filamentous fungi grow in vegetable and their growth may result in

production of toxins known as mycotoxins, which can cause a variety of ill effect in human from allergic responses to immunosuppression and cancer (Adebayo-Tayo et al., 2012).

Side by side is the huge nutritional benefit derivable from consumption of these salad vegetables especially they have therapeutic, curative and preventive health uses. Although salad vegetables are commonly associated with food poisoning, they harbour disease causing organisms (Adebayo-Tayo et al., 2012); raw vegetables should not be exposed to any further contamination during transport and storage (WHO, 1996; Ameko et al., 2012). Just as with other foods, consumers have some responsibilities to carry when handling these salad vegetables. Washing of hands with warm water and soap before and after handling salad vegetables cannot be overemphasized (Adebayo-Tayo et al., 2012). Also washing of salad vegetables with salt and clean water before consumption could help in reducing microbial content eventually. However, the most efficient way to improve safety not for fruits and vegetables only, is to rely on a proactive system of reducing risk factors during production and handling. Apart from washing, other methods of decontamination seem to have a limited influence on safety (Adebayo-Tayo et al., 2012).

5. CONCLUSION

This study has further confirmed the presence of pathogens in street-vended ready-to-eat fresh salad vegetables sold in Port Harcourt, Metropolis, Rivers State, Nigeria. Vegetable can be contaminated with pathogen from animal and human reservoirs and the environment as a result of production practices. A major source of contamination is organic fertilizer (e.g. manure, municipal sludges) and faecal contaminated water. The need for microbial assessment of street-vended ready-to-eat fresh vegetables for production of food salads and for other use cannot be over emphasized to reduce possible contamination. Harvesting at the appropriate time and keeping the harvested products under well-controlled condition will help in restricting growth of pathogenic and post-harvest spoilage microorganism. Reduction of risk for human illness associated with raw product can be better achieved through controlling points of potential contamination in the field during harvesting, during processing or shipment, storage or distribution in the retail markets food services facilities or home.

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