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Emails:
aarena@gmail.com
editor@sciencepub.net

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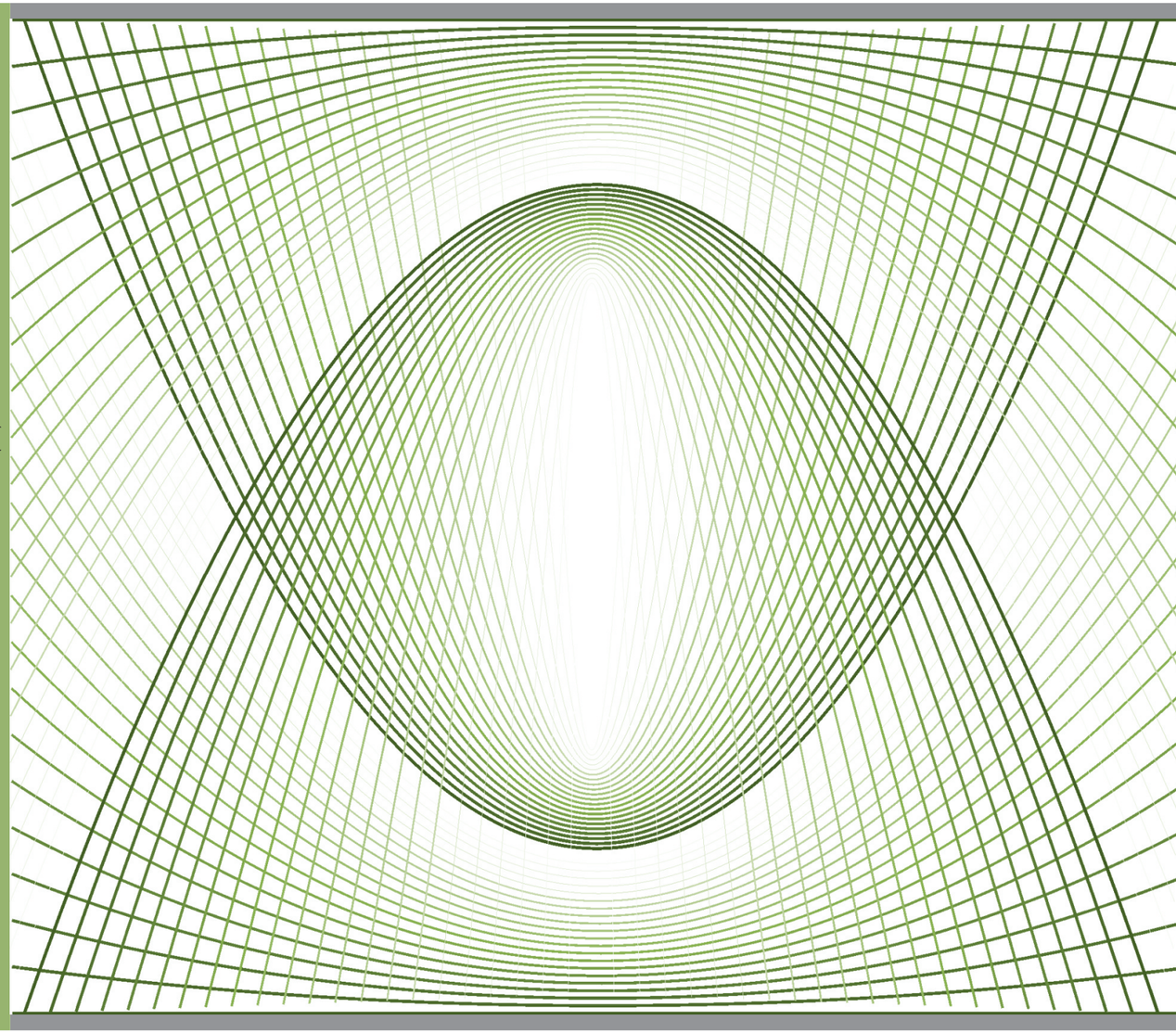

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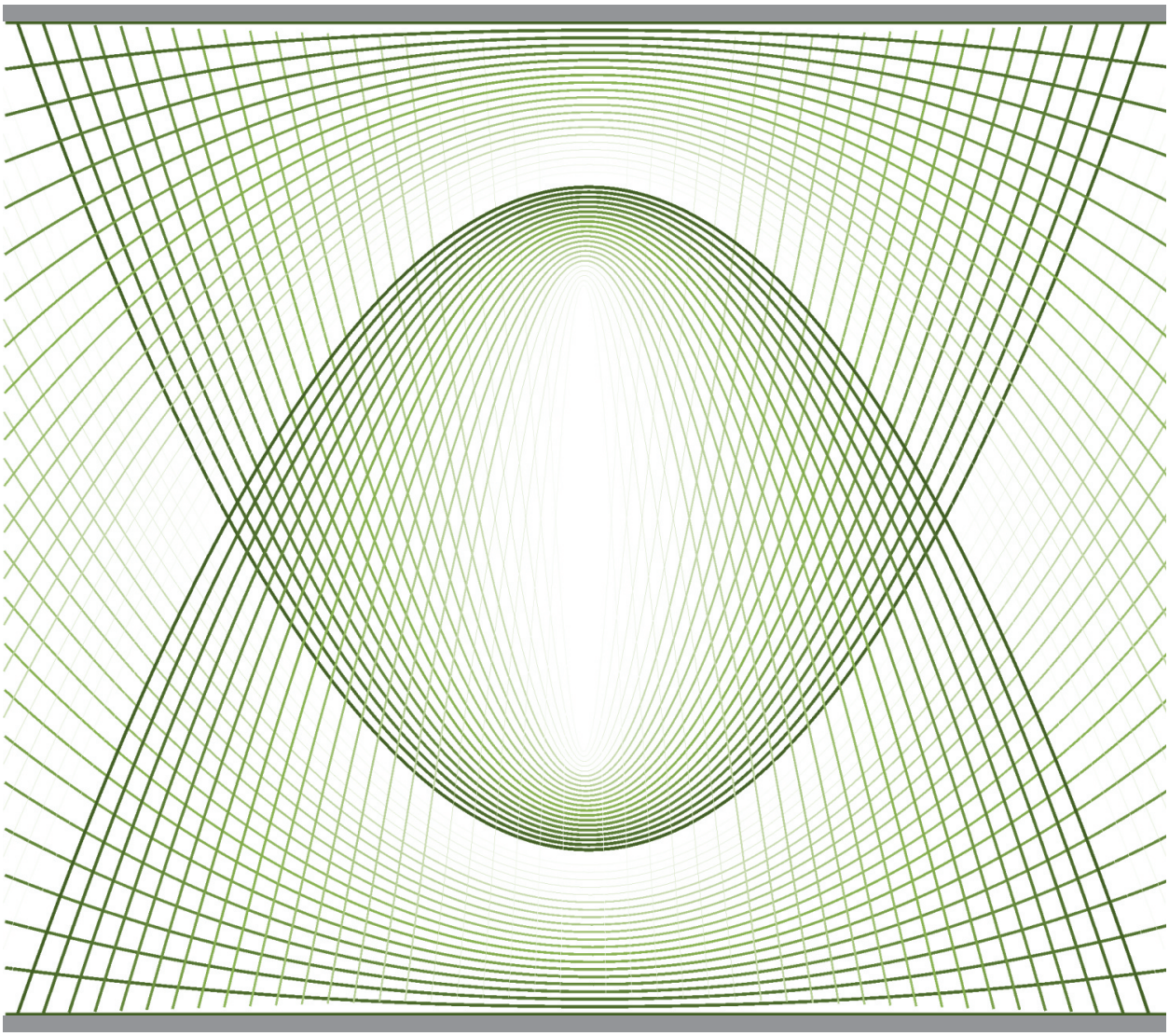

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学术争鸣

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CONTENTS

辐射量子论与自然的连续性 （一评量子物理学）

谭天荣

青岛大学 物理系 青岛 266071
ttr359@126.com
Recommended by Zhang Dongsheng, zhangds12@hotmail.com

内容摘要： 本文证明：我们可以选择适当的连续光滑函数来描写一个量子的发射过程，使得对应的黑体辐射公式与普朗克公式足够接近，以致两者的差别的测量效果被实验误差所掩盖。物理实验永远不可能没有测量误差，因此，我们永远不可能通过物理实验来判断单个量子的发射到底是一个瞬间完成的“跳跃”，还是一个历时足够短促的连续过程。 根据“连续性”与“不连续性”的相互渗透性，自然界没有像“几何点”那样的“绝对小”的物体，也没有“一瞬间完成的”的“跳跃”。由此可以断言，单个量子的发射只能是一个历时足够短促的连续过程。 辐射量子论可追溯到如下三个前提，第一，物质的辐射过程是由一个个离散的原子的辐射过程迭加起来的；第二，单个原子的辐射过程是一个有始有终的有限过程；第三，在实验误差范围内，单个原子的发射过程所经历的时间，是可以忽略的。这三个前提不仅不与经典物理学相冲突，而且还是经典物理学所预期的，因此，辐射量子论并不与经典物理学相矛盾，并没有“摧毁经典世界”。

[谭天荣. 辐射量子论与自然的连续性（一评量子物理学）. Academia Arena, 2012;4(3):1-7] (ISSN 1553-992X). http://www.sciencepub.net. 1

关键词： 辐射量子论；普朗克；原子论；经典物理学；量子；自然的连续性；跳跃；阶跃函数；物理学规律；物理学范畴

1 引言

最近，读了曹天元的新作《上帝掷骰子吗——量子物理史话》，重新点燃了我批判量子物理学的激情。我把我的批判写成下面的一组论文。我已经到了耄耋之年，这是我的最后一搏。

1900 年 12 月 14 日，德国物理学家普朗克通过他创建的、现在称为“普朗克公式”的黑体辐射公式，提出了“辐射量子论”。其中心点是：

A. 物质在发射和吸收电磁波的时候，不是连续不断，而是分成一份一份的。

普朗克的发现使得当时的物理学家们极为震惊，例如，爱因斯坦当时就说：

“我要使物理学的理论基础同这种认识相适应的一切尝试都失败了。这就像一个人脚下的土地都被抽掉了，使他看不到哪里有可以立足的巩固基地。”

关于命题 A，曹天元写道：

“正是这个假定，推翻了牛顿以来 200 多年，曾经被认为是坚固不可摧毁的经典世界。这个假定以及它所衍生出来的意义，彻底改变了人们对世界的最根本的认识。盛极一时的帝国，在这句话面前轰然土崩瓦解。”

然而本文却试图证明，辐射量子论与物理学的理论基础原来并不矛盾；命题 A 并未摧毁经典世界，恰好相反，这一结论原经典物理学早该预期的。

2 量子论与原子论

早在辐射量子论发表以前，原子论就在物理学中巍然屹立。诚然，那时的原子论还没有与辐射理论挂钩，但已经确认物质是由一个个离散的原子组成的，由此自然想到：

B. 物质的辐射过程是由一个个“单个原子的辐射过程”迭加起来的。

我们可以通过如下比方来理解它。如果有一个小组的学生在水田里插秧，那么，这个小组一天所插的秧的面积就是该小组各个组员一天所插的秧的面积的迭加。这无论如何不是一件难以理解的事情，而命题 B 说的无非就是这个道理。

接踵而来的一个问题是：单个原子怎么发射电磁波。对于这个问题，人们首先想到的是另一位德国物理学家赫兹在 1883 年发现的“电磁波”的发射过程。在这里，我们不谈赫兹发现电磁波的光辉事迹，只说一个平淡的结论：赫兹的“高频振荡回路”能连续不断地发射电磁波。人们自然联想，单个原子发射电磁波也是这样连续不断的。或许，在波尔理论之前，每一个物理学家都是这样设想的。

按照这一思路，从命题 B 并不能引出命题 A，从而由大量原子组成的物质发射电磁波当然也是连续不断的。这就说明了一个历史事实：当普朗克提出辐射量子论时，他做梦也没有想到这一理论与原子论有什么关联。或许在未来的物理学家们看来，这是一个颇为费解的历史事实。

然而，只要仔细想一想，我们就不难得出结论：单个原子发射电磁波不可能是连续不断的。道理很简单：赫兹的“高频振荡回路”之所以能连续不断的辐射，是因为赫兹不断从外部向它供应能量，换句话说，是因为它有一个“外部能源”。那么，在单个原子辐射的过程中，有没有一个外部能源呢？如果有，那么在物质辐射时，每一个原子旁边都有一个外部能源连续不断向它输送能量，这种想法未免太古怪了，如果我们不是故意追求奇思异想，就只能回答：“在单个原子辐射的过程中，没有外部能源！”因此，根据能量守恒定律，单个原子不得不以自身的能量的减少为代价来进行辐射。原子是一个有限的物体，有限的物体不可能储存无限的能量，从而单个原子的能量是有限的。因此，它的辐射不可能是一个连续不断的无限过程，这就立刻得出结论：

C. 单个原子的辐射是一个有始有终的有限过程。

并且还能进一步得出结论：单个原子将在一个有始有终的有限过程中发射一份电磁波，从而发射一份能量。

从命题B与命题C我们立刻得到如下一幅图景：在物质辐射过程中，诸原子各自发射一份电磁波，物质辐射的电磁波就是由这些一份一份离散的电磁波合成的。而这就是命题 A，这就是辐射量子论的实质。

综上所述，光波发射之所以是一份一份的，是由于作为光源的物质是由一个一个离散的原子组成的，换句话说：“发光的量子性起源于光源的原子性。”

我们可以用一个日常生活的比喻来阐明这一平易近人的道理。春节时，孩子们放鞭炮。如果有一位“大人国”的观察者，他看不见孩子们更看不见鞭炮，但他根据一系列的测量、计算与推理得出结论：在放鞭炮的过程中声波的能量一份一份地跳跃地增加。那么，这位观察者合理的推测应该是：声波的能量不连续地增加因为声波的波源是由一个一个的鞭炮组成的。在比喻的意义下我们也可以说：“发声的‘量子性’起源于声源的‘原子性’。”

更一般地说，通常我们说的“连续性”的含义可以分成两个方面：一方面是指空间方面的连续性，像山脉、河流那样的连绵不断；另一方面是指时间方面的连续性，像唱歌、拉琴那样的前后相接。如果说辐射量子论破坏了自然界在时间方面的连续性，那么，物质的原子论就早已破坏了自然界在空间方面的连续性。因此，只要我们静下心来想一想，就不必为普朗克的发现感到惊讶，辐射量子论只不过是物质的原子论的必然补充。

由此可见，1900 年普朗克发表辐射量子论这件事情最令人惊讶的地方不是这个理论违反了经典物理学的原理，而是普朗克为什么没有把这个理论与经典物理学的原子论联系起来！

不难设想，如果命题 B 和命题 C 能在建立辐射量子论之前被发现，则辐射量子论将是经典物理学的一个组成部分。不幸的是，这两个如此重要而又显而易见的命题，却直到 1913 年才在波尔建立的原子理论（波尔理论）中被发现。命题 B 和命题 C 本是两个足以恢复经典物理学的论据，而包含了这两个论据的波尔理论却反而宣判了经典物理学的死刑。在我们这个星球上，物理学的发展进程就这么颠三倒四。

3 一个逻辑上的疏忽

然而，话又说回来，即使有了命题 B 与命题 C，普朗克的量子论也还有费解之处，因为按照普朗克的理解，命题 A 还有进一步的含义：

D. 在物质辐射过程中，辐射场的能量总是某一“能量的最小单位”的整数倍。

这里的“能量的最小单位”就是普朗克所说的“量子”；只有命题 D 才是辐射量子论的确切表达。从命题 B 与命题 C 能不能得到这样表述的辐射量子论呢？为了回答这一问题，让我们考虑一个日常生活的例子。

记得我上小学时，学校为了建造一个跳高跳远用的沙坑，把同学们分成两拨，一拨人把一辆汽车上的沙子装到一个个脸盆里，另一拨人则把装满沙子的脸盆把沙子倒在沙坑里，在这一过程中，沙坑里的沙子是否总是一盆沙子的整数倍呢？未必！例如，如果沙坑里已经有 10 盆沙子，这时又有一位小朋友往沙坑里倒沙子，当他刚倒一半时，沙坑里的沙子就是 10 盆半，从而这时沙坑里的沙子就不是一盆沙子的整数倍。

然而，至少当没有人往沙坑里倒沙子时，沙坑里的沙子确实是一盆沙子的整数倍。因此，每个小朋友往沙坑里倒沙子的时间越短，沙坑里的沙子是一盆沙子的整数倍的时间就越长。在极端情况下，如果每个小朋友往沙坑里倒沙子根本不需要时间，即“倒沙子的过程”是一瞬间完成的，则沙坑里的沙子就总是一盆一盆地增加的。

同样，在命题 B 和命题 C 成立的前提下，如果再加上一个新的前提：

E. 单个量子（一份电磁波）的发射是在一瞬间完成的。

我们就能得到命题 D，从而得到辐射量子论。

曹天元断言辐射量子论“摧毁了经典世界”，是因为这个理论破坏了经典世界的一个基本属性——“自然的连续性”。关于这种属性，曹天元写道：

“自然的连续性是如此的不容置疑，以致几乎很少有人会去怀疑这一点。当预报说气温将从 20 度

上升到 30 度，你会毫不犹豫地判定，在这个过程中间气温将在某个时刻到达 25 度，到达 28 度，到达 29 又 1/2 度，到达 29 又 3/4 度，到达 29 又 9/10 度……总之，一切在 20 度到 30 度之间的值，无论有理的还是无理的，只要他在那段区间内，气温肯定会在某个时刻精确地等于那个值。”

显然，命题 E 破坏了“自然的连续性”，这是不容置疑的。但当曹天元因此而断言“辐射量子论破坏了自然的连续性”时，却犯了一个逻辑上的错误，至少是一个逻辑上的疏忽！

如果（可惜只是如果）在命题 B 和命题 C 成立的大前提下，从命题 D 可以导出命题 E，即证明了命题 E 是命题 D 的“必要条件”，就可得到如下推理过程：辐射量子论“蕴含”命题 D，命题 D“蕴含”命题 E，命题 E 摧毁了经典世界，于是，根据“蕴含关系”的“可传性”，就顺理成章地得出了“辐射量子论摧毁了经典世界”的结论。

不幸的是，谁也没有证明命题 E 是命题 D 的“必要条件”，更不幸的是，谁也没有想到要给出这一证明。那么，从上面那个“倒沙子”的比喻我们只证明了在命题 B 和命题 C 成立的大前提下，从命题 E 可导出命题 D，即证明了命题 E 是辐射量子论的“充分条件”（顺便说一句，这一证明虽然由于应用了关于“倒沙子”的比喻而显得有些“下里巴人”，但在逻辑上倒是无懈可击的）。于是在其他条件不变时，我们就有了两个前提：第一，命题 E 可导出辐射量子论；第二，命题 E 摧毁了经典世界。那么，从这两个前提又能导出什么结论呢？什么也导不出！

因此，“辐射量子论摧毁了经典世界”这一结论其实立足于一个逻辑上的疏忽：混淆了“充分条件”与“必要条件”，这可是一种太常见的疏忽。

同样的疏忽在普朗克的原始推导中也存在：虽然普朗克确实地证明了：如果命题 E 成立，就可以得到他的普朗克公式，但反过来，为了得到普朗克公式，是不是非用命题 E 不可呢？或者，命题 E 是不是普朗克公式的必要条件呢？普朗克完全忘记向自己提这个问题，物理学家们对逻辑思维总是这样粗心大意。

糟糕的是，无论是物理学家们还是物理学的爱好者，谁都没有证明命题 E 是辐射量子论的必要条件，就惊慌失措地（或许，更多的人则是幸灾乐祸地）满世界嚷嚷：“辐射量子论摧毁了经典世界！”真不知道未来的人们将会怎样评价这次物理学史上罕见的狂热！

下面我将证明，命题 E 并不是辐射量子论的必要条件，从而证明，辐射量子论其实并没有摧毁经典世界。

4 “连续性”的数学表述

我知道，对普朗克的这种诘难，将引起读者们的狂怒：“辐射量子论摧毁了经典世界，这早已是板上钉钉的事，你是何人？敢对这件事说三道四！”

这种谴责，不是立足于实验事实，也不是立足于逻辑推理，而是立足于一种宗教情绪。对于被谴责的人，这可是最具毁灭性的打击。自古以来，得罪了某一宗教的教徒从来就没有好果子吃，触怒了物理教的虔诚的教徒大众自然也不例外！再说，认为“普朗克公式摧毁了经典世界”乃是全体物理学家们的共同见解，谁敢捅这个马蜂窝！

然而，我虽然人微言轻，却不得不冒天下之大不韪，提出一个可怜的异教徒的卑微的建议：我们能不能别忙着得出“摧毁经典世界”的结论，先考察一下“连续性”这一概念，或者换一个说法，别忙着创建新的“物理学规律”，先反思一下我们表达这些规律的“物理学范畴”。

如果我向一位物理学家提出这一建议，他肯定会“不屑置辩”：即使我的运气特别好，遇到一位极有耐心的物理学家，他也只会说：“我天生会用‘连续性’这一概念，用不着为它浪费时间！”在这一点上，数学家们倒是好说话一些，他们并不认为“连续性”是一个不言而喻的概念，他们天生就会用。相反，数学界的前辈们曾经仔细考察过这一概念。我们面临的问题是：“辐射量子论是否破坏了自然界的连续性？”借助于前人的研究成果，我可以把这个问题提得更明确一些。

曹天元关于温度从 20 度上升至 30 度必定经过从 20 至 30 度的每一个温度的论断，乃是“连续函数”的一个性质（布尔查诺定理）。追本溯源，这一“连续函数”的性质立足于“时间的连续性”，确切地说，是立足于“实数集的连续性”。如果说“函数的连续性”表现了两个数集（数的集合）之间的“关系”，那么“实数集的连续性”就表现了一个数集的“属性”，这是一种更根本的“连续性”。

那么“实数集的连续性”又是怎么回事呢？对于这一问题，数学家们已经给出了极为精美而又多种多样的回答，特别是德国数学家狄德金对这种“连续性”作了经典的、堪与我们这个星球上的极品艺术媲美的表述，可惜太“阳春白雪”了，不宜在这里讨论。

回到曹天元说的温度从 20 度上升到 30 度的过程。顺便说一句，曹天元引用的“布尔查诺定理”，只是“连续函数”的必要条件，却并不是其充分条件，因此，我们不要把这个性质与“函数的连续性”等同起来。幸运的是，曹天元在这里说的温度函数（温度作为时间的函数）倒的确是一个“连续函数”，这一结论可以表述为：在给定的时间区域中（从开始时刻到终结时刻），“温度函数在该区域中的每一点都是连续的。”因此，如果这个温度函数在该区域中的某一点不连续，它就不是一个连续函数。

那么，“某一函数在某一区域中的某一点不连续”这句话是什么意思呢？在这里，用玄之又玄的数学语言来考验读者的耐心是不合时宜的，我还是给出一个例子吧。如果曹天元的温度函数从开始时刻到某一时刻 c，温度一直是 20 度，而在时刻 c 这一瞬间，温度从 20 度突变到 30 度，而且直到这段时间终结时，温度一直保持 30 度，我们就说该函数在 c 点是不连续的。尽管该函数在这个区间上的其他点都是连续的，它仍是这个区间上的“不连续函数”。在数学上，这种特殊的不连续函数称为“阶跃函数”。

另一方面，在物理学中往往遇到如下类型的过程：物体从某一状态突变为另一状态，所经历的时间极为短促，而且我们仅仅关心其初始状态与终结状态而不关心其过渡阶段。正如牛顿力学把只考虑其位置与质量而不考虑其大小与形状的物体抽象为“质点”（有质量的几何点）一样，我们把这种类型的过程抽象为一种一瞬间完成的过程，这种过程根本不经历时间，从而它自身根本没有过渡阶段。通常，我们把上面两种过程都称为“跳跃”。以后为了区别起见，我们称历时足够短促的现实过程为“实际的跳跃”，称完全不经历时间的抽象过程为“抽象的跳跃”。而“跳跃”这一用语，则用于一般地表现“不连续性”。

阶跃函数作为最简单的不连续函数，用数学的语言表现了一种典型的“不连续性”，当物体的状态用一个数值表示时，“抽象的跳跃”表成一个阶跃函数。

如果说“抽象的跳跃”对应于命题 E，那么“实际的跳跃”就对应于如下命题：

F. 在实验误差范围内，单个量子的发射过程所经历的时间是可以忽略的。

而对于我们考察的问题，曹天元说的“自然的连续性”可以表述为如下命题：

G. 自然界没有一个物体会是一个“几何点”，也没有一个变化会是一次“抽象的跳跃”。

这样，“辐射量子论到底有没有破坏自然界的连续性”的问题，就归结为选择命题 E 还是选择命题 F 的问题；归结为单个量子的发射到底是一次“抽象的跳跃”还一次“实际的跳跃”的问题；归结为命题 G 是否成立的问题。

5 普朗克公式的双重含义

如果命题 E 成立，则单个量子的发射是一次“抽象的跳跃”，从而辐射场的能量作为时间的函数是一个“阶跃函数”，对应地，黑体辐射公式是普朗克公式。在其他条件不变的前提下，用一个连续光滑的新函数来取代“阶跃函数”，则命题 F 取代了命题 E，对应地，黑体辐射公式也不再是普朗克公式。在这种意义下，命题 E 不仅是普朗克公式的充分条件，也是普朗克公式的必要条件，我们是否可以由此得出“普朗克公式破坏了‘自然的连续性’”的结论呢？

为了回答这一问题，让我们先考察一个日常生活的例子。如果用一条皮尺来测量一个直角三角形的两个直角边，分别得出 1 尺与 2 尺的结果，因此，这两个边的长度与单位长度之比分别是 1 与 2。用 L 表示这个直角三角形的斜边的长度与单位长度之比，则测量与计算给出结论：“L 等于 5 的平方根。”有了这一结论，我们能不能断言“L 是一个无理数”呢？

乍一听来，回答是简单明了的：“L 作为某一长度与单位长度之比，只能是一个实数。既然 L 是一个实数，它就要么是一个有理数，要么是一个无理数。既然 L 是 5 的平方根，它当然是一个无理数！”

对不起，这个回答是错误的，而且从头错到尾！对于物理学，尽管“L 是一个实数”这一命题无可非议，但进一步问“L 是有理数还是无理数”却是一个不着边际的问题。怎见得呢？

“L 是一个实数”这句话本身在不同的场合有不同的含义。作为测量和计算的结果，L 不会是一个“复数”，也不会是“非标准分析”中的一个“超实数”，在这种意义下，说“L 是一个实数”一点没错。还有，对于数学来说，一个实数要么是有理数，要么是无理数，这话也没错。但在物理学领域里，我们不能从这两个前提得出“L 是要么是有理数，要么是无理数”的结论。因为在这里，“L 是一个实数”这句话有另一种含义。

物理学是一门实证科学，它是以实验为基础的，实验中的每一次测量，其精确度都受当时的实验条件的限制而有一定的“误差”。这种“测量误差”通常总是秘而不宣的，但是“不说”不等于“没有”！只要考虑到测量误差，物理量 L 就不再是一个实数，而是一个“实数的区间”了。根据“实数集的连续性”，不论这个区间多么小，其中都既有数不清的有理数，也有数不清的无理数！请问，我们该怎么评价“L 当然是一个无理数”这一结论呢？

“那你怎么不说清楚！L 明明是一个‘实数的区间’，为什么偏说它是一个‘实数’！”

当问题不涉及测量误差时，通常人们都会说“L 是一个实数”而不会说“L 是一个实数的区间”，人们这样说话是约定俗成的。

回到黑体辐射问题。

数学证明：我们可以选择适当的连续光滑函数来取代“阶跃函数”来描写一个量子的发射过程，使得它对应的黑体辐射公式与普朗克公式足够接近，以致两者的差别的测量效果被实验误差所掩盖。“阶跃函数”描写了一次“抽象的跳跃”，它对应的黑体辐射公式破坏了自然的连续性；而取代“阶跃函数”的连续光滑函数则描写了一次“实际的跳跃”，

它对应的黑体辐射公式满足自然的连续性。

“普朗克公式”这一用语在不同的场合也有不同的含义，当我们说“阶跃函数对应于普朗克公式”时，“普朗克公式”指的是一个单一的黑体辐射公式，但一旦涉及到“自然的连续性”的问题，就不能不考虑测量误差，这时，“普朗克公式”就具有另一种含义了。

正如考虑到测量误差，L 就是一个“实数的区间”一样；只要考虑到测量误差，“普朗克公式”就不再是一个单一的“黑体辐射公式”，而是一个包含无数“黑体辐射公式”的“公式集合”；正如一个“实数的区间”既包括数不清的有理数，也包括数不清的无理数一样，作为“黑体辐射公式”的“公式集合”的普朗克公式既包括数不清的破坏了“自然的连续性”的公式，也包括数不清的满足“自然的连续性”的公式。因此，断言“普朗克公式破坏了‘自然的连续性’”，也像断言“L 当然是一个无理数”一样荒谬。

综上所述，正如从“L 是一个实数”无论得出“L 是一个无理数”还是得出“L 是一个有理数”都不着边际一样。考虑到测量误差，我们既不能断言“普朗克公式破坏了‘自然的连续性’”，也不能断言“普朗克公式没有破坏‘自然的连续性’”。

物理实验永远不可能没有测量误差，因此，我们永远不可能通过物理实验来判断单个量子的发射到底是一次“抽象的跳跃”，还是一次“实际的跳跃”。

6 “连续性”的哲学表述

回到命题 G，这一命题是最浅显的常识，也是最深奥的哲理。

我这里所说的“哲理”，专指以黑格尔为代表的“辨证哲学”的“哲理”。我将借助于辨证哲学的基本原理来得出与命题 G 一致的结论，在这之前，我不得不阐述辨证哲学的这个原理本身。

大家知道，辨证哲学的第一规律就是“对立的相互渗透”，说句大白话，就是：“相反的东西之间的对立只是相对的。”哲学家们一向对“本质”与“现象”、“原因”与“结果”、“偶然性”与“必然性”等对立范畴津津乐道，至于“连续性”与“跳跃”（不连续性）这一对范畴，我似乎没听到过他们的高论。为了回答单个量子的发射到底是一次“抽象的跳跃”还是一次“实际的跳跃”这一问题，我将在这里阐述“‘连续性’与‘跳跃’是相互渗透的”这一哲理。我不得不有言在先，这一哲理不仅听起来“深不可测”，甚至连说起来都相当拗口，读者得有点思想准备。

顺便说一句，那些哲学家们津津乐道的“哲学范畴”，诸如“本质”与“现象”、“原因”与“结果”、“偶然性”与“必然性”等等，哪一个也不是省油的灯。诚然，哲学家们的对这些范畴的讲解或许通俗易懂并且引人入胜，但肯定不能解决实际问题，特别是不能解决物理学中的实际问题。用黑格尔的话来说，他们说的都是“非哲学的话”。

回到“连续性”与“跳跃”这一对范畴。

先举一个日常生活的例子：我现在住在青岛，青岛多雾天，有时候雾还很浓。我们可以用“数密度”即单位体积中的“雾珠”的个数来描写雾的“浓度”。如果把这个数密度与一个雾珠的质量相乘，就得到雾的“质量密度”，简称“密度”。我们通常总是用一个连续光滑的三维函数来表现这个物理量，并且毫不犹豫地对这个函数进行微分和积分运算。因此说起“雾的密度”，人们自然联想到“雾”是“连续分布”的。但我们也知道，雾实际上是由一粒粒离散的雾珠组成的。如果有一位哲人从这一现象得出结论：“连续的东西是由离散的东西组成的”，我们最多谴责他书呆子气，但还不至于谴责他“胡说”。再进一步，如果我们观察一粒单个的“雾珠”，将发现它也有其“密度”，从而也是连续分布的。如果这位哲人再次发表怪论：“离散的东西自身是连续的。”我们也不会过分的反感。但是，如果这位哲人把这两句话连接起来，断言：

“连续的东西是由离散的东西组成的；而离散的东西自身是连续的。”

我们就会说他颠三倒四、自相矛盾了。其实，我们明明知道，上述命题中的两句话分开来说都是有道理的，怎么连在一起就显得那么别扭呢？

问题在这里：“雾的密度”是雾的“数密度”与一粒雾珠的质量的乘积，从而是一个较大的空间区域中的全体雾珠的“质量”之和与这个区域的“体积”的比值；而“雾珠的密度”则是一粒雾珠的“质量”与它的“体积”的比值。这是两个物理量，其含义不同，数值也相差很远。这一事实意味着“雾的连续性”与“雾珠的连续性”不是一回事，上面那个哲人的话之所以显得颠三倒四、自相矛盾，就是因为他把这两种不同含义的“连续性”搅在一起了。

再考虑另一个日常生活的例子：挂在我对面墙上的时钟有三个指针，分别是时针、分针和秒针，其中时针、分钟总是连续转动的，而秒针则是跳跃的，跳一次历时一秒钟（也可能不是一秒钟，似乎没有人在乎这一点）。如果我们关注一个历时数小时的过程，往往就忽略这种一秒一秒的小跳跃，把秒针的转动看作是连续运行的，就像我们把广阔空间的浓雾看作连续分布的一样。在这种意义下，我们遇到了化了妆的旧相识：“连续过程是由跳跃组成的。”另一方面，如果我们把历时一秒的跳跃过程当作一个全过程来考察，就会发现这种跳跃并不是一瞬间完成的，它还是经历了从起点到终点的所有中间的点，于是，另一老朋友又碰头了：“跳跃自身是

连续的。”把这两句话连接起来就得到：

H. 连续过程是由跳跃组成的；而跳跃自身是连续的。

这话听起来也是怪扎耳朵的，为什么呢？

还是同样的原因：在命题 H 的前半句话中，“连续性”是指历时数小时的大尺度过程的连续性，而在其后半句话中，“连续性”则是指历时仅一秒的小尺度过程的连续性。把这两句话前后相连，也就把这两种不同含义的“连续性”搅在一起了。

在黑格尔哲学中，这种搅和乃至混淆是故意的，黑格尔似乎有意不让读者理解他的观点。

命题 H 就是我说的关于“‘连续性’与‘跳跃’的相互渗透性”的哲理。上面说的关于“雾”与“秒针”的两个日常生活的现象，恰好从各自的特殊角度体现了这一普遍的哲理，那只是适逢其会。只有在辐射量子论中，这一哲理才得到真正的体现：赫兹的“高频振荡回路”发射电磁波是一个连续过程，但这一连续过程是由一份一份电磁波的发射过程组成的，这就体现了“连续过程是由跳跃组成的”。另一方面，每一份电磁波的发射本身又是一个连续过程，这就体现了“跳跃自身是连续的”。

7 物理学的不归路

在这里，我们将根据辨证哲学的基本原理，判断辐射量子论到底有没有破坏自然的连续性的问题。

直接根据“对立的相互渗透”这一规律，就可立刻得出结论：各种表现自然界的“量”的关系的对立范畴，诸如“大”与“小”、“快”与“慢”、“轻”与“重”、“密”与“疏”、“浓”与“淡”、“强”与“弱”等等，都是相对的。特别是，由于“快”与“慢”的相对性，再快的过程也是需要时间的，从而自然界的“跳跃”只不过是一种相对快的连续过程，即都是“实际的跳跃”。至于不需要时间的“跳跃”，即“抽象的跳跃”，用黑格尔的话来说，纯粹是“知性的虚构”，在大自然中是不可能存在的。同样，再小的物体也占有空间，大自然中没有一个物体是“绝对小”的“几何点”。

还可以从另一角度得出同一结论：根据“连续性”与“不连续性”的相互渗透性，一个自然过程究竟是“连续的”还是“不连续的”，取决于我们从哪一个层次去观察它。例如，物质的辐射过程从可见世界的层次来看是连续的，从原子的层次来看是不连续的，再深一个层次，又是连续的。因此，自然界没有像“几何点”那样的“绝对小”的物体，也没有像“一瞬间完成的”那样的“抽象的跳跃”。

有一个简单的命题可以作为判据，把“实际的跳跃”与“抽象的跳跃”区别开来，它就是阿基米德原理。电子很小，太阳很大，但我们可以找到一个自然数 N，使得 N 与电子的“线度”的乘积大于太阳的直径；原子发射一份电磁波的过程很短，一个星球从生成到死亡的演化过程很长，但我们可以找到一个自然数 M，使得 M 与原子发射一份电磁波的过程所经历的时间的乘积，大于某一星球从生成到死亡的演化过程所经历的时间。而如果电子是一个“几何点”或原子发射一份电磁波的过程是一次“抽象的跳跃”，这样的自然数是找不到的。

这样，我们就从辨证哲学的基本原理，得出了与命题 G 一致的结论。

当辐射量子论问世时，物理学面临选择，要么接受由命题 H 表述的“连续性”与“跳跃”这一对范畴的辨证关系，要么修改由这一对范畴所表达的物理学规律。

如果当年的物理学家中有一个人掌握辨证哲学，就像经济学家中有一个马克思一样，那么，这位物理学家就能凭借命题 H 得到命题 G。从而在辐射量子论中用命题 F 取代命题 E，使得物理学从此走上了辩证思维的康庄大道。

不幸的是，在创建量子物理学的群英中，却没有这样一位学者，结果是物理学走上了相反的道路。

赫兹的“高频振荡回路”发射电磁波是一个连续过程，但这一连续过程是由一份一份电磁波的发射过程组成的，这就表明“连续过程是由跳跃组成的”。在这里，还可以更细致地表成：“宏观的连续过程是由微观的跳跃组成的。”这种“微观的跳跃”是一种特殊的“跃迁”。对于“跃迁”，物理学家们有分歧，但作为一个整体，物理学接受了这一新的物理学范畴。在某种意义下，这就意味着物理学接受了命题 G 的前一半；然而，物理学作为一个整体，断然地拒绝了命题 G 的另一半。

当年，创建辐射量子论的普朗克最苦恼的是，他的这个理论与麦克斯韦“电磁场论”相矛盾。其实，只要接受“‘跳跃’自身是连续的”这一哲理，承认每一份电磁波的发射，或者说每一个单个量子的发射也是一个连续过程，就能立刻化解这一矛盾。不幸的是，历史事实不是这样：如果说当今“微观的连续性”这一用语指的是“原子层次”的连续性，那么单个量子的发射过程的连续性，就是一种比“原子层次”更深一层次的连续性。接受这一连续性，就得超出“原子层次”，在当年，这一关口却是物理学家们无论如何也逾越不了的天险。

就是因为不敢逾越这一天险，物理学家们没有转向辨证哲学，相反，面临辐射量子论，他们接受了“抽象的跳跃”，放弃了自然的连续性，从而轻率地放弃了一个最基本的物理学原理，从而“摧毁了经典世界!”从此，一个比一个怪诞的“新颖观念”取代了合逻辑的思考，一次比一次激进的“革命”不仅摧毁了经典物理学的优良传统，而且还摧毁了人类健全的常识以及任何正常人的智慧。这是一条

通往非理性、通往极端的幻想、迷信与盲从的不归路。踏上这条路之后，物理学经历了一段颇为辉煌的繁荣时期（顺便说一句，正如辐射量子论的成功与“抽象的跳跃”的观念完全无关一样，量子物理学的成功与伴随着它的那些“新颖观念”也完全无关）。但好景不长，在一段回光返照式的闪耀之后，物理学还是可悲地停滞下来。今天，物理学已经退化为一门边沿学科。面临如此绝境，物理学家们还在倚靠惯性的作用把一切困难归罪于“经典思维的残余”，这种惯性堵塞了物理学每一条自我更新的通路。

8 结束语

综上所述，关于“辐射量子论与自然的连续性”的问题，我提出了如下论点：

第一，从逻辑上说，如果单个量子的发射是一瞬间完成的，即是一次“抽象的跳跃”，就可以导出普朗克公式。但反过来，从普朗克公式却不能得出单个量子的发射是一次“抽象的跳跃”的结论。

第二，数学证明，“抽象的跳跃”对应的“能量时间函数”是“阶跃函数”，这个“阶跃函数”对应的“黑体辐射公式”是普朗克公式。但我们可以选择适当的连续光滑函数取代这个“阶跃函数”，使得对应的黑体辐射公式与普朗克公式的差别的测量效果被实验误差所掩盖。由此可见，永远不可能通过物理实验来判断单个量子的发射到底是一次“抽象的跳跃”，还是一个足够短促的连续过程。

第三，根据辨证哲学的一般原理，“跳跃”自身是连续的。“抽象的跳跃”只是一种虚构，在自然界是不可能存在的。这就得出结论：单个量子的发射也是一个连续过程，诚然，它只能是一种比“原子层次”更深层次的连续过程。

第四，由于不能接受单个量子的发射是一个连续过程的论据，物理学接受了“抽象的跳跃”的概念，从此走上了非理性的不归路。

关于“辐射量子论与自然的连续性”的问题，我只能到此打住。尽管我竭尽所能地把道理说得通俗一些，但显然不成功。这一方面是因为我笨嘴拙舌，不能像讲故事那样把问题讲解得引人入胜。另一方面则是因为我面临的课题实在太复杂，其中有太多的死扣，有数学的死扣、物理学的死扣、逻辑学的死扣、哲学的死扣，还有语义学与修辞学的死扣，哪一个死扣都不是一时半会能解开的。总之，关于这一课题，我已经尽力了。我还得养精蓄锐，对付以后的几个课题：关于“波粒二象性”的课题；关于“原子世界的特殊规律”的课题；关于“概率与不确定性”的课题；关于“测量与波包编缩”的课题；关于“远程量子相关与贝尔不等式”的课题，等等，这些课题哪一个也不比这一课题更轻松。

Quantum Theory of Radiation and Natural Continuous

It is proved that we can choose an appropriate continuous and smooth function to describe the emission processes of a single quantum, such that the corresponding blackbody radiation formula is so close to Plank formula, that the difference between the measurement results were overshadowed by experimental error. There is no experiment can be without measurement error, and thereby we can never judge the emission of a single quantum in the end is a jump that takes no time or a continuous process of short enough duration.

According to the mutual penetration of “continuity” and “discontinuity”, there is no object is absolute small like a “geometric point” or a process is absolute short like a jump taking no time. Therefore, we assert that the emission of a single quantum can only be a continuous process of short enough duration.

Quantum theory of radiation can be traced back to the following three premises: Firstly, atomic radiation processes sum the material radiation process; Secondly, a radiation process of a single atomic is a finite process with beginnings and ends. Thirdly, within the experimental error range, the time that a single atom emission process takes is negligible. These three premises are not only in no conflict with classical physics, but also classical physics expected. Therefore, the quantum theory of radiation is not in contradiction with classical physics, and never “destroys the classical world”.

Keywords: quantum theory of radiation; Plank; classical physics; quantum; natural continuity; jump function; physics laws; physics category.

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光电效应与麦克斯韦电磁学 （二评量子物理学）

谭天荣

青岛大学 物理系 青岛 266071
ttr359@126.com
Recommended by Zhang Dongsheng, zhangds12@hotmail.com

内容摘要：本文证明：爱因斯坦的光子论不能说明光电效应．因为按照光子论，光电效应是静止电子与光子的非弹性碰撞。按照这种机制，电子在吸收光子的能量的同时，也会吸收光子的动量，一个静止电子在吸收了光子的动量以后，应该沿光的传播方向运动。因此在光电效应的实验中，光电子的运动方向应该与入射光的传播方向一致，但在光电效应的实验中，光电子的运动方向与光的传播方向几乎是相反的。因此，光子论为光电效应所设想的机制违背了动量守恒定律。第二，光电效应可以通过麦克斯韦理论说明如下：电子有一个自身的固有电磁场，而光波则是另一个电磁场。当电子进入光波中之后，这两个电磁场的因相互迭加而场能突变，这个场能的改变量立刻转化为电子的动能，就像落体进入重力场以后落体的势能立刻转化为落体的动能一样。金属中的静止电子进入光波以后，将经历一个吸收一份光波并从静止转向运动状态的过程，如果该电子立刻作脱出功并离开金属，那就是光电效应。如果它接着又离开光波则将经历一个与进入光波相反的过程，从而再次改变运动状态并发射一份光波，这就是康普顿效应。

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关键词：光电效应；爱因斯坦；光子论；光的波动说；电动力学；落体运动；势能；迭加场能；洛伦兹问题；康普顿效应

1 引言

最近，读了曹天元的新作《上帝掷骰子吗——量子物理史话》，重新点燃了我批判量子物理学的激情。我把我的批判写成下面的一组论文。我已经到了耄耋之年，这是我的最后一搏。

关于光电效应，曹天元写道：

“对于可怜的物理学家们来说，万事总是不遂他们的愿。好不容易有了一个基本上完美的理论，实验总是要搞出一些怪事来搅乱人们的好梦。这个该死的光电效应正是一个丧气和扫兴的东西。高雅而尊贵的麦克斯韦理论在这个小泥塘前面大大地犯难，如何跨越过去而不弄脏自己那华丽的衣裳，着实是一桩伤脑筋的事情。”

那么，该死的光电效应是怎么令物理学家们丧气和扫兴的呢？

2 咄咄怪事

实验证明，当光照射金属表面时，会从它的表面打出电子来。这就是“光电效应”，被光打出的电子称为“光电子”，光电效应具有如下基本性质：

第一，对于某种特定的金属来说，是否有光电子逸出只与光的频率有关。频率高的光线能打出能量较高的光电子。

第二，照射金属的光越强，能打出的光电子越多。

第三，光照射金属表面时，立刻有光电子逸出，没有时间延迟。

人们认为，光的波动说不能解释光电效应，怎见得呢？大学物理教程是这样描写的：按照光的波动说，光照射金属表面时，金属中的自由电子进入光波，于是电子在光波作用下强迫振动，当电子的振动能积累到一定程度时，就逸出金属表面成为光电子，这就是光电效应。按照这种机制，光电子的动能取决于光的强度，与光的频率无关。而且电子的振动能的积累要一定时间，因此，从光开始照射到光电子逸出，应有“时间延迟”。而这些结论都与实验事实不符。

于是曹天元称光电效应为“咄咄怪事”，并且还

说：

“然而，更加不幸的是，人们总是小看眼前的困难。有着洁癖的物理学家们还在苦思冥想着怎样可以把光电现象融入麦克斯韦理论之中而不去损害它的完美，它们却不知道这件事情比它们想象的要严重得多。很快人们就会发现，这根本不是袍子干净不干净的问题，这是一个牵涉到整个物理体系基础的根本性困难。对于这一点，没有最天才、最大胆和最富有锐气的眼光，是无法看出来的。”

谁具有最天才、最大胆和最富有锐气的眼光呢？曹天元说的是爱因斯坦。1905 年，这位天才在《关于光的产生和转化的一个启发性观点》一文中，大胆地提出了“光量子”假说：能量子概念不只是在光波的发射和吸收时才有意义，光波本身就是由一个个不连续的、不可分割的“光量子”所组成的，他还利用普朗克的能量量子化公式给出了光量子的能量和动量表达式。爱因斯坦的光量子现在称为“光子”，而他的光量子假说现在称为“光子论”。

人们普遍认为：爱因斯坦的光子论是物理学上的划时代的建树，它成功地解释了经典电磁场理论无法解释的光电效应，首先揭示微观世界的“波粒二象性”，为量子力学奠定了基础。爱因斯坦在 1921 年获诺贝尔物理学奖是因为他的这一光子论而不是因为他的相对论。到了晚年，爱因斯坦自己也认为光量子概念是他一生中所发现的最具革命性的思想。

然而，本文却试图证明：

第一，爱因斯坦的光子论不能说明光电效应。

第二，“光电现象”可以融入麦克斯韦理论之中，但为此而需要的不是“最天才、最大胆和最富有锐气的眼光”，而是一个平常人的心态；不是蓬勃的革命激情，而是细心的思考与宁静的探索。

3 光子论——天才的失误

我丝毫不想贬低爱因斯坦对物理学的贡献，但我不能不指出：他的光子论有一个极为初等的错误。在这里，我将从各种角度指出这一错误。

按照光子论，光电效应是如下过程：光波同时又是一束称为“光子”的粒子，频率为ν的光波，其光子具有能量 hν，其中 h 是普朗克常量。当光照射金属表面时，如果在金属中静止的电子了吸收一个光子，则将获得光子的能量，并将这一能量转化为自身的动能，从而离开金属。在逸出金属表面的过程中经过金属的表面层时将作“脱出功”W。于是，只有当 hν大于 W 时，该电子才能离开金属，成为光电子，其动能等于 hν与 W 之差。

这里有一个细节要弄清楚：光电子是“先吸收光子再作脱出功”还是“一面吸收光子一面作脱出功”。实验证明，对于给定的金属，每个光电子所作的脱出功是一样的，从而只有频率大于某一下限（或“阈值”）的光才能从该金属击出电子。光电子只有先吸收光子再作脱出功，才能出现这种情况。因此，光电效应可以分解为两步：

第一步，在金属中静止的电子吸收了一个光子，从而获得动能 hν。

第二步，吸收了光子的电子离开金属表面，作脱出功 W，从而其动能从 hν变成 hν减去 W。

光子论的问题出在上面的第一步，我提出了四个论据证明这一步是不能实现的。

论据 1：如果按照光子论把光电效应理解为静止电子与光子的非弹性碰撞，那么，电子在吸收光子的能量的同时，也会吸收光子的动量，一个静止电子在吸收了光子的动量以后，应该沿光的传播方向运动。因此在光电效应的实验中，光电子的运动方向应该与入射光的传播方向一致，但在光电效应的实验中，光电子的运动方向与光的传播方向几乎是相反的。因此，光子论为光电效应所设想的机制违背了动量守恒定律。

论据 2：按照光子论，对于地球这一参照系，光电效应是如下过程：电子原来是静止的，由于吸收了一个光子，转入某一等速直线运动状态。这一过程满足能量守恒定律。但存在另一参照系，对于它该过程却具有如下效果：电子原来处于等速直线运动状态，吸收电子以后，反而转入静止状态。这样，电子吸收了一个光子，反而失去了动能，这就违反了能量守恒定律了。

根据相对论，“能量守恒定律”与“动量守恒定律”是一个整体，称为“能量动量守恒定律”。按照光子论，虽然对于地球这一参照系，光电效应过程满足能量守恒定律，但对另一参照系却不满足。这样，对于地球这一参照系，该过程肯定不遵守“动量守恒定律”。因此，论据 2 与论据 1 其实是同一论据的两种表现方式。这个论据就是：光子论为光电效应所设想的机制违背了物理学的一个最基本的原理——能量动量守恒定律。

论据 3：在爱因斯坦的“相对论”中，“相对”与“绝对”具有如下特殊含义：对一切参照系都成立的性质称为“绝对的”，仅对某一参照系成立而对其他参照系却不成立的性质称为“相对的”。按照这种含义，如果对于某一参照系，一个物体经历了一个吸收（发射）过程，则对于其它参照系，该物体所经历的也是一个吸收（发射）过程，因此，“吸收”与“发射”的对立是绝对的。反之，如果对于某一参照系，一个物体经历了一个加速过程，则对于另一参照系，该物体所经历的可能是一个减速过程，因此，“加速”与“减速”的对立是相对的。由此我

们得出结论：一个物体不可能仅仅靠吸收来加速（也不可能以减速为代价来辐射）。这个命题也可以表成：“如果一个物体在一个吸收过程中被加速，则该过程除了吸收和加速之外，一定还有第三种效果。”

根据爱因斯坦的光电效应公式，电子吸收光子的过程乃是电子经历一个吸收并且加速却并不引起第三种效果的过程，这就与相对论相矛盾了。

论据 4：根据相对论，如果一个电子吸收了一个光子，则它的静止质量一定会增加，从而不再是电子。可是在光电效应中，电子被光波打出金属表面以后，仍然还是电子。或许有人问：按照波尔的原子理论，原子中的电子可以吸收一个光子，并且从一个稳定轨道跃迁至另一稳定轨道。电子的静止质量为什么没有因此而改变呢？在原子中，吸收光波只会改变原子的静止质量却不会改变电子的静止质量。因此，这一过程吸收光波的是原子而不是电子。

因此，光子论为光电效应所设想的机制不仅与实验事实不符，而且明显地违背相对论，而相对论正是爱因斯坦自己建立的。爱因斯坦确实是当之无愧的物理学天才，而光子论，则是这位天才的失误。这一失误充分说明，爱因斯坦对于他创建的相对论极度缺乏感性认识。尽管相对论是一个他自己建立的王国。但相对论对于他来说始终是一个神秘莫测的王国。

4 落体运动与光电效应

为了“把光电现象融入麦克斯韦理论之中”，首先必须否定前人的“光的波动说不能说明光电效应”的论断。这远不是一件令人开心的差事，因为前人的有关论据实在错误百出，惨不忍睹。

就说“电子在光波作用下作强迫振动”吧，简直错得离谱！要一个电子作强迫振动，必须有某种“恢复力”，这种恢复力是一种电子之外的力场，而“自由电子”之所以是自由电子，就是因为他不处在外力场中。再说，就算电子在光波作用下会作强迫振动，它的频率多大，振幅多大呢？按照强迫振动的定义，其频率是光的频率，从而其振幅小于光的波长（否则电子的速度将超过光速），这么急促而微小的振动，连仪器都观测不到，怎能使电子离开金属表面呢？总之，前人只要稍稍思考一下，就决不会提出像这样的令人啼笑皆非的论据。

不幸的是，诸如此类的错误命题在物理学的各个领域比比皆是。今天，物理学积累的错误已经成了人类思想领域中的奥吉亚斯牛圈。我远没有清理这个牛圈的雄心壮志，只有对于导致物理学重大失误的关键性错误，例如像爱因斯坦的光子论那样的错误，我才不得已地给以必要的清理打扫。

美国物理学家大卫·波姆在《量子理论》一书中对“光的波动说不能说明光电效应”这一论断提出了另一种论据。他不是诉诸某种特殊的机制而是诉诸经典物理学的普遍原理，为此，他着重考察光电效应没有明显的时间延迟这一实验事实，在考察了各种可能性之后，玻姆得出结论：

A. 用能量从辐射场向物质逐渐转移过程来解释光电效应的所有努力都失败了。

我不在这里一一反驳玻姆的各种论据。只想指出一点：命题 A 中的“辐射场”是“场”的一种特殊形式，而“物质”则是指某种“实物”。问题在于，对于经典物理学，“场”与“实物”的相互作用是不是总有时间延迟。我们不妨考虑一个最熟悉的例子：“重力场”是“场”的一种特殊形式，而“落体”则是某种“实物”，对于落体运动，自由落体进入重力场就立刻下落，并没有时间延迟。借问波姆，如果你用能量从“重力场”向“落体”逐渐转移过程来解释落体运动，你能不失败吗？

那么，在落体运动中，重力场的能量是怎样转移给落体的呢？

中学的物理教程对这一问题的回答是：重力场的能量是“势能”，落体的能量是动能，落体进入重力场中以后，立刻开始了从势能转化为动能的过程，这就是重力场的能量转移给落体的过程。

可是，什么是“势能”？它从何而来？储存在什么地方？怎样转移到落体？等等，等等……从中学到大学，我一直为这些问题而苦恼。学过电动力学之后，我总算得到了一个令自己满意的回答。

电动力学研究的是电磁场而不是重力场，电磁场的能量是“场能”，但电动力学中的“静电学”中也有“势能”这一概念，这就为认清“势能”与“场能”之间的关系打开了一个小窗户。

为了阐明我对“势能”这一概念的理解，首先引进一个用语：设有两个场组成一个系统，当这两个场相互分离时，系统的场能是这两个场各自的场能之和；而在两个场相遇并相互迭加，形成一个统一的场之后，系统的场能是这个统一的场的场能。在这两个场从“相互分离”的状态过渡到“相互迭加”的状态的过程中，系统的场能将会改变，我把这个“场能的改变量”称为这两个场的“迭加场能”。

按照静电学，静止的电荷将激发一个静电场。考虑由两个静止的点电荷组成的系统，当两个点电荷远离时，它们各自激发一个静电场；当它们靠近时，两个静电场迭加起来合成为一个。我作了一个推导，证明在这一“两个点电荷相互靠近”的过程中这两个静电场的“迭加场能”，就是这两个点电荷的“相对势能”。如果两个点电荷都是正的或者都是负的，则过程中系统的静电场能会增加，这时势能是正的；反之，如果两个点电荷一正一负，则过程

中系统的静电场能会减少，这时势能是负的。

我是在大学三年级的时候给出这一推导的，其关键的一步是通过已知的静电场的“场强”的表达式，用积分算出相隔一定距离的两个点电荷的静电场能，这是一道不难不易的计算题。当我算出这一结果时，兴奋得一夜未眠，我可知道“势能”是怎么回事了！然而当我试图与我对同学们分享我的快乐时，却完全意外地遭到冷遇，他们异口同声地说：“这有什么意义！”

从那时起，我隐约感到，我的同学们对物理世界的理解和我大不一样。我理解的物理世界总是带着感性的微笑每日每时地向我招手。而他们却把物理世界看作一个神秘莫测的“奇迹王国”，这个王国的状况越是稀奇古怪、匪夷所思，他们就越是感到亲切和欣喜。反之，对我所理解的感性的物理世界，他们总是怀着莫名其妙的敌意。

回到落体问题，有了“迭加场能”的概念，重力场向落体转移能量的机制可描述如下：

B. 地球有一个引力场，即重力场，落体也有一个引力场。在落体进入重力场以后，这两个引力场相遇，其迭加场能就是“落体的势能”。当一个物体成为自由落体时，这个势能就立刻转化为落体的动能。这样，落体的势能转化为动能的过程，就是“重力场的能量转移给落体”的过程。

有了对“落体运动”的上述感性认识，当我在课堂上听到老师讲到“光电效应”时，立刻领悟到它是怎么回事：

C. 电子有一个“固有电磁场”，而光波则是另一个电磁场，当电子进入光波以后，这两个电磁场的“迭加场能”立刻转化为电子的动能，就像落体进入重力场以后落体的势能立刻转化为落体的动能一样。这就是在光电效应中，光波向自由电子转移能量的机制。

根据这种机制，当时（那年我 19 岁）我就知道光电效应为什么没有时间延迟，至于光电效应的其他性质，我过了一段时间才弄清楚。

在某种意义下，“经典物理学”起始于落体运动，而终结于光电效应。从命题 B 和命题 C 我们看到，“经典物理学”的起点与终点竟然都是关于“迭加场能”的问题，真可谓“成也迭加场能，败也迭加场能”！

如果说“光子论”源于“最天才、最大胆、最富有锐气的眼光”；那么，“迭加场能”的概念就来自细心的思考与宁静的探索。光子论早已名扬天下，而“迭加场能”却恐怕永远也登不了大雅之堂。为什么会这样呢？记得一位哲人遇到类似的情况时，埋怨他所处的那个“充满卑鄙的成见与狡猾的妄想的时代”，而我更愿意把这种现象的根源归结为人的天性：至少在物理学领域里，怪诞的“新颖观念”总比平淡的逻辑推理更受欢迎！

如果说通过命题 B 我们对落体运动并没有进一步的认识，那么命题 C 就为说明光电效应铺平了锦绣前程。但在此之前我们还得对电子有某些新的认识。

5 怪异的电子

今天，人们非常熟悉“电子”这一用语：要看时间，手上带着电子表，墙上挂着电子钟；要看书，电子版各种书籍应有尽有，可以打开电子计算机在网上在线阅读，也可以下载下来慢慢看；要写信，可以写电子邮件，通过电子信箱投递，快的几乎没有时间延迟；要开车，驾驶台前电子仪表琳琅满目；要给孩子买生日礼物，超市的电子玩具目不暇接……。一言以蔽之，现代生活的任何一个环节似乎都少不了某种以“电子”命名的玩意。

然而，只有少数人才关心电子到底是一个什么东西，也只有少数人才知道，电子的行为十分出人意料，使人们绞尽脑汁。

早在上世纪的二十年代，物理学家们就为了研究电子的行为建立了一个新的分支——量子力学，但这个量子力学却极为艰深难懂。对此，许多物理学家直言不讳。例如，美国物理学家费曼曾说：“没有人能理解量子力学。”前苏联物理学家兰道也说：“量子力学永远不可能被‘理解’，你们只须去习惯它。”或许，任何一门新的学科对于初学者都是困难的，但是量子力学的困难却不同一般，量子力学王国里的国王波尔曾说：“如果一个人说他可以思考量子力学而不会感到迷惑，这只不过说明他一点也不懂量子力学。”

在量子力学中，电子是一个幽灵，美国物理学家马根瑙是这样说的：“一个电子是一个抽象的事物，它不能使用日常经验所熟悉的样子去直觉地理解，而是要运用数学算符、可观察量和态等形式上的步骤去确定的。”

为什么前人把电子说得这样“邪乎”呢？我的回答是，由于一系列大大小小的错误，其中一小部分是来自“最天才、最大胆、最富有锐气的”重大失足，而大部分则是源于多如牛毛、驳不胜驳的小小的疏忽，所有这些错误归根结底是由于一个原因：物理学家们忘记了电子有一个“固有电磁场”。诚然，

电子不同于我们日常经验所熟悉的物体，但它决不只是一个“抽象的事物”，而是一个活蹦乱跳的、实实在在的小家伙。在这里，我们从电子的两个显而易见的性质出发，应用麦克斯韦电磁学的已知规律，导出的电子的某些虽然新奇但并不古怪的特征。

第一，根据牛顿力学，一个物体（例如，一个带电刚球，或更复杂的带电系统）可以有固定的质量，固定的形状，甚至可以有固定的转动惯量（相对于质心的），但不可能有固定的角动量。因为物体的角动量在外部作用下是可变的。如果一个物体在外部作用下获得了某一角动量，则当外部作用停止时，它就随遇而安地保持这一角动量。因此物体可以取任意角动量，它对哪一个角动量也不偏爱。

然而大家都知道，电子却有它所偏爱的自旋角动量，在各种外部条件下电子总能保持自己的角动量不变。这一事实表明：电子有一种“内在的自我调节机制”，既然是调节，当然是有弹性的，电子的角动量并不是绝对不变，只不过当它在外部作用下有所改变时，电子总能自动地迅速恢复到它所偏爱的角动量。

德国生物学家恩斯特·海克尔早就说过，原子是具有“意识”的，他的意思正是说，原子有“内在的自我调节机制”。但“意识”这一用语似乎还是有一点词不达意，原子与其说是“有意识的”，倒不如说是“自动的”。

第二，电子的状态是“经久不变”的：一个电子今天是电子，明天它还是电子，不论过多久它还是电子。从牛顿力学的角度来看，这一事实似乎是不言而喻的，而从电动力学的角度来看，这里面可就大有玄机了。

“不变”意味着电子内部达到了“平衡”，而“持久不变”则意味着这种平衡是极为“稳定的”。问题在于：在电子内部到底达到了什么样的平衡？又怎样维持稳定？

考虑到电子有一个“固有电磁场”，我们可以把电子看作是一个带电粒子与一个电磁场的复合体。为了言简意赅，我把电子的“带电粒子”称为“粒子”，把电子的“固有电磁场”称为“波包”。根据电动力学，这两部分处于经常的相互作用之中，而电子内部达到的平衡就是其“粒子”与“波包”之间的平衡。这种平衡是双重的：一方面，波包以“洛仑兹力”四面八方作用于粒子，但其合力必须为零，从而波包既不会推动也不会阻滞粒子，这是一种“力学的平衡”。因为有力学的平衡，粒子不受外力作用时，其整体运动是等速直线运动；更一般地，在外电磁场中，粒子将像一个“点电荷”或“带电刚体”一样运动。另一方面，电子有电荷，根据麦克斯韦方程，“粒子”作为电荷的负荷者必然不断激发电磁场。但这种激发过程必须既不会改变粒子的状态，也不会改变波包的状态，这是一种“电学的平衡”。因为有电学的平衡，静止电子的“波包” 只能是一种“静止的波”，即只能是一种“驻波”。我把电子内部的“力学的平衡”与“电学的平衡”两者之合，总称为“电动平衡”。而电子的“内在的自我调节机制”，则负责维持这种电动平衡的稳定性。

如果电子处于永恒的电动平衡状态，则除了它有固定的角动量和固定的磁矩之类的特征以外，与牛顿力学意义下的“物体”无异。然而事实并非如此，在不同的外部条件下电子的电动平衡状态是不同的，当外部条件突然改变时，电子不得不从一种电动平衡状态过渡到另一种电动平衡状态。这种过程的前一半是破坏原来的电动平衡，后一半则是建立新的电动平衡。这就表明，电子的电动平衡虽然由于电子有内在的自我调节机制而极为稳定，但也不是永恒不变的。

如果在某一过程中，电子始终保持最初的电动平衡状态，则从微观的角度来看，该过程是一个连续过程。反之，如果电子经历了一个从一种电动平衡状态到另一种电动平衡状态的过渡阶段，那么该电子就经历了一次所谓“量子跃迁”。只有从比“微观”更深一层次的角度来看，“量子跃迁”才是一个连续过程。

由此可见，电动力学意义下的“物体”与牛顿力学意义下的“物体”有完全不同的含义：牛顿力学意义下的“物体”是僵死的、被动的、只能受外力推动的“物体”；而电动力学意义下的“物体”则是有着内部的、必然的、自己的运动的一种新型“物体”。

上面，我们列举了电子的某些特征。尽管挂一漏万，还是能看出电子的行为极为奇特。但同时我们也看到，电子的形象依然是直观的，电子的行为依然是因果的、决定论的。或许，对于习惯了牛顿力学思想方法的初学者来说，电子的行为有些“高深莫测”，但决不是“匪夷所思”的！

考虑到电子有一个固有电磁场，电子在给定的外部条件下将会怎样运动呢？首先考虑这一问题的是以洛伦兹为代表的“电子论学派”，我们称它为“洛伦兹问题”。由于没有考虑到电子是一个有着内部的、必然的、自己的运动的一种新型物体，没有考虑到电子有一种内部的自我调节机制，电子论解决洛伦兹问题的尝试失败了。但我们即将陆续看到：所谓“量子现象”正是大自然对洛伦兹问题的回答，而量子力学，则是这种回答的数学表述。

6 对光电效应的再考察

回到光电效应。

曹天元说光电效应是“无法用电磁理论说通的现象”，是“光子论”的一门重炮。而我将在这里证明，光电效应是一种与电子的固有电磁场相关的电磁现象，是电子在某种特殊的外部条件下的行为，从而是大自然对洛仑兹问题的回答。

当电子从真空进入光波时，由于外部条件突然改变，电子原有的电动平衡遭到破坏，这时电子内部的自我调节机制将使自己迅速达到新的电动平衡。于是，电子进入光波以后将经历一个从“真空中的电动平衡”过渡到“光波中的电动平衡”的过程，我称这一过程为“入光过程”。这是一个怎样的过程呢？

根据力学原理，进入光波的电子将在光波的电力作用下振动，虽然由于没有平衡位置与恢复力，这种振动的中心位置是移动的，其振幅也小得不能为宏观仪器所察觉，但仍然还是“振动”。此外，电子有磁矩，因此它还会在光波的磁力作用下以交变的角速度“进动”。我把这种振动和进动统称为粒子的“光致运动”，光致运动将使粒子激发一个附加的电磁场，我称它“光致波包”。于是，电子在真空中只有两种运动：内部运动与整体运动；而电子在光波中却有三种运动：内部运动、光致运动与整体运动。

在入光过程中，电子将产生“光致运动”，并且激发“光致波包”，为此，电子将从光波中吸收一份能量，换句话说，将吸收一份光波。这份光波是入射光波的一部分，从而是一份有限的单色平面光波，由于有限，单色只是近似的。在某些情况下，这份光波相当于一个爱因斯坦所说的“光子”，但这个作为单色平面光波的“光子”，已经是麦克斯韦电磁学家族中的一个成员。

当电子进入光波以后，将经历电子的固有电磁场与光波相互迭加的过程，但对于不同频率的两个交变电磁场，其迭加场能的平均值为零。只有电子的“光致波包”才与光波具有相同频率，从而会产生不为零的迭加场能。在入光过程中，电子与光波的这一“迭加场能”将转化为电子的整体运动的能量，从而使得电子作为一个整体，从一种等速直线运动状态过渡到另一种等速直线运动状态。

我曾经把历时足够短促的现实过程称为“实际跳跃”，把完全不经历时间的抽象过程称为“理想跳跃”。“入光过程”本是一次“实际跳跃”，但在这里让我们把它抽象为一次“理想跳跃”，这意味着我们只考虑过程的最终效果而不考虑过程的中间阶段。如果电子的“初态”是静止的，则该过程有如下三个效果：

第一，电子作为一个整体从静止状态转入等速直线运动状态；

第二，电子从入射光中吸收一份光波，这是一份单色平面波；

第三，电子从真空中的电动平衡过渡到光波中的电动平衡。

如果金属中的静止电子完成入光过程就作脱出功并离开金属，那就是光电效应。这种机制可以说明光电效应的基本性质：

首先，入光过程极为短促，因此光电效应没有明显的时间延迟；

其次，光越强，入光过程就越短促，从而就有越多的电子在两次与晶格碰撞的“自由程”内完成入光过程，成为光电子，因此光电子的数量依赖于入射光的强度。

最后，电子在入光过程中所获得的动能取决于电子与光波的迭加场能，这个迭加场能决定于电子进入光波以后的光致运动，这个光致运动决定于光的频率而与光的强度无关。于是电子在入光过程中所获得的动能决定于入射光的频率而与其强度无关。

爱因斯坦的“光子论”乃是用牛顿力学的观点来处理洛仑兹问题的典型例子。这位物理学中的“革命家”忘记了电子自身有一个“固有电磁场”，更不曾想到这个电子的固有电磁场与光波相遇会出现什么事情，却把电子与光波的相互作用理解为两个牛顿力学的粒子之间的“碰撞”。

如果把光电效应分为两步，第一步是电子与光的相互作用，第二步是作脱出功。则“入光过程”是其中的第一步，在这一过程的三个效果中，“光子论”仅表现了其中的前两个，而抹煞了“第三个效果”，因此违背了能量动量守恒定律。

行文至此，说几句题外的话。

在“向科学进军”的 1956 年，我曾经试图对几位同班同学介绍我对光子论的上述看法，但刚一开始就被打断：“人家爱因斯坦是物理学的泰斗，你是谁，我信他的还是信你的？”在他们看来这一论据是不容置疑的，可惜当时未能说服我。这种情况使他们极为苦恼：“谭天荣的问题不好解决！”

50 多年以后，我们又在一次聚会上重逢，又扯了几句与光电效应有关的话。他们深感遗憾的是：“谭天荣的问题至今没有解决！”另一方面，我也觉得失望：他们已经是颇有名气的光学专家，但他们竟然忘记了光电效应是怎么回事！忘记了爱因斯坦光电效应公式！总之，忘记了关于光的“波粒二象性”的一切。诚然，对于“解决谭天荣的问题”他们仍然底气十足，因为爱因斯坦仍然是泰斗，谭天荣仍然是无名小卒，这就是他们的全部论据，别的事情他们一概不予理睬。

我想起了一个故事：一位旅行家漂流到一个小

岛上，岛上的居民都得了一种怪病：他们看到的景象、听到的声音与现实世界的完全不同，但他们彼此之间的感知却是相通的。这位旅行家到岛上以后，岛上的居民一致认为他们遇到了一位“病人”，正好他们有一套对症的“治病”方法，于是他们对这位“病人”进行“治疗”。可怜的旅行家险些儿被他们“治愈”，幸运的是他在最后关头逃跑了。结果是岛上的居民继续在他们的“奇幻的世界”安居乐业，这位旅行家也继续过自己的旅行生活，就像不曾到过这个小岛一样。我不知道这位“旅行家”是小说家的虚构还是真有其人，但我总觉得自己与他同病相怜。

7 康普顿效应与“盲人摸象”

按照曹天元的意见，光子论还有另一门重炮——康普顿效应。在这里我将证明：和光电效应一样，康普顿效应也是大自然对洛仑兹问题的回答。

麦克斯韦方程在时间顺序上是可逆的：如果一个过程满足麦克斯韦方程，则该过程的“时间反衍”（与原过程的时间顺序相反的过程）也满足麦克斯韦方程。由于我们总是把“量子跃迁”简化为一种“理想跳跃”，即只考虑初态与终态而不考虑其中间阶段，只考虑其最终效果而不考虑其“过程”，对于这种特殊的过程，某些新的推理与计算的方法应运而生。例如，引进这种“时间反衍”就成了我们常用的从“已知效应”导出“未知效应”的推理手段。

下面我们把入光过程记作 A，把其“时间反衍”记作 B。对比过程 A，过程 B 具有如下效果：

第一，电子作为一个整体从等速直线运动状态转入静止状态；

第二，电子发射一份光波（单色平面波），加入入射光；

第三，电子从光波中的电动平衡过渡到真空中的电动平衡。

在该过程中，电子将离开光波进入真空，在这种意义下，我称它为“出光过程”。

如果一个电子在经历过程 A 以后，紧接着离开光波，则它将经历另一个“出光过程”C。对比过程 B，过程 C 具有如下效果：

第一，电子作为一个整体从过程 A 的终态变成另一种等速直线运动状态；

第二，电子发射一份光波（单色平面波），但不再加入入射光；

第三，电子从光波中的电动平衡过渡到真空中的电动平衡。

如果一个电子先经历过程 A 再经历过程 C，则该电子将经历一个“入光过程”与一个“出光过程”的合成过程 D，它具有如下效果：

第一，电子作为一个整体从静止状态转入等速直线运动状态，接着再转入另一等速直线运动状态；

第二，电子从入射光吸收一份光波，再沿另一方向发射一份光波；

第三，电子先从真空进入光波，接着又从光波返回真空。

把入光过程和出光过程理解为“理想跳跃”，已经是对实际过程的简化，但对于合成过程 D，还可以进行“第二次简化”：把第一个效果中的两次变速合成一次，再把第三个效果中的两个相互抵消的“电动平衡状态的突变”略去，则其的效果可描述如下：

第一，电子作为一个整体从静止状态转入等速直线运动状态；

第二，电子从入射光吸收一份光波，再沿另一方向发射一份光波。

这就相当于一个电子与一个“光子”的完全弹性碰撞。

如果金属中的静止电子完成入光过程 A，接着又离开光波返回真空，从而经历过程 D，那就是康普顿效应。

康普顿效应对应的过程 D 有两个阶段：分别是过程 A 与过程 C。这两个阶段的“第三种效果”相互抵消，从而即使从“光子论”的角度看来，康普顿效应也满足能量动量守恒定律。于是，尽管光子论所理解的康普顿效应乃是对真实的过程的“第二次简化”，却似乎成了光子论的铁证。

关于康普顿效应，曹天元写道：“在粒子的基础上推导出波长变化和散射角的关系，和实验符合得一丝不苟。这是一场极为漂亮的歼灭战，波动的力量根本没有任何反击的机会便被缴了械。康普顿总结道：‘现在，几乎不用再怀疑伦琴射线是一种量子现象了……实验令人信服地表明，辐射量子不仅具有能量，而且具有一定方向的冲量。’”

然而对于光子论，康普顿效应虽然满足能量动量守恒定律，却也像光电效应一样不能融入麦克斯韦理论，因此在光电效应中已经显示的波动与粒子两种表象的基本矛盾依然故我。曹天元对这一基本矛盾描述得很确切：

“……光子一陷入干涉的沼泽，便显得笨拙而无法自拔；光波一进入光电的丛林，也变得迷茫而不知所措。粒子还是波？在人类文明达到高峰的 20 世纪，却对宇宙中最古老的现象束手无策。”

这就是人们通常说的“波粒佯谬”，这一佯谬令人想起“盲人摸象”的寓言：盲人们为大象到底是大萝卜还是大蒲扇、是大柱子还是草绳争论不休。不过物理学家们并不像盲人们那样，只摸到大象的某一部分而没有摸到其他部分。不！他们摸到了物理世界这只大象的每一部分，可就是因为脑子里有

太多的“新颖观念”，没法勾画出这只大象的全貌。更糟糕的是，物理学家们还要荒谬绝伦地断言：大象有时候是大萝卜有时候是大蒲扇、有时候是大柱子有时候是草绳。或者干脆断言，大象实际上什么也不是！我们只能用数学公式来描述它！一言以蔽之，他们自己弄不清大象是怎么回事，就断言人类永远弄不清大象是怎么回事！通过这种古怪的方式，物理学家们宣布了自己无所不知。

这就不难理解，当物理学家们听到我说“大象到底是怎么回事”的时候，他们为什么会如此狂怒！

8 预言

根据麦克斯韦电磁学对光电效应与康普顿效应的上述说明，可以预言一种新的效应。如果一个电子原来在光波中静止，突然将光波截断，则电子将经历一个“出光过程”。其效果是：发射一份光波，并转入等速直线运动。我把这种效应称为“反光电效应”。这一预言简单明了，可惜不容易实现。另一预言说起来复杂些，但却比较容易实现：如果在光波（最好是伦琴射线）中制备一个单色电子束（动量一致的电子束），则该电子束将在光波中保持等速直线运动，就像在真空中一样。但如果光波突然被截断，则电子束将被冲散，同时还伴以被散射的光波。这一效果从光子论的角度来看完全无法理解：一束电子在光子的丛林中穿插却不发生碰撞！电子束离开光波竟然被“乌有”所冲散！光波离开电子束竟然遭到“乌有”的散射！……等等。这些可都是咄咄怪事！我期望这种怪事不会因为其预言者是一个无名小卒而被置之不理。

9 结束语

综上所述，光电效应与康普顿效应并未显示出光的“粒子性”，相反，它们乃是麦克斯韦电磁学的必然结论。迄今为止，得出这一结论的前提只是电子有一个固有电磁场，而没有涉及电子的结构。至于电子的结构问题，涉及电子论处理洛伦兹问题的根本失误，这是一个专门的课题，我们以后再考察。

2/11/2012

Photoelectric effect and Maxwell Theory

Abstract: it is proved that Einstein's photon theory cannot explain the photoelectric effect. Because, according to the mechanism on the mechanism of photon, absorbing the photon energy, an electron would also absorb the photon's momentum, a rest electron absorbed the photon momentum should move along the light propagation direction. So, the movement direction of the photoelectron should be consistent with the direction of the incident light. But in the photoelectric effect experiment, the direction of photoelectron and that of light propagation are almost the opposite. Therefore, the mechanism envisaged in violation of the law of conservation of momentum. It is also proved that the photoelectric effect can be described by Maxwell's theory as follows: an electron has a natural electromagnetic field of its own, while the light is another electromagnetic field. As the electron enters into the light, the two electromagnetic field above due to the superposition with each other, the change of the sum field energy can be immediately converted into kinetic energy of the electron, just like as a falling body enters into the gravity field, the potential energy of the falling body immediately becomes kinetic energy. After a rest electron in the metal enter into light wave, will go through a process, in which it will absorb a part of light wave, and achieve a constant linear motion from stationary state. If the very electron leaves the metal immediately, then that is the photoelectric effect. If the electron then left again the light, it will go through a reverse process, which is changing the state of motion again and emitting a part of light wave, that is the Compton effect.

Keywords: photoelectric effect; Einstein; photon theory; wave theory of light; electrodynamics; falling bodies; potential energy; superposition field energy; Lorentz problem; Compton effect.

原子模型与经典物理学 （三评量子物理学）

谭天荣

青岛大学物理系青岛 266071

ttr359@126.com

Recommended by Zhang Dongsheng, zhangds12@hotmail.com

内容摘要：本文证明经典物理学适用于卢瑟福模型。按照经典物理学，在卢瑟福模型中，电子的运动满足麦克斯韦方程，至于它满足该方程的哪一个特解，经典物理学本来就没有规定，只能根据实验事实给出。既然事实证明原子的状态经久不变。麦克斯韦电磁学是否适用卢瑟福模型的问题，就归结为："应用于卢瑟福模型的波动方程有没有一个特解，使得原子的状态经久不变。"

推迟解与超前解是波动方程的两个特解，推迟解与超前解的算术平均值也是波动方程的一个解，它表示一个球面驻波场。它描写如下过程：电子绕核旋转既发射又吸收，发射与吸收达到平衡，形成驻波。这一特解符合原子经久不变的事实。这就表明波尔关于原子世界有特殊规律的论断是不成立的。

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关键词：卢瑟福模型；波尔论断；经典物理学；牛顿力学；电动力学；电子论学派；洛伦兹问题；电磁不可逆性；波动方程；推迟解与超前解

1. 引言

最近，读了曹天元的新作《上帝掷骰子吗——量子物理史话》，重新点燃了我批判量子物理学的激情。我把我的批判写成下面的一组论文。我已经到了耄耋之年，这是我的最后一搏。

波尔理论在量子物理学的发展中占有一席之地，曹天元这样评价他的特殊贡献：

"在浓云密布的天空中，出现了一线微光。虽然后来证明，那只是一颗流星，但是这光芒无疑给已经僵硬而老化的物理世界注入一种新的生机，一种有着新鲜气息和希望的活力。这光芒点燃了人们手中的火炬，引导它们去寻找真正的永恒的光明。"

关于波尔理论的出现，曹天元写道：

"卢瑟福的实验展示了一个全新的原子面貌：有一个致密的核心处于一种的中央，而电子则绕着这个中心运行，像是围绕着太阳的行星。然而，这个模型面临着严重的理论困难，因为经典电磁理论预言，这样的体系将会无可避免地释放出辐射能量，并最终导致体系崩溃。……

"波尔面临着选择，要么放弃卢瑟福模型，要么放弃麦克斯韦和他的伟大理论。波尔勇气十足地选择了放弃后者。他以一种深刻的洞察力预见到，在原子这样小的层次上，经典理论将不再成立，新的革命性思想必须被引入，这个思想就是普朗克的量子以及他的 h 常数。"

本文将给出第三种选择：既保留卢瑟福模型，又保留经典物理学。但这里说的"经典物理学"是指她的基本原理，而不包括她的某些个别结论。为了辨别这两者，不得不先说几句题外的话。

2. 经典物理学的回顾

朗之万在某处说过：现代物理学上是在牛顿力学的世界观与电动力学的世界观的冲突中发展起来的。他忘了补充一句：现代物理学正处在牛顿力学的世界观已经衰老而电动力学的世界观却尚未成熟的时期，量子力学则是这种青黄不接的理论表现。

电动力学建立比牛顿力学晚，开始时她自然接受牛顿力学的现成的世界观，只有在长期的内部斗争中，她才显示出自己的本来面目。因此，这两种世界观的斗争，也就是电动力学的内部斗争。

早期的电动力学有两个对立的学派。以安培为代表的法国学派继承了英国人牛顿的"超距作用"的观点；而以法拉第和麦克斯韦韦代表的英国学派则继承了法国人笛卡儿的"接触作用"观点。英国学派建立的电磁场论统一地解释了当时的电学、磁学、光学和辐射热力学的实验资料，从而战胜了法国学派，这是电动力学世界观对牛顿力学世界观的

第一次胜利。

洛仑兹用他的“洛仑兹规范”简化了麦克斯韦方程，从而显示接触作用观点与超距作用观点的数学表达式只有一点微妙的差别：表现超距作用观点的方程是“泊松方程”，而表现接触作用的方程则是“波动方程”（非齐次波动方程，也称达朗贝尔方程）。对于所谓“无界问题”，泊松方程的特解表示电磁作用是“瞬时”的，从而是超距作用。而波动方程的特解则表示电磁作用的“推迟”的，从而是接触作用。泊松方程遵循伽利略变换，而波动方程则遵循洛仑兹变换。伽利略变换表现牛顿力学的时空观，而洛仑兹变换则表现电动力学的时空观。因此，用波动方程取代泊松方程来表现电磁作用已经蕴含着物理学史上的一次空前的大变革：用电动力学的时空观取代牛顿力学的时空观。

1905 年爱因斯坦建立的相对论开始了这一变革，1908 年闵可夫斯基对相对论的几何解释则基本上完成了这一变革。这是电动力学世界观对牛顿力学世界观的第二次胜利。

然而，上面的两次交手都不过是两种世界观斗争的序幕而已，真正的决战在于对物质结构的认识，即在于“物质观”的问题。牛顿力学的物质观是所谓“机械论”，她认为“现象世界”的五光十色的运动形式都可以归结为原子的机械运动（即位置移动）。因此，物质的质变（运动形式的转化），只不过是现象，而本质世界即原子世界则只有量变。古希腊的原子论哲学家德谟克里特对这种世界观作了或许是最早的表述：

“按照意见存在着温暖，按照意见存在着寒冷，按照意见存在着颜色、甜味、苦味；但按照真理，则只存在原子与虚空。”

笛卡儿、牛顿以及同时代的大多数哲学家和物理学家，都是机械论的信徒，但只有到了 1842 年，机械论的基本观点才在物理学中获得第一次证实。这一年“热的唯动说”成功地把热现象归结为分子的机械运动，从而在物理学中掀起了把一切运动归结为机械运动狂热。

然而，把电磁运动归结为某种物理模型（例如，以太粒子）的机械运动的一切尝试都遭到挫折。与此同时，法拉第和麦克斯韦的电磁场论却成功地把电磁现象统一于一组数学方程。于是电磁场论作为一种“唯象理论”和原子论对立起来。与此同时，关于热现象的能量理论——热力学，也作为一种唯象理论和热现象的原子理论——分子运动论——分庭抗礼。

在哲学史上，唯象理论与原子论的对立表现为以奥斯特瓦尔德唯代表的“唯能论”和机械论学派的分子运动论的对立。唯能论确认运动形式的转化时自然过程的本质，但她在反对把一切运动形式归结为原子的机械运动的狂热时，却走向了另一个极端——否认原子本身。

以洛仑兹为代表的“电子论学派”把原子论与电磁场论两大巨流汇合起来，从而克服了机械论与唯能论的对立。她一方面确认现象世界五光十色的运动形式可以追溯到原子世界的本质，另一方面又确认本质世界也有质变。原子世界不是只有单一的机械运动，而是有两种对立的运动形式：机械运动与电磁运动，它们的转移与转化形成现象世界的各种运动形式。

更重要的是，在“电荷”与“电磁场”哪一个是物质本源的问题上，电子论又克服了法国学派与英国学派的对立。按照法国学派的观点，电荷是实在的，而电磁场则不过是一种为表现电荷之间的相互作用力而引进的辅助概念；按照英国学派的观点，电磁场是实在的，而电荷则只不过是表示“场的纽结”的辅助概念。电子论把这两种观点各自作为一个环节容纳于自身，认为电荷是实在的，电磁场也是实在的。传递电荷之间“作用力”的电磁场不是纯粹的数学抽象，而是物质的一种特殊形式，她有连续分布的能量与动量；作为“场源”并承受场的“作用力”的电荷，也不是“场的纽结”，而是组成电荷原子的物质微粒——电子。

电子论认为：电子是一个基本的带电粒子，作为电磁场的“场源”，它激发一个电磁场，这是电子的“固有电磁场”，这个固有电磁场也电子的自身的组成部分。于是电子乃是一个带电粒子与一个电磁场的统一体。带电粒子的运动是机械运动，而电磁场的运动则是电磁运动，两者统一于“电子的运动”。电子论既然把一切物理运动归结为机械运动与电磁运动，也就把一切运动归结为电子的运动。

这就是电子论的世界观，而电子论则是经典物理学的顶峰，不幸的是，经典物理学不久就从这一顶峰上坠落下来。

3. 洛伦兹问题

按照现代物理学的一般观点，物质有“实物”与“场”两种形式，在电子的两个组成部分中，带电粒子是“实物”，而“电磁场”则是“场”。按照电动力学原理，电子的这两个组成部分经常处在双重的相互作用之中：带电粒子按照麦克斯韦方程不断激发电磁场，而电磁场又反过来以“电磁力”（洛仑兹力）不断作用于带电粒子。电子论认为这种经常的相互作用乃是电子的各种行为的内因，外力只有通过这种内因才能对电子起作用。于是电子不再是牛顿力学意义下的那种抽象的、僵死的、只能被动地接受外力作用的“力学粒子”，而是包括“实物”与“场”的对立于自身，从而处于永恒的、内部的、

必然的、自己的运动之中的“电学粒子”了。

那么，外力怎么通过电子的内因起作用呢？具体地说，问题可以这样提：电子有电荷，它的运动（整体运动与内部运动）形成电流，电荷与电流按照麦克斯韦方程激发电子的固有电磁场，而电子的固有电磁场有和外电磁场一起作用于电子的电荷与电流。在这种相互作用中，电子在外部作用下将会怎样运动呢？回答这个问题就意味着描写并说明电子（单个电子或电子束）在给定的外部条件下的行为。

在物理学史上，只有以洛仑兹为代表的“电子论学派”才自觉地考察过这一问题，我称它“洛仑兹问题”。电子论既然把一切物理运动最终归结为电子的运动，也就把一切物理学问题最终归结为洛仑兹问题。

然而，电子论学派并没有如此明确地表达过自己的观点，这是我从她的基本观点引出的必然结论。电子论在处理具体问题时常常简单地把电子当作点电荷来处理。点电荷是带电粒子的一种简化的模型，当带电粒子作为电磁场的场源时，只要观察点离带电粒子足够远，这个带电粒子就可以当作点电荷来处理；当带电粒子作为电磁力的受力者时，只要场源离带电粒子足够远，这个带电粒子也可以当作点电荷来处理。但是，对于洛仑兹问题，电子既作为“场源”又作为“受力者”。这样，电子的带电粒子作为电磁场的场源，离观察点的距离为零；作为受力者，离场源的距离为零，因此无论电子多么小她都不能当作点电荷来处理了。由此可见，当把电子当作点电荷来处理时，电子论完全忘记了洛仑兹问题，即完全忘记了自己的基本观点。然而，电子论的一切积极成果，（例如，推导微观欧姆定律，计算拉摩旋进等。）都得归功于她的这种健忘。因为她解决洛仑兹问题的尝试遭到了彻底的失败。

洛仑兹问题的解答决定于电子的结构，而电子是看不见的，我们只能通过电子的行为去认识。这就是说，我们应该先分析实验事实，再塑造电子模型，然后通过计算给出这个电子模型在各种特殊场合的行为，与电子的实际行为比较，即把该模型交给实验去检验。可电子论不是这样，她想当然地把电子当作“带电刚球”来处理，这就注定她只能一无所获。更糟糕的是，她又想当然地用了麦克斯韦方程的“推迟解”。这就使得她不仅是一无所获而已。

电子论学派采用“刚球模型”和“推迟解”，导出了一个电子动力学方程。从这一方程得出结论，电子的固有电磁场对电子的带电粒子的作用可归结为两项。一项相当于电子增加了一份质量，称为“电磁质量”；另一项乃是与电子辐射相联系的“阻力”，称为“辐射阻尼”。这一方程不是像电子论期待的那样解开原子世界的秘密，而是给物理学带来了两次危机。

第一次危机是“电磁质量”这一范畴带来的。电磁质量不遵循质量守恒定律，从而也不遵循动量守恒定律和能量守恒定律，再加上当时人们误解了放射性等实验事实，从而从另一角度感觉到能量守恒定律不再成立。这一情况使得物理学家们大为震惊，彭加勒惊呼这是“物理学原理的普遍毁灭”！

第二次危机则是“辐射阻尼”这一范畴引起的。与辐射阻尼相关联的是如下结论：

A. 一个带电粒子作加速运动必然发射电磁波。

这一命题可是一场灾难的肇事者！

1911 年，卢瑟福通过他的α粒子实验，提出了原子的“行星模型”（下面简称“卢瑟福模型”）：原子的中心有一个带正电的“原子核”，它占据原子绝大部分质量和角动量；带负电的电子则沿着特定的轨道绕着它转动。在卢瑟福模型中，绕原子核旋转的电子作加速运动，根据命题 A，它们必然因发射电磁波而失去能量，从而离原子核越来越近，最终落在核上。于是卢瑟福模型应该是不稳定的，但实际上原子却极为稳定。

物理学家们把这一矛盾理解为电动力学与卢瑟福模型的矛盾，电动力学是经典物理学的一部分，而卢瑟福模型则是根据α粒子散射实验得出的。于是问题归结为经典物理学与实验事实的矛盾。最终，鼎鼎大名的波尔，物理学王国中的亚历山大大帝，一剑砍断了这一形而上学的纽结，宣布：

B. 经典物理学在这里不适用，原子世界有特殊规律！

这一称为“波尔论断”的命题惊天地，泣鬼神。真可谓：“天柱折，地维绝。天倾西北，故日月星辰移焉。”

第一次危机动摇了人们对经典物理学的信念，第二次危机则把经典物理学逐出了原子世界。在这里，人们忘记了如下事实：第一次危机乃是电子论的电子动力学方程推翻了经典物理学的普遍原理，第二次危机则是卢瑟福所发现的新的实验事实否定了这个方程。两次危机的效果刚好相互抵消。唯一留下的结论是：电子论的电子动力学方程既违背了经典物理学的普遍原理，又违背了新的实验事实，从而肯定是一个错误的方程。

电子论解决洛仑兹问题的尝试就这样以她的电子动力学方程带来的两次危机告终。在这以后，电子论退出了物理学的舞台，而洛仑兹问题则完全被人们遗忘了。但是，接踵而来的所谓“量子现象”的一类实验事实正是大自然对洛仑兹问题的回答，而为说明量子现象而建立的理论——量子力学，则

是对这种回答的数学描述，只不过人们仍然按照牛顿力学的物质观来看待这些量子现象，使得这些回答采取极为神秘的形式，并且被当作原子世界的特殊规律与经典物理学相对立。

可以预期：一旦人们掌握了电动力学的物质观，现代物理学将向经典物理学复归。当然，她将带着量子力学的一切积极成果来实现这一复归。

4. 电子无所适从

自从波尔宣布“原子世界有特殊规律”以后，他的这一论断就不断被证实，原因是电子的行为一而再再而三地违反经典物理学的预言。然而这可怪不得电子行为乖谬，怪只怪经典物理学对电子的行为提出了自相矛盾的要求。怎见得呢？让我们先提一个问题：

“如果原子世界没有特殊规律，在卢瑟福模型中，电子到底应该怎样运动？”

按照经典力学，点电荷在外电磁场中的运动满足牛顿第二定律。汤姆逊当年发现电子，即发现阴极射线是电子流时，他默认了一个前提：“电子在外电磁场中的行为和点电荷一样”，即满足牛顿第二定律。不久以后，人们还根据这一前提发现电子的质量与速度之间的相对论关系。由此可见，自从发现电子以来，人们一致认为：如果原子世界没有特殊规律，则电子在外电磁场中的行为和点电荷一样。

量子力学建立以后，人们发现：在普朗克常量趋于零的极限情况下，薛定谔方程蜕化为经典力学的“雅可比方程”。将雅可比方程应用于质点，将得出与牛顿第二定律相同的结论。可见即使在量子力学建立以后，人们仍然默认：如果原子世界没有特殊规律，则电子在外电磁场中的行为和点电荷一样。

根据牛顿第二定律，一个带负电的点电荷在一个质量大得多带正电的点电荷的有心力场中，将作椭圆轨道运动。由此立刻得出结论：

“如果原子世界没有特殊规律，则对于卢瑟福模型来说，电子将绕核作椭圆轨道运动。”

可是，当玻尔提出它的原子理论，并断言原子世界有特殊规律时，他的前提却是：如果原子世界没有特殊规律，则对于卢瑟福模型来说，电子将会因为辐射而落于核。因此，

“如果原子世界没有特殊规律，则对于卢瑟福模型来说，电子将不会绕核作椭圆轨道运动。”

即使电子是一个百依百顺的女孩子，任我们梳妆打扮，她也不可能在卢瑟福模型中既绕核作椭圆轨道运动，又不绕核作椭圆运动。因此，电子将无所适从。她会问：

“你们到底要我怎样运动？”

可是谁也不曾认真回答这一问题，结果是无论电子怎样运动，它都不断地证明原子世界有特殊规律。就说卢瑟福模型吧，如果电子绕核作椭圆轨道运动，它就违背了经典电动力学，这就表明原子世界有特殊规律；如果电子不绕核作椭圆轨道运动，它就违背了经典力学，这也表明原子世界有特殊规律。

由此可见，波尔论断之所以不断被证实，只不过由于经典物理学自相矛盾。

5. “电磁不可逆性”与“电寂说”

在命题 A 中，“加速运动”与“发射电磁波”这两个用语有一个重要的区别：如果一个物体作加速运动，其“时间反衍”还是该物体作加速运动；但如果一个物体“发射电磁波”，其“时间反衍”却是该物体“吸收电磁波”。因此，如果一个带电粒子作加速运动并且发射电磁波，则其时间反衍将是该粒子作加速运动并且吸收电磁波。按照命题 A，这个时间反衍是不可逆实现的。因此，除了作等速直线运动以外，带电粒子所经历的一切运动都是不可逆的。这是一种深入原子世界的不可逆性，我们不妨称它“电磁不可逆性”。

我们记得，热力学第二定律表达了一种不可逆性：“熵增加原理”。这种仅限于宏观世界的不可逆性给出一种宇宙毁灭的前景——“热寂说”。经过类似的推理，“电磁不可逆性”会给出一种宇宙毁灭的前景，我们不妨称它“电寂说”。如果热寂说还是一种来自遥远将来的威胁，那么，“电寂说”的威胁就迫在眉睫。曹天元对“电寂说”作了颇为形象的描述：

“世界……会在转瞬之间因为原子自身的坍塌而毁于一旦，原子核和电子将不可避免地放出辐射并相互中和，然后把卢瑟福和它的实验室，乃至整个英格兰，整个地球，整个宇宙都变成一团混沌。”

曹天元没有看到的是，这种“电寂说”其实来自经典电动力学的命题 A 和它导出的“电磁不可逆性”，这种宇宙毁灭的前景并不需要“卢瑟福模型”作为佐证。

因此，只要波尔稍微细心一点，他就不该把他的超人的才智用来在卢瑟福模型和麦克斯韦理论之间进行选择，而是用来审查命题 A，把这个命题从经典物理学中清除出去。这样他就不得不稍稍打扫一下物理学这个奥吉亚斯牛圈，稍稍改善一下物理学的环境。不幸的是，这不是波尔的性格，这位物理学的亚历山大大帝正式宣布了经典物理学的死刑，从而把物理学引向了另一方向。

6. 波动方程与因果律

按照经典物理学，在卢瑟福模型中，电子的运动满足麦克斯韦方程，至于它满足该方程的哪一个特解，经典物理学本来就没有规定，只能根据实验事实给出。既然事实证明电子的能量不会流失，麦克斯韦方程是否适用卢瑟福模型的问题就归结为：

该方程有没有这样一个特解，它表示如下过程：一方面，电子持续地沿着轨道旋转，另一方面，原子的能量却不会因此而流失。应用洛伦兹规范，麦克斯韦方程化为一组波动方程，因此麦克斯韦电磁学是否适用卢瑟福模型的问题，就归结为波动方程是否适用卢瑟福模型的问题。这一问题可表述如下：

“应用于卢瑟福模型的波动方程有没有一个特解，使得原子的状态经久不变。”

不幸的是，非常不幸的是，物理学家们在这里误入歧途。卢瑟福模型遇到的问题其实是该模型与命题 A 相矛盾。而命题 A 是从电子论的一个电子动力学方程得出的结论，导出这个方程时曾用到波动方程的推迟解，因此，卢瑟福模型遇到了困难只不过表明：

C. 波动方程的推迟解不适用于卢瑟福模型。

推迟解描述的正是电磁波的发射过程。因此，应用这个电子动力学方程就已经预先假定命题 A 成立，因此命题 A 的推导只不过是一个同语反复而已。问题在于，波尔是通过什么途径从命题 C 得出命题 B 的，即从“波动方程的推迟解不适用于卢瑟福模型”得出“原子世界有特殊规律”的？

前人有关这一问题的叙述是一团乱麻，剪不断，理还乱。我从来没有看到过一本书专门讨论过这一问题，只零星地听到一些有关的只言片语。这里，我把这些只言片语串联一下，整理成一个论据。

人们断言：波动方程有两种特解，一种是推迟解，一种是“超前解”，超前解违背因果律，必须抛弃，于是在因果律成立的前提下，命题 C 意味着波动方程不适用于卢瑟福模型，从而意味着麦克斯韦电磁学不适用于卢瑟福模型。这就从命题 C 得出了命题 B。在这里，使波尔误入歧途的关键论据是：

D. 波动方程的超前解违背因果律。

于是，为了拯救经典物理学，首先必须否定这一命题。

从 1956 年新年起，我对波动方程进行了半年探索，得出的结论之一是，命题 D 不成立，对于一个给定的波动方程，其超前解并不违背因果律，它表示一个特殊的波动过程。在这里，我先通过一个例子阐明这一结论

扔一个石头到平静的池塘里，在池塘的水面激起一个向外发散的波纹，这一过程由一个波动方程，记作α，的推迟解来描述的。人们认为，这一过程的时间反衍是“石头还没有扔出去水面就已经有了波纹”，这是违背因果律的。这也未免太不动脑筋了，正是这一轻率的、想当然的断言毁了整个经典物理学。

还是让我们细心地考察一下这个“扔一个石头到平静的池塘里在水面激起波纹”的过程吧。把这一过程记作 I，它的“时间反演”是如下过程：开始时，水面有一个波纹向里会聚，当会聚到波纹中心时，一块石头从水中冒出，飞向那个扔石头的人的手中，在这以后，水面恢复平静。描写这一过程是一个超前解，但不是波动方程α的超前解，而是另一波动方程的超前解。波动方程α的超前解表示的如下过程：开始时，水面有一个波纹向里会聚，当会聚到波纹中心时，一块石头进入水中，在这以后，水面恢复平静，我们把这一过程记作 II。

过程 II 虽然十分离奇，但并不违背因果律。为了阐明这一点，让我们把表示这一过程的超前解表成两项之和，第一项就是推迟解，表示过程 I；第二项满足一个“齐次波动方程”，描述如下过程：开始时，水面有一个波纹向里会聚，当会聚到波纹中心时，反过来向外发散，把这一过程记作 III。

过程 III 在数学上是最简单的，却难以理解。为了理解这一过程，你可以用脸盆打一盆水，然后敲一下盆边，你将看到一个波纹从脸盆的边缘开始向里会聚的波纹，会聚到脸盆中心以后会反过来向外发散。如果你更细心一点，还会发现，会聚的波纹原来凸出的部分到达中心后，会变成了凹陷的部分，反之亦然。我想这个实验能够使你相信过程 III 也不违背因果律。

过程 II 作为 I 和 III 两个过程的迭加可描写如下：开始时，初始的波纹向里会聚，当会聚到中心时，初始的波纹反过来向外发散，与此同时，一块石头入水激发另一个向外发散的波纹，这两个向外发散的波纹恰好相互抵消，因此，水面平静下来。既然 I 和 III 都不违背因果律，II 作为 I 和 III 的迭加也不违背因果律。因此，对于我们所考察的例子，超前解并不违背因果律。

到现在为止，我们仅仅给出命题 D 的一个“反例”，这对于否定命题 D 已经足够了，但并未一般地证明超前解表示一个特殊的波动过程。前苏联的物理学家富拉索夫写过一本“电动力学”，其中有一道习题，对于给定的非齐次波动方程，推迟解与超前解之差满足对应的齐次波动方程。沿着同样的思路，就不难给出这一证明。

7. 电磁波的发射与吸收

从“石头入水”的例子我们还得出另一结论。

在过程 I 中，石头入水这一事件“发射”了一个波纹；而在过程 II 中，同一事件却“吸收”了一个波纹。一般地说，一个波源按照波动方程的规律激发一个“波场”，这个波场将与原来就在该处的波场相互迭加，如果迭加以后的波的能量比原来的能量更大，波源就是在“发射”能量；如果比原来的能量更小，波源就是在“吸收”能量。将这一结论应

用于电磁波，则表述为：

E. 一个波源的某种行为到底是发射还是吸收电磁波，不仅取决于波源的行为本身，而且还取决于其周围的环境。

用数学的语言来表达，命题 E 可表成：波源到底是发射还是吸收电磁波，不仅取决于波动方程的“非齐次项”，而且还取决于波动方程的“初始条件”。

回到命题 A。在这里，作加速运动的带电粒子作为波源只能给出波动方程的“非齐次项”，而不能给出波动方程的“初始条件”。根据命题 E，如果作加速运动的带电粒子能发射电磁波，它就同样能吸收电磁波。仅凭这一点，命题 A 就必须修改为：

F. 一个带电粒子作加速运动必然发射或吸收电磁波。

经过这一修改，“电磁不可逆性”与“电寂说”就都烟消云散，从而卢瑟福模型也不再与电动力学相矛盾，而波尔论断也就失去其原始依据了。

波尔宣判经典物理学死刑，诚然是源于他极端的轻率与偏执的个性，但也不仅如此。爱因斯坦对“波尔论断”也感到不安，但对于卢瑟福模型与经典物理学之间的矛盾，他也束手无策。为什么呢？因为这两位二十世纪的物理学巨头都有一个致命的毛病：大胆有余而细心不足。当接触到物理学最敏感的神经时，他们都醉心于构思最天才、最大胆和最富有锐气的“新颖观念”，却不愿意进行细心的思考与宁静的探索。他们动不动就高谈阔论“因果律”、“时空结构”或“经典物理学”之类的大问题，而实际上真正切题却是一些小问题。对于这些小问题，他们却不屑去思考，这可就误了大事！以卢瑟福模型遇到的困难为例，在这里困扰他们的问题只有把命题 A 修改成命题 F 才能解决。而这一修改只有否定了命题 D 才能实现。要证明命题 D 不成立，除了不厌其烦地解波动方程，别无他法。而波动方程的求解却是一个登不了大雅之堂的小问题。在他们看来，要他们做这种小事无异杀鸡用牛刀。于是他们对这些小事不理不睬。“上有所好，下必甚焉！”其他物理学家就更不关心这种小事了。以至于不论谁有一个小小的疏忽，一代又一代物理学家就没有一个人肯屈尊去纠正，这一领域里的奥吉亚斯牛圈就是这样形成的。

我们看到，波动方程的推迟解和超前解之间的区别仅仅是初始条件的不同，并不涉及“因果律”这样高深的哲理。我们还看到：波动方程的解对初始条件的依赖是极为敏感的。由于推迟解只是波动方程无穷多个特解中的一个，它对初始条件的要求极为苛刻，因此推迟解在诸特解中并没有特别优越的地位。对于宏观过程，我们原则上可以创造适当的条件，使得推迟解得以实现。而对于微观过程，初始条件不能人为地“创造”，取而代之的是“自然边界条件”。这时再胡里胡涂应用推迟解，就难免得出与实验事实不符的结论，从而引出怪诞的“新颖观念”。

8. 电动力学中的“物体”

当人们塑造原子模型时，遇到了两个至今人们还没有明确意识到的障碍。

牛顿力学的基本方程是牛顿三定律，质点、刚体、弹性体和理想流体则是其“物体”的模型。电动力学的基本方程是麦克斯韦方程和洛仑兹力方程，其“物体”的模型是什么呢？有人说是连续的电磁场，这个回答似乎不能令人满意：“物体”似乎应该是某种分布在有限空间并且具有相对稳定性的东西，而按照麦克斯韦方程，分布在有限空间的电磁场如果没有带电的实物相伴，将会以光速四面飞散，一瞬间就会无影无踪。因此，电动力学中的“物体”应该是电磁场与带电的实物的统一体，问题在于这种统一体怎样才能形成一个相对稳定的“物体”。

当我们从宏观电动力学向微观电动力学过渡时，必须摆脱某些根深蒂固的思维习惯，例如，一个宏观的偶极子作电磁震荡时，不言而喻地有某种外部能源向它源源不断地供给能量，只有这样它才能连续不断地发射电磁波。但对于一个原子，我们应该随时记住它们是没有外部能源的。还有，对于宏观的带电粒子我们可以任意加上某种约束条件，我们可以让它被关在某一空间范围内，可以让它限制在某一曲面或某一曲线上运动。但对于原子，我们却不能想象给它赋予这样的约束，当年的汤姆逊塑造他的原子模型时，似乎就没有考虑到这一点。

为了摆脱“外部能源”和“约束”这样的“思维定势”，让我们考察一个宏观电动力学中的例题。

设想由两个金属小球，一个带正电，另一个带相等的负电（下面分别称为正电小球和负电小球），用一根很轻的小棍连接着，形成一个有固定电矩的“电偶极子”。固定正电小球，让负电小球以某一角速度绕它旋转。按照麦克斯韦方程的推迟解，这个旋转着的电偶极子将发射一个向外发散的球面电磁波。我们将这一过程记作 I。

发射电磁波将带走能量，为了维持偶极子以恒定的角速度旋转，必须由外部能源向它源源不断地供给能量。我们假定这个能源是一个下降的重物，它通过一个机械装置推动偶极子旋转。这是一个恒定的发射过程。

把这一过程拍成电影，然后倒过来放映，银幕上的过程将是过程 I 的时间反演。它可描述如下：

一个球面电磁波从无穷远向旋转着的偶极子会聚；偶极子不断吸收着向它会聚的电磁波，并且通

过机械装置推动重物上升。这是一个恒定的吸收过程。这一过程中的偶极子的旋转方向与过程 I 的相反，我们把这一过程记作 II，它是波动方程的超前解，但它是另一个波动方程的超前解，因为其中的偶极子的旋转方向与过程 I 的相反。如果在银幕前置一面镜子，则过程 II 在镜中的过程也是一个恒定的吸收过程，而且其中的偶极子的旋转方向与过程 I 的相同，从而是原来的波动方程的超前解，我们把这一过程记作 III。

过程 III 在技术上是不能实现的，因为我们不能在实验室造成一个向里会聚的球面电磁波，再说，机械装置的摩擦和空气阻尼也会是重物的下降过程变成不可逆的。因此 II 只是一个理想过程。但它是一个满足麦克斯韦方程的理想过程。

推迟解与超前解的算术平均值也是麦克斯韦方程的一个解，它在所谓“波场区”表示一个球面驻波场，我们称它“驻波解”。它描写如下过程：旋转着的偶极子既发射又吸收，发射与吸收达到平衡，形成驻波。重物在既不上升也不下降，于是重物连同传动的机械装置不再起作用。在这一过程中去掉重物与机械装置，就剩下偶极子与自身的驻波场在相互作用中永恒地旋转。

在偶极子旋转时，由于向心力的反作用，小棍受到一个拉力；由于两个小球的库仑吸引，小棍由受到一个压力。当旋转的角速度适中时，拉力与压力达到平衡，小棍就不再起作用。如果正电小球的质量远比负电小球的质量大。则在我们去掉小棍，并解除对正电小球的约束以后，它照样静止，负电小球照样以原来的角速度绕它旋转。

我们把这样一个旋转着的偶极子称为“自旋子”。它既摆脱了外部能源，又摆脱了约束，这是从宏观电动力学向微观电动力学过渡的关键的一步。

自旋子可分为两个部分，其一是两个带电小球和邻近的库伦场，我们称为“粒子”；其二是波场区的驻波场，我们称为“波包”。这两个组成部分显然不可能分割开来。

9. 卢瑟福模型的新形式

将自旋子中的正电小球换成一个质子，负电小球换成一个电子，则自旋子就成了一个氢原子的模型，这是一个满足经典电动力学的氢原子模型，它是一个粒子与一个波包的统一体。

我们看到，关于电子在原子中的行为有三种意见：首先的电子论的意见，电子在原子中绕核旋转时，只能发射，不能吸收，因此电子将因发射而落于核。这一结论与事实不符。其次是玻尔的意见，电子在原子中绕核旋转时，既不发射，也不吸收，这一结论不对应麦克斯韦方程的任何解，因而违背经典电动力学。最后是我们的意见，电子在原子中绕核旋转时，既发射，又吸收，发射与吸收达到平衡，形成驻波，这一结论既不违背原子经久不变的事实，又满足麦克斯韦方程。

或许有人会质疑波动方程的驻波解的现实性：这个解有半个超前解，超前解在技术上是不能实现的，而我们却不能制备一个向里汇聚的电磁波。因此，驻波解也不能实现。这种疑问来自如下想法：如果一个静止的原子有一个驻波场的话，那就是这样形成的：原子先激发向外发散的波，然后再遇上一个向里汇聚的波并与它迭加成为驻波。对于这种形成过程，自然要问向里汇聚的波是从哪儿来的。但一个静止的原子满可以一开始就激发一个球面驻波，就像一个点电荷一开始就激发一个静电场一样。这样，就没有理由再怀疑驻波解的现实性了。

当物体处于平衡状态时，其发射与吸收必须达到平衡这一观点，可以追溯到古希腊的伊壁鸠鲁。他说过：“从物的表面放出一股连续不断的流，而这股流是感觉所不能察觉到的，这是因为有逆向的补充，因为物体本身依然保持充盈，这种补充使得固体中的原子的排列和位置长久地保持着。”诚然，我们不能说伊壁鸠鲁的连续不断的流就是现代物理学中的电磁波，再说，伊壁鸠鲁所说的“长久地保持着”是原子的排列和位置，而不是原子的内部运动。但有一点是肯定的：伊壁鸠鲁用“逆向的补充”来消除“从物的表面放出一股连续不断的流”与“物体本身依然保持充盈”之间的矛盾，这一基本思路和我们是一致的。谁也不会否认大量原子组成的物质处于平衡状态时，其发射与吸收必须达到平衡。但玻尔之所以断言原子世界有特殊规律，则是因为他没有认识到单个原子处于平衡状态时，其发射与吸收也必须达到平衡。

综上所述，卢瑟福模型与经典物理学确实有矛盾，但与卢瑟福模型相矛盾的不是经典物理学的基本原理，而是经典物理学中的某些个别的错误结论。因此，如果把经典物理学理解为其基本原理与其正确的推论，则卢瑟福模型正是经典物理学中的典型的“电动力学的物体”，而波尔理论则是经典物理学的一个组成部分。

Atom model and Classical Physics

Abstract: It is proved that classical physics is suitable for Rutherford model. According to classical physics, in Rutherford model, an electron motion satisfies Maxwell equation, as for which a special solution of this equation is suitable, classical physics had no provisions. This answer can only be given based on experimental facts. Since the state of the atom has proved enduring. The problem of the applicability of Maxwell equation for Rutherford model comes down to that: “whether or not the wave equation applied to

Rutherford model have a particular solution, making the enduring state of the atom." The arithmetic mean of the postponing solution and leading solution is also a solution of the wave equation. This solution describes the following process: an electron rotating around the nuclear both emits and absorbs, the emission and absorption balance, forming a standing wave. This particular solution is in line with the fact of atomic enduring. As a result, the Bohr thesis that there are special laws in atom world is not established.

Keywords: Rutherford model; Bohr thesis; classical physical; Newtonian mechanics; electrodynamics; electron school; Lorentz problem; electromagnetic irreversibility; wave equation; postponing solution and leading solution

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Attitudes Towards English Among Bangladeshi Students: College Level Education

Nitish Kumar Mondal

English Discipline, Khulna University, Khulna-9208, Bangladesh
nitish.english@yahoo.com

Abstract: There is a continuing debate on the status and use of English in Bangladesh. Historically, English experienced rise and fall of its status and importance here. This is because of the change of attitudes towards the language in the passage of time. Thus, the researcher found it relevant to profile Bangladeshi college level students' contemporary attitude towards English. The purpose of this study was to investigate Bangladeshi college level students' attitudes towards English since this group of people is considered an important source of human capital in the development of the nation. Data for this study was collected through a questionnaire survey administered upon a sample of college level students and analyzed them quantitatively. The findings revealed that the respondents showed positive attitudes towards English. They also felt that Bangladeshi variety of English should be standardized.
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Keywords: Attitudes; English; Bangladeshi student; College; Education.

1. Introduction

The issue of English language learning is a very important phenomenon for the Bangladeshi students like non natives (Whose native language is not English) where the students of higher secondary level education in Bangladesh is not far from that purposes. Though English language is taught in the different stages (From the primary level to tertiary level education) of the educational institution in Bangladesh for different purposes, the students of Bangladesh especially at higher secondary level students can not reach their goal. So, there has been a mismatch between English language learning and the students of Bangladesh. But what constrains the mismatch of English language learning? A host of variables come into play an important role in determining the issue, which may vary from one context to another. It may be difficult to make a complete list of the variables, however, some of them are luck of proficiency of the teacher, attitudes of the students, socio-cultural background, and in particular, language learning (As it is not mother language) policy itself.

No doubt Bangladesh is a multilingual as well as multicultural country. But it is expected that students in Bangladesh from primary level to tertiary level will learn English language equally in different domains for different purposes. What are the authentic problems in English language learning of the Bangladeshi students that constitute the main objective of this paper.

2. Background of the study

The history of English may be divided into three periods: Old English from about 700 to 1100 AD, Middle English from 1100 to 1500 AD, and Modern English from 1500 to the present (Thirumalai, 2002). Though the history of English is back dated, it is introduced in the Indian subcontinent long time after which became the dominant language of communication among the educated classes after the famous Minute of Lord Macaulay in 1833. English is an international language, spoken in many countries both as a native and as a second or foreign language. It is taught in the primary level to tertiary level educational institutions in almost every country on this earth. It is a living and vibrant language spoken by over 300 million people as their native language. Millions more speak it as an additional language. There can be no denying the fact that English is learned everywhere, where Bangladesh is not beyond of them, because people have found out that knowledge of English is a passport for better career, better pay, advanced knowledge, and for communication with the entire world. English is also learned for the literature it possesses, and for the variety and rich experience it provides. In this computer age, English is bound to expand its domains of use everywhere. Everyone wants to appropriate English as their own. Where in Bangladesh, On 19 January 1989, English language was introduced as a compulsory language from primary level education to college level education with students having to qualify in both English and Bengali in the board examinations. Moreover, at the tertiary level, in addition to the regular courses,

English language was introduced as a compulsory subject in many disciplines.

3. Literature Review

Language attitude is very much important for learning and teaching in any language for any country. Many studies are available that conducted investigation into the issue of language and attitude. Hogan-Brun and Ramoniene (2005) showed that the state's inclusive language and citizenship policies in Lithuania have led to the consolidation of society which has positively affected attitudes amongst the minority communities to learn the state language and to integrate. Another study of the same authors (2004) also suggested that in their pragmatic attitude, the parents perceive integrative learning as being of instrumental value and favour their children's accommodation to the majority society as a necessary process for success in life in today's changed environment.

Lanara (1999), similarly, in a study of 90 first-year English major university students, found that there was a negative response to their high school English language classes. Students expressed the view that they had not learned anything of value in high school due to poor teaching methods, which were characterized by monotonous grammar-translation drill practice.

Christensen (1989) reinforced these findings in her study of first year university students, with many subjects indicating they had a negative impression of high school English classes. When questioned regarding weak aspects of high school English, grammar was the most frequently mentioned. Students pointed out that little time was allocated to spoken English, with heavy stress being placed instead on university entrance examination preparation.

Al-Abed Al-Haq (2000) conducted a study to investigate changes in the attitudes of Jordanian university students to the Hebrew language. He found that motivation towards learning Hebrew among the Jordanian university students is apparently instrumentally-oriented, i.e. they are religiously and nationally motivated.

Hohenthal (2003) also found similar result in her study. She identified that attitude to English in India is instrumental: English is perceived as a useful language to know mostly because of job opportunities and for education.

Ting (2003) showed that in Sarawak of Malaysia, while people were already embracing Bahasa Malaysia as official language, they still held on to the previous role of English as an official language. Where wider communication was concerned, the usefulness of English as a common language was clear but other languages were also important. The participants' favourable attitudes to the sharing of language function between Bahasa Malaysia and English indicates that they would still like English to perform the functions officially designated for Bahasa Malaysia.

When we understand that attitude plays a very important role in the life of a language, determinants of attitude to a language are important in the discussion of language and attitude.

There are a number of factors that may be influential in construction and change of attitude to a language. No model or even a list of factors that make up attitude to a language has been drawn up. However, based on the previous studies on attitudes towards language this study considers Bangladeshi college level students' attitude towards English. Gender was found to play significant role in constructing attitude to Welsh. W. R. Jones (1949, 1950), Sharp et al. (1973) and E.P. Jones (1982) all found that girls had more favourable attitudes to Welsh than boys. Like gender, language background also affects language attitude. Sharp et al. (1973) found that the higher the number of Welsh speakers in a neighbourhood, the more favourable the attitude. Effect of proficiency on language attitude has also been studied extensively.

Hakuta (1991) investigated the relationships of language choice, proficiency and attitude in a Puerto Rican bilingual education programme in New Haven, Connecticut. She reported that language shift in the Hispanic communities in the United States is usually characterized by a combination of processes related to proficiency, choice and attitude. Similarly, influences of ethnicity on attitudes was found in a number of study (e.g. Ferrer and Sankoff, 2003; Sayahi, 2005). With reference to influence of ethnicity on attitudes it is stated that people show their preference to languages through the exercise of maintaining, shifting, or switching among languages which can be attributed no less to the ethnic configuration of attitudes towards language use.

4. Research Questions

The study put forward the following specific research questions:

(1) What are the Bangladeshi college level students' attitudes towards English?

(2) What are their perceptions regarding the Bangladeshi variety of English?

(3) What are the effects of class distinction (From Primary to Tertiary level education) and proficiency on their attitudes towards English?

5. Significance of the study

This study has great importance for both the teachers and students in general and for higher secondary (College) level educational system in particular, as this study has collected a lot of information about the attitudes towards English of the college level students, the effectiveness and appropriateness of the English (Specially which is used in their class) will help the various learners learning second language (English is specified here) through their mother tongue transparently. Furthermore, this present study will guide the English teachers in exploring proper way of teaching and learning English which their students demand. The significance of the study will also be for the planners and education managers in policy formulation or revision of teacher education programs at secondary and higher secondary level in the country. It will also help the teachers gaining perfect knowledge about their students both in school level students and college level students where the college level students are more significantly adopted and involved especially at higher secondary level education in Bangladesh.

6. Definition of Attitudes

The term 'attitudes' as defined by Sarnoff (1970), deals with a disposition to react favourably or unfavourably to a class of objects. Eagly and Chaiken (1989) expand on this idea by stating that attitude is an outcome of the categorization process, this process being influenced by the social environment. Attitudes can be classed as items of social knowledge that are continually formed, strengthened and modified. They can therefore be defined as mediated reactions that have been strongly influenced by social context (Long & Russell, 1999). Attitudes are a means of adjusting to and making changes in one's social environment.

Baker (1988) outlines the main features as:

1. Attitudes are cognitive and affective.
2. Attitudes are dimensional, in that they vary in degree of favourability / unfavourability.
3. Attitudes incline a person to act in a certain way.
4. Attitudes are learnt.
5. Attitudes often persist, however they can be modified by experience.

7. Nature of Language Attitude

Language attitude varies in nature. People show attitudes of different nature such as attitude to the variation of language; attitude to minority language and dominant language; attitude to foreign and second language; attitude to a specific language etc. Whatever the nature of attitude, it has two components: instrumental and integrative (Baker, 1992). Instrumental attitude refers to showing attitude to a particular language for self-achievement and recognition. People favour a particular language when they find that the language is a tool to achieve high status, economic advantage, basic security and survival and matters related to self-orientation. Integrative attitude, on the other hand, concerns someone's attachment with a particular speech community. People show such attitude in order to be identified as a member of the desired community. However, instrumental and integrative orientation to language attitude are not necessarily opposite and alternatives rather complementary to each other.

A person may be motivated in different strengths by both orientations (Baker, 1992). The present study assumes that attitude of the students (College level) in Bangladesh towards English is instrumental in orientation. It expects that people in Bangladesh show favourable attitude to English and learn and use it for individual development and survival in this era of globalization. This study, thus, aims to investigate attitudes towards English among Bangladeshi college level students.

8. Overview of English in Bangladesh

Though English language is taught in the different stages of the educational institutions in Bangladesh for different purposes, the role of English in Bangladesh is purely functional as English is used as an international link language where this "English language is introduced through different methods like Grammar-Translation (First introduced in Germany especially in Prussia, But this method was immigrated for teaching language in Bangladesh during colonial period which is being used till today.), Direct method (alternatively called "The Natural Method. This method was introduced in Bangladesh by the hands of the Ministry of Education), Audio-lingual (It was originated in America at the time of World War II), Natural Approach and Communicative Language Teaching (CLT). Though this CLT method was started in England in the early 19th century but it was introduced for teaching English at secondary education in Bangladesh in 2001 and is being continued till today" (Mondal, 2012). It is true that a number of methods have been used for learning and teaching English in Bangladesh but Grammar-Translation method and Communicative Language Teaching are used in Bangladesh alike where CLT gains more application for Bangladeshi context (Mondal 2011). English language is not used as an interpersonal and inter-institutional communication in Bangladesh. But

English has been used for years and for different purposes and gradually it is becoming part of the socio-cultural system. As the use of English language is increasing day by day in different forms, there is significant evidence of use of English along with Bengali. As Bangladesh after birth as an independent country, has evaluated 'Bengali more everywhere' the learning of English language affected and limited more naturally. Though English language was introduced as a compulsory language from primary level education to college level education with students having to qualify in both English and Bengali in the board examinations in Bangladesh alike, because of faulty language policies since 1972, English was set back and English language education suffered tremendously, leaving a vacuum which is yet to be filled. Interestingly, instead of having different political ideologies on the concept of nationalism, all the leaders of subsequent governments of the country, since independence, stress on shedding the so-called dominance of 'imperial English', and assigning new roles to Mother Tongue (Bengali) in public life. But English has continued to be an important part of the communication system, especially of urban educated Bangladeshis. While the government continually tried to establish Bengali everywhere, the space and the role of English, though not defined, could not be ignored due to strong presence of English as the language of international correspondence.

9. Methodology

The methodology of this research describes the location of the study followed by sampling procedures employed in the study, a profile of the informants, and method of data collection, instrumentation, data collection procedures and data analysis procedures.

10. Location and informants of the study:

This research examined Bangladeshi higher secondary (college) level students' attitude towards English language learning and teaching. The students (As samples) were a number of colleges of south-western part of the country like both colleges (urban and rural) in Khulna, Satkhira and Bagerhat districts. The informants were first year, second year and third year college students. The research had been implemented taking both male and female informants. In the present research, the informants were not taken equally, rather taken randomly.

11. Sampling and instrumentation procedures:

The population of this research was college students. A total of eighty seven college students were selected as the sample for this research. The respondents were from the different colleges in three districts. The sample was selected through a random sampling method. A total of eighty seven college students were selected as respondents to whom the questionnaire was administered to collected data for this research. This research is descriptive and non-experimental. The research was based on primary data. The data were collected via the survey approach through a self- administrated questionnaire. The questionnaire survey method was preferred because the researcher investigated informant's attitude and use of English language in their class room and out of their class room at higher secondary education. This method was chosen because (i) this method is suitable for empirical research; (ii) the data collected through this method is easily quantifiable; (iii) this method gives informants enough time to provide well thought out answers; (iv) this offers grater anonymity to the informants; and (v) this requires low cost and saves time. The questionnaire was prepared by researcher in connection the research demands where the total questionnaire was prepared through English language. In preparing the questionnaire, caution was exercised to ensure the standard and quality of the questions. The researcher was concerned about the validity, reliability, clarity, practicality, administerability of the instruments. A pilot survey was conducted to study the feasibility of the instruments. The feed back from this pilot survey on the appropriateness of the questionnaire was then incorporated into the questionnaire and approved of administration.

12. Data collection procedures:

Quantitative method was used to collect the data. The data was collected through a survey in the form of a questionnaire. The questionnaires were administrated by the researcher himself. The questionnaires were distributed to the college students and requested them to return the completed questionnaires after answering. Upon completion of the correction of data, the data was edited, coded classified and tabulated for computation and analysis. The analysis was done using SPSS (statistical package for social sciences) software. This software was used to examine and investigate about teachers' choice of answer through which the percentage values were obtained.

13. Data Analysis

Data collected were tabulated, analyzed and interpreted and presented in Figure 1. Percentage was calculated by using statistical technique for analysis.

The short terms which are used in the chart are described below:

SA = Strongly Agreed
A = Agreed
UNC = Uncertain
DA = Disagreed
SDA = Strongly Disagreed

Figure 1

Questions	SA	A	U	D	SD
1. Do you think your current text book of English is apt?	9 10.3 %	15 17.2 %	13 14.9 %	33 37.9 %	17 19.5 %
2. Should your English book be changed?	10 11.5 %	31 35.6 %	14 16%	11 12.6 %	21 24.1 %
3. Is grammar-translation method apt for learning English?*	48 55.1 %	23 26.4 %	9 10.3 %	5 5.75 %	2 2.3%
4. Is communicative language teaching apt for English learning?*	41 47.1 %	21 24.1 %	10 11.5 %	9 10.3 %	6 6.9%
5. Is reading helpful for English learning?*	34 39.1 %	26 29.9 %	4 4.6%	17 19.5 %	6 6.9%
6. Is speaking helpful for English learning?*	31 35.6 %	21 24.1 %	5 5.75 %	13 14.9 %	17 19.5 %
7. Is writing helpful for English learning?	11 12.6 %	9 10.3 %	7 8.0%	31 35.6 %	29 33.3 %
8. Is listening helpful for learning English?	43 49.4 %	23 26.4 %	2 2.3%	13 14.9 %	6 6.9%
9. Is English newspaper helpful for this?*	41 47.1 %	22 25.3 %	4 4.6%	7 8.0%	13 14.9 %
10. Is English movie needed for learning English?*	38 43.7 %	31 35.6 %	3 3.4%	9 10.3 %	6 6.9%

Frequency and Percentage of Participants' Opinions toward the English (N = 87)

14. Findings

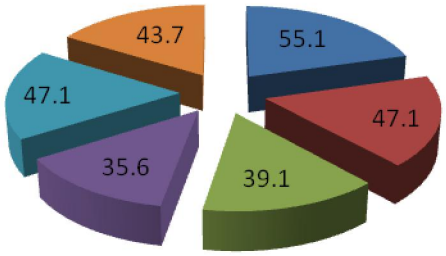
Following findings were drawn on the basis of question analysis of the questionnaire:

1. Majority of 37.9 % respondents disagreed with the statement that their current text book of English is apt used in teaching English at the Higher Secondary education in Bangladesh which has been expressed through their agreement with the statement.
2. Majority of 35.6% respondents agreed with the statement that their text book should be changed which has been expressed through their strong agreement with the statement.
3. Majority of 55.1% respondents strongly agreed with the statement that grammar-translation method is essential for learning English which has been expressed through their strong agreement with the statement.
4. Majority of 47.1% respondents strongly agreed with the statement that communicative language teaching is helpful for learning English which has been expressed through their strong agreement with the statement.
5. Majority of 39.1% respondents strongly agreed with the statement that reading is helpful for learning English which has been expressed through their statement.
6. Majority of 35.6% respondents strongly agreed with the statement that speaking is helpful for learning English which has been expressed through their strongly agreement with the statement.
7. Majority of 33.3% respondents strongly disagreed with the statement that writing is helpful for learning English at the Higher Secondary education which has been expressed through their strongly disagreement with the statement.
8. Majority of 49.4% respondents strongly agreed with the statement that listening is helpful for learning English at the Higher Secondary education which has been expressed through their strong agreement with the statement.
9. Majority of 47.1% respondents strongly agreed with the statement that English newspaper is helpful for learning English which has been expressed through their strong disagreement with the statement.
10. Majority of 43.7% respondents strongly agreed with the statement that English movie is helpful for learning English which has been expressed through their strong agreement with the statement.

15. Results and Discussions:

The result is drawn up through data analysis and findings of the research. When designing the attitudes of the college level students towards English, the present research could address the focal evaluation questions, so it designed corresponding questions to obtain information about that theme desired. The questions the study implemented were highly structured and the students' answers and responses to the questions helped to continue the research effectively. When analyzing the data, it also obtained a clearer picture of the implementation status of the current research.

On the basis of the results and discussions (where ten questions are structured) a pie chart can be drawn in the following way through taking the highest percentages of star (*) marked questions-



16. Conclusion

Though English is not the official language of Bangladesh, it is used in every purposes of life of Bangladeshi people from the primary education to tertiary level education where college level students play a vital role. Bangladeshi students learn English from different sources. As they learn English from different sources, their attitudes are not the same towards English language.

Majority of the respondents realized the necessity of learning English in this era of globalization and they reported their strong positive attitude towards English. They were of the opinion that those who speak English create good impression and get advantages in seeking good jobs. They felt that their current text book of English is not appropriate and it should be changed partially for learning English well. They also felt that English language teaching methods like grammar-translation and communicative language teaching should be used at college level education in Bangladesh. Side by side four skills like reading, writing, speaking and listening are more helpful for this purpose. As a whole they wanted an increase use of English in education where English newspaper and English movie play a vital role for learning English at this stage.

The findings indicate that respondents were found to be loyal to their own language at one hand; on the other hand they showed the positive attitudes towards English. This could be attributed to the fact that respondents were instrumentally motivated.

Their motivation is so positive that a sizeable majority of the respondents desired standardization of the Bangladeshi variety of English. It indicates that the college level students of Bangladesh want to increase their linguistic repertoire adding English to the list of commonly used languages in Bangladesh.

Though respondents have no high proficiency in English showed more preference for English, in fact a positive attitude towards English as a whole was found among the respondents irrespective of grammar-translation method and communicative systems. Findings of this study can be concluded saying that when a number of methods of English are used for learning English and different varieties are shown for learning English, then the college students (Respondents) showed positive attitudes towards English declaring their views and opinions of English, the respondents of this study felt and desired an increase use of English in different domains of life which marks their positive attitudes towards English.

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Corresponding Author:
Nitish Kumar Mondal
English Discipline
Khulna University
Khulna-9208, Bangladesh.
E-mail: nitish.english@yahoo.com

References

1. Al-Abed Al-Haq, F. Changes in the attitudes of Jordanian university students to the Hebrew language. Journal of Sociolinguistics 2000; 4(2):263-273.
2. Baker, C. Key issues in bilingualism and bilingual education. Clevedon, Avon: Multilingual Matters 1988.
3. Baker, C. Attitudes and Language. Clevedon: Multilingual Matters Ltd 1992.
4. Christensen, T. Survey of student perceptions of changes between English teaching in high school and in college in large classrooms in Japan. Journal of Hokusei Gakuen Women's Junior College 1989; 26: 1-13.
5. Eagly, A. & Chaiken, S. The psychology of attitudes. Fort Worth: Harcourt Brace 1989.
6. Ferrer, R. C. and Sankoff, D. Identity as the Primary Determinant of Language Choice in Valencia. Journal of Sociolinguistics 2003; 7 (1): 50-64.

7. Hakuta, K.. Distinguishing Between Proficiency, Choice, and Attitudes in Questions about Language for Bilinguals. (SCCR Working Papers Series, No. 32). Stanford: Stanford University 1991.
8. Hogan-Brun, G., and Romoniene, M. Perspectives on Language Attitudes and Use in Lithuania's Multilingual Setting. Journal of Multilingual and Multicultural Development 2005; 26 (5): 425-441.
9. Changing Levels of Bilingualism across the Baltic. The International Journal of Bilingual Education and Bilingualism 2004; 7 (1): 62-77.
10. Hohenthal, A. English in India: Loyalty and Attitudes. Language in India, Vol. 3, May 2003. http://www.languageinindia.com Accessed on 5th January 2012.
11. Jones, W. R. Attitude towards Welsh as a second language. A preliminary investigation. British Journal of Educational Psychology 1949; 20 (2): 44-52.
12. Attitude towards Welsh as a second language. A further investigation. British Journal of Educational Psychology 1950; 20 (2): 117-32.
13. Lanara, S. Attitudes and motivation of Japanese students studying English at Asia university 1999; Retrieved January 05, 2012 from http://www.asia-u.ac.jp/english/cele/articles/Lanara_Attitudes&Motivation.htm
14. Long, R.W., & Russell, G. Looking back: Student attitudes change over an academic year. The Language Teacher 1999; 23(10): 17-27.
15. Mondal, N. K. Evaluation of English Language Teaching Methods Used in Higher Secondary Education in Bangladesh. Language in India 2011; Vol.11, No.12: 181-197 (ISSN: 1930-2940). Retrieved January 05, 2012 from http: www.languageinindia.com
16. Mondal, N. K. Assessment of English Teaching Methodologies at Secondary Level in Bangladesh. Language in India 2012; Vol.12, No.1: 310-327 (ISSN: 1930-2940). Retrieved January 15, 2012 from http: www.languageinindia.com
17. Sarnoff, I. Social attitudes and the resolution of motivational conflict. In M. Jahoda & N. Warren (Eds.), Attitudes (pp. 271-282). Harmondsworth: Penguin 1970.
18. Sharp, D., Thomas, B., Price, E., Francis, G., and Davies, I. Attitudes to Welsh and English in the Schools of Wales. Basingstoke/ Cardiff: Macmillan/ University of Wales Press 1973.
19. Sayahi, L. Language and Identity among Speakers of Spanish in Northern Morocco: Between Ethnolinguistic Vitality and Acculturation. Journal of Sociolinguistics 2005; 9 (1): 95-107.
20. Ting, S-H. Impact of Language Planning on Language Attitudes: A Case Study in Sarawak. Journal of Multilingual and Multicultural Development 2003; 24 (3): 195-210.
21. Thirumalai, M. S. An Introduction to TESOL Teaching English to Speakers of Other Languages. Language in India 2002; Vol.2, No.2. (ISSN: 1930-2940). Retrieved January 05, 2012 from http: www.languageinindia.com.

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评生命智因学与外星人

旗晨峰

Recommended by 王德奎 y-tx@163.com

Abstract: 生命智力智因与外星人风暴王红旗先生编辑的《重构人类知识体系》一书，解释“重构”是指万事万物的变化。而重构论或“重构学”是指研究万事万物变化，且注重实施者对万事万物的重新构造、重新建构的知识学问和科学体系。凡是发生重构的地方，一定会有相应的实施者。实施者可划分为三种情况：物质结构的自然变化，其实施者是万有智力；生命结构的变化，其实施者是生命智力；万事万物的人为变化，其实施者是人的大脑思维生命智力系统。

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Keywords: 生命智力; 智因; 外星人; 重构; 大脑思维

一、生命智力智因与外星人风暴王红旗先生编辑的《重构人类知识体系》一书，解释“重构”是指万事万物的变化。而重构论或“重构学”是指研究万事万物变化，且注重实施者对万事万物的重新构造、重新建构的知识学问和科学体系。王红旗先生本身就是一个“重构主义”者，甚至达到编辑《重构（王红旗）文集》的热忱。而“重构论”2012年的进展，是“搜寻地外智慧生命”的人认为：“外星人或许已经进化到和自然融合为一体难以发现”，这成为王红旗先生批判达尔文，重构“生命智因学”以来的最大突破。这是加拿大科幻作家卡尔·施罗德（Karl Schroeder）提出了一种全新的观点，试图解决天文观测与费米佯谬之间的矛盾，他说：“任何足够先进的技术都与自然无异”。 这种人类历史背后的发展动力与天道运化规律是怎么一回事呢？因为王红旗是和施罗德各自一方在独立研究，所以请看王红旗先生是怎样推出“生命智因学”的？

重构（王红旗）先生说：凡是发生重构的地方，一定会有相应的实施者。实施者可划分为三种情况：物质结构的自然变化，其实施者是万有智力；生命结构的变化，其实施者是生命智力；万事万物的人为变化，其实施者是人的大脑思维生命智力系统。所谓“重构”， 一般主要是指人的大脑思维生命智力系统，对万事万物进行的重新构造或重新建构。所以“重构”者可以重构“思维重构宇宙”、“信息重构宇宙”、“大脑重构宇宙”、“智脑重构宇宙”。即用不着像达尔文那么辛苦，去作两年多的巡洋考察才创建的“进化论”。 重构先生根据生命智力学暨智因进化论，指出“生命与生命智力同时起源、同步进化，生命与非生命的分水岭在于生命拥有生命智力；生命智力的实质是使用间接信息达成期望效应。

“所有的生命都拥有生命智力，不同的生命拥有不同结构、不同形式和不同层次的生命智力，生物进化的实质是生命智力主导实施的生存方式多样化和生存技术复杂化，以及生命智力系统自身的不断发展。

“地球上的生命具有多种形式、多种层次的生命智力或生命智力系统，它们主要有DNA生命智力系统、细胞膜生命智力系统、单细胞生命智力系统、细胞膜网络生命智力系统、神经元细胞生命智力系统、大脑思维细胞生命智力系统，以及生命智力巨系统等等。其中，DNA生命智力系统主要由基因和智因组成，智因即正在形成过程中的新基因。所有的生命智力系统都是运行在相应的生命体物质结构之上的，‘我’就是生命智力系统的自觉，‘灵魂’属于高级层次的生命智力”。这且不是对施罗德的“任何足够先进的技术都与自然无异”定律的精辟的解读：外星人与地球人已融合为一体吗？王红旗先生说，他根据生命智力学暨智因进化论的基本原理，还可以得到30余项重要的推论。王红旗先生甚至说：“如果说相对论是对牛顿古典力学的超越，那么生命智力学暨智因进化论则是对达尔文古典随机进化论的超越”。

令人饶有兴趣的是，生命智力学能否有智因进化不升反降的情况呢？因为王红旗先生说，生命智力学暨智因进化论的重要推论之一是“生命智力的发展是无止境的”。在《超越谷歌-全球网脑新商机》（高路，中国经济出版社2010年）一书中，还有高路和他的团队阐述致力于通过技术实现智能搜索引擎、互联网操作系统WebOS和全球智慧网脑的匹配，以实现“所见即所需，所得即所需”的工作。重构论的实施者是否会产生重构“头脑风暴”，已经引起社会的关注。因为据2012年2月9日新华社发表黄敏先生的文章介绍，美国弗吉尼亚理工大学卡里莱昂研究所里德·蒙塔古教授带领的研究小组，负责的一项研究证实：开会或许使人智商降低。蒙塔古教授的研究方法是，从两所大学征募70名志愿者，

先让他们参与智商测试。大家的平均智商大约126。随后按照测试成绩，将志愿者分成5组，进行第二次智商测试。测试时，志愿者每完成一道题，研究人员便向其反馈他（她）在小组中得分排名。结果，尽管每组志愿者第一次智商测试成绩相当，第二次测试时多人成绩显著下降。第二次测试时，研究人员从每组随机抽取2人，借助功能性磁共振成像技术扫描他们的大脑。 蒙塔古教授小组的成员肯尼思·岸田称：当被告知自己在小组中得分排名时，志愿者大脑多个区域变得活跃，尤其是杏仁核、前额叶皮质层和伏隔核区域，它们关乎情感处理、问题解决以及奖赏和愉悦。这在某种程度上显示，身处团队环境影响智力表现。原因或在于“头脑风暴”、劳资谈判等小组会议，可能令与会者急于表现良好，将部分脑力“转移”至维持在团队中的社会地位。所以“头脑风暴”反而令大脑“死机”，使智力表现显著下降。可见用重构“头脑风暴”本身，就可以检验生命智力或智因有没有智力或智因。

据王红旗透露，重构“头脑风暴”使智慧网脑公司联合创始人高路写信给他，要求与他合作，希望向他学习。从而促进全球智慧网脑的量子跃迁，与星际意识谐振对接。这不是类似地球人与外星人融为一体的冲刺吗？王红旗和高路先生说，这确实是将传统以人为中心的社会学观，提升为宇宙生命整体进化的层面，以此来指导互联网进化论和未来的互联网产品设计。

王红旗、高路和施罗德等先生是一个意思：人类生命智力将无法判断，这种超级智力系统究竟是生命智力系统还是超自然智力系统？即类似说，人们不知王红旗和高路先生，是纯地球人还是地球人与外星人融为一体难以区分的“重构人”？重构（王红旗）先生已出版《生命智力学》等专著说：“人类的生命智力已经非常发达，如果不能正确使用，将对自身和全球造成不可挽回的灾难”。“生命智力学的创建问世，标志着达尔文古典随机进化论霸主地位的终结”。 二、什么叫生命智力或智因？关于生命智力或智因，我们不谈“思维重构宇宙”、“信息重构宇宙”、“大脑重构宇宙”、“智脑重构宇宙”。数学已是地球人公认的一种“智慧”。据张奠宙、王善平著，南开大学出版社2011年出版的《陈省身传》说：“数学的精神，自从发皇于古希腊，古今一贯，从未中绝，一切的现代学问中，最能守持古典精神的，仍是数学”。《陈省身传》说：数学精神的源头在古希腊哲人那里。菲尔茨奖没有奖金，只有奖章，但它是数学界的最高荣誉，奖章上刻着的是古希腊阿基米德的头像。数学有“经典的”与“现代的”之分。发思古幽情的现代人，往往喜欢“经典的”东西，不喜欢“现代的”东西，文章、艺术、建筑，无不是古胜于今。数学不同，数学显然是“现代的”胜于“经典的”，现代数学把经典数学吃进去了，消化掉了，几乎没有排出什么“糟粕”；经典的数学优美，现代的数学除了优美，更有壮美。如俄罗斯人佩雷尔曼。佩氏在本世纪初成功证明了庞加莱猜想，这是克莱研究所公布的新千禧年七大数学难题的第一题。2006年国际数学联盟给佩雷尔曼菲尔茨奖，他没有要；2011年克莱研究所给他百万美元奖金，他也没有要。他说：“如果我的证明是正确的，就不需要任何其他形式的肯定。”佩雷尔曼也许是截断众流的孤傲，陈省身则精神内守，而又随波逐浪，佩氏大推开，陈氏大洒脱，二者皆好。但陈省身更为圆熟，因为佩雷尔曼毕竟不是中国人。陈省身经常说：“为了个人名利，数学不是一条坦途。”人说政治是屁股指挥脑袋，我说数学能脑袋端正屁股。“追求知识”的题中应有之义，是知识不能被占有，所以没有“智者”；如果知识比作财富，“智者”就是大富翁，然而知识不是财富。追求知识的前提是“知其不知”，所以真正的知识必然是“无知之知”。关于“外星人”知识就是一个从“无知”到有知的“无知之知”，但这个过程是有主持活动系统的公开过程，而不类似“水变油”许驭定理的是“保密” 活动过程。据国外媒体报道，对于外星文明的搜寻工作一直以来受到一个非常著名的观点的困扰，这就是“费米佯谬”：外星人在哪儿呢？宇宙这么大，如果只有我们，那是不是太浪费地方了？那么回到我们的原点：既然宇宙中还存在着其他的生命，那么它们在哪儿呢？于是费米通过计算，假设银河系中果真存在外星智慧生命，考虑到银河系古老的年龄以及其它因素，它们应当早已经造访地球了。但事实是我们的“大寂静”宇宙一片安宁，无声无息。这样的矛盾构成了现代天文学上的最大挑战之一。哈佛大学的天文学家霍华德·史密斯认为，我们在宇宙中是独一无二的。而更多的专家倾向于赞同西斯·肖斯塔克的观点：“如果最终证实宇宙中真的没有其它高级生命的话，那将是个奇迹。”所以要进行“寻找地外智慧生命” 计划的活动项目。这个项目认为，或许有朝一日会截获一条光谱信号，显示外星生命正将他们的核裂变废料倾倒进恒星之中，或者我们会探测到他们的核聚变反应堆泄漏出的氚的信号。但如果这些外星技术文明可能已经实现了“绿色化”，即达成了与自然界的平衡态。尽管我们缺乏直接观测证据，也没有探测到所谓泄漏出来的无线电信号，但我们的周围却有可能正被先进的技术文明所包围，这些技术文明巧妙地和星系背景融为一体。或许在宇宙中，只有那些最终达成了生态平衡的技术文明才可以长久地存在下去。但反过来，费米佯谬又是：如果外星智慧生命，或许已经由于自己的原因导致了毁灭。这些原因可能包括核战争，生物恐怖主义或者失控的纳米技术。然而即便如此，他

们的一部分技术成果应该还会保存下来。这当然不是类似重构（王红旗）先生的生命智力学或生命智因进化论说的：实施者是指人的大脑思维生命智力系统，对万事万物进行的重新构造或重新建构。而是如达尔文亲自科考类似的现实活动。例如，即便有朝一日，人类作为一个种族彻底灭亡，我们至少还有两颗美国宇航局的先驱者号探测器（先驱者10号和11号），两颗旅行者号探测器（旅行者-1号和2号）以及目前正飞往冥王星等5个人工设备，游荡在星系之中，述说着曾经的人类文明的故事。这不是科幻，也不是仅是大脑的思维。先驱者号飞船上携带的铭牌，旅行者号上携带的金质唱片，是地球人实实在在活动的直立智慧生命的证明。即便这些只是类似无人飞船。即便这些飞船的复制过程是完美的，它们的内部内置有一个电路算法程序，可以约束飞船不至于永远不停地复制自己。即便按照这种逻辑，反过来应当已经有大量的机器“外星人”造访过我们太阳系。应当散布着无数的这种无人飞船类似机器的探测器。并且很显然，地球当然会引起对方的极大兴趣。但即便如此，如果哪一天，我们真的发现了这样的一个机器探测器，那也一点不让人吃惊，反而要是最终没有发现这样的探测器，那才会让人意外。因为如果这些机器探测器都是以“绿色”技术制造的，那样的话，想要找到它们，真的就像是大海捞针，因为它们将会和太阳系的自然背景完美地融为一体。即如果真有王红旗、高路等先生说的生命智力学或生命智因进化论、全球智慧网脑与星际意识谐振对接器，那也类似是和外星人“绿色”技术制造的自然背景，完美地融为一体的。即类似英国作家亚瑟·克拉克说的那句名言：“任何足够先进的技术都与魔法无异。”或者类似许驭定理说的：“在任何国家，无论国家拨款的原始创新，还是民间自发自费的千辛万苦原始创新，一旦事关国家兴衰成败，都会被列为国家级保密项目；自觉遵守国家保密法规并作出了重大贡献，国家绝对不会亏待个人；相反，如果在一定时期不谨慎造成泄密，除了给国家造成损失，个人的人身安全也无法得到保障”。

王红旗、高路和许驭等先生的这类智因，是不等同于施罗德解决天文观测与费米佯谬之间存在矛盾的智因。科幻作家卡尔·施罗德的意思是，如果这些外星人先进的技术文明，已经实现了乌托邦式的社会，那么他们不会产生任何我们可以探测到的废弃物。他们已经实现了“绿色科技”，因此他们可以彻底“融入”星系之中。也因此他们和自然界本身已经无法区分开来。这也就意味着：缺乏对于外星文明存在的直接观测证据，恰恰就是外星智慧文明存在的一个令人信服的证据。 三、如何保护真实的生命智力或智因从以上看来，首先是要分清什么是真实的生命智力或智因。这虽然很难，但也有一个简单的办法，因为我们中华民族已经是世界上最有智慧的民族之一，中国传统有两类智慧：第一类战略是说对方错了，另立方法竞争；第二类战略是“田忌与齐王赛马”，相同方法竞争。而所谓“田忌与齐王赛马”战略的智慧类似说，第一阶段，我国是以自己的“科学下等马”对西方的“科学上等马”；第二阶段，以我国的“科学上等马”对西方的“科学中等马”；第三阶段才是以我国的“科学中等马”对西方的“科学下等马”。总的比赛下来，田忌是2：1胜过齐王。由此来分生命智力或智因，也就是两种，即第一种类似是说对方错了，另立方法竞争；第二种类似是“田忌与齐王赛马”，相同方法竞争。王红旗先生说他的“生命智力学的创建问世，标志着达尔文古典随机进化论霸主地位的终结”。这显然是推证不出来的。因为王红旗先生用的是属于中国人的第一种智慧：说对方错了，另立方法竞争。即王红旗先生是说达尔文错了，他是另立方法----重构生命智力学或生命智因学，进行竞争。这样我们不是说王红旗先生错了，而是说王红旗先生任重道远，还需努力。因为这是一种平行的竞争。公认达尔文生物进化论的人还不少。 其次，王红旗先生推证达尔文错了，用的是类似三段论，是用“如果说相对论是对牛顿古典力学的超越”，那么生命智力学暨智因进化论则是对达尔文古典随机进化论的超越。而爱因斯坦的相对论与牛顿的古典力学的竞争，恰巧用的是类似我国的第二种智力或智因：相同方法竞争。这是有彭罗斯证明的。即类似爱因斯坦用他的“下等马”韦尔张量，对牛顿的“上等马”韦尔张量，爱因斯坦是赢不了牛顿。但爱因斯坦用他的“中、上等马”里奇张量，对牛顿的“中、下等马”韦尔张量，牛顿无还手之力。彭罗斯的解释是，爱因斯坦的广义相对论方程，包括韦尔张量和里奇张量。韦尔张量囊括类似平移运动的相对加速度，对球面客体单向的拉长或压扁作用；这与牛顿力学的性质对应。而里奇张量囊括当球面客体有绕着的物体圆周运动时，被绕着的物体的整体都有一个纯粹向内的加速，产生有类似向心力的扩张或收缩的缩约、缩并作用。韦尔张量，韦尔是测量类似自由下落的球面的潮汐畸变，即形状的初始变形，而非尺度的变化。里奇张量，里奇是测量类似球面的初始体积改变。这与牛顿引力理论要求下落球面所围绕的质量，和这初始体积的减少成正比相合。张量与矢量相比，是直接进入了一种“关系域”，即张量比矢量更复杂一些，但同时里奇张量也比韦尔张量更复杂一些。

因为按彭罗斯的说法，韦尔张量类似“一对一”，而里奇张量类似“一对多”。而里奇创立里奇张量，爱因斯坦应用里奇张量，只是类似才开了一个头。因为如果说里奇张量是囊括当球面客体有绕着的

物体圆周运动时，被绕着的物体的整体都有一个纯粹向内的加速，产生有类似向心力的扩张或收缩的缩约、缩并作用；那么为什么这个客体能绕着那个物体作圆周运动？客体绕着的那个物体是怎么形成的？都没有说。其次，客体绕着的那个物体如果有自旋，里奇张量又是怎么样的形式？客体绕着的那个物体如果有破裂、变形、内外翻转，里奇张量又是怎么样的形式？即使是嘉当、陈省身、彭罗斯、欧拉、丘成桐等，也都才研究了一部分，所以在朗道的《场论》和彭罗斯的《通往实在之路》等书中，对里奇张量的具体数学描述也仍然语焉不详。

这里，里奇张量和韦尔张量很容易被人弄反。因为里奇张量和韦尔张量都具有向心的引力作用，只是韦尔张量类似“一对一”，而里奇张量类似“一对多”，所以“韦尔张量使得物体被拉伸，或者扭曲——这个就是潮汐力”，并不等同于里奇张量在引力中，是全方位效果的使得朝向下落的那个引力源的物体的的缩约、缩并作用。在西方，里奇张量起因于圆周运动的数学进化和物理射影，这是由意大利几何学家格里高里•里奇（Gregorio Ricci）想到的。

里奇（1853～1925），意大利数学家，理论物理学家。张量分析创始人之一。1884～1894年里奇通过研究黎曼、李普希茨以及克里斯托费尔微分不变量的理论，萌发了绝对微分学（现称张量分析）的思想。1896年发表了内蕴几何学的论文，进而提出缩约张量（里奇张量）的概念，这是一种协变或逆变张量的集合。1900～1911年里奇和他的学生列维-齐维塔进一步推动了这一学科的发展。但直到爱因斯坦在广义相对论中使用了里奇理论之后，里奇思想才受到普遍的重视。

所以重构（王红旗）先生说的“重构”和大家说的创新，也是分为两种的：即第一种类似是说对方错了，另立方法的重构和创新；第二种类似是“田忌与齐王赛马”，相同方法竞争的重构和创新。对于第一种的重构和创新，我们一般不给予评判，即使类似陈省身教授说的那种“政治是屁股指挥脑袋”的问题。而对于第二种的重构和创新，我们可以说一般90%的的重构和创新，都类似模仿、组合、改进、复制，这是没有什么值得大惊小怪的。只说明真实的的重构和创新，不容易。人类需要保护这种的生命智力或智因。这也是人们说的“科学权”，和一个国家或民族强盛不衰的根本。这个发现有一则史料，是《近代工业的兴起》一书中讲的：科学权发现的曲折和命运联系瓦特及其蒸气机：瓦特是在英国一所大学实验室工作发明蒸气机的，但十多年间大学里的师生知晓却无人过问。终于有一天来了一位贫穷的老头，他是偶然闯进大学里来捡拾破烂的。他看了瓦特的表演蒸气机后说，他有救了。原来他是一个大矿山的资本家，十多年前矿井因水淹，他破产了。瓦特的蒸气机唤起他的希望，也唤起了瓦特的希望。往日老头在社会上留下的信用，以及他的百般游说，一些往日的银行家友人支持他与瓦特办起了蒸气机生产厂家。蒸气机在英国矿山、纺织工业以及火车、轮船交通等上的应用，引起欧洲其他一些国家商人的注意，他们用高薪挖走了一些蒸气机厂的技工。因此，英国与这些国家发生了外交纠纷。斗争的结果，有八个国家和英国签定了和约。和约认为，有价值的科技创造是人类的共同财富，任何国家因不用而毁灭它，都是对人类的犯罪。因此和约签定国对科学家的自由流动，不能限制；但对工厂花钱培训出的高级技工流动，却有严格的限制。道理是，他们不是科技原理的第一创造者，而是二传手；没有得到厂主同意的流动，一经发现，逃到的和约签定国，都应该给予送还或允许追回。该书认为，这项国际条约的签定，引领了近代工业的潮流.

2/11/2012

Survey study on the tick fauna of small ruminants on the University of Maiduguri Research Farm (UMRF), Nigeria.

[1]Biu, A.A., [2]Rabo, J.S., [3]Dawurung J.S and [4]Abubakar, S.I G.

[1&4]Department of Veterinary Microbiology and Parasitology, Faculty of Veterinary Medicine, University of Maiduguri, Nigeria
[2]Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine, University of Agriculture Makurdi, Nigeria
[3] WHO National Polio Laboratory, University of Maiduguri teaching Hospital, Maiduguri, Nigeria
dawurungj@yahoo.com

ABSTRACT: A survey of the tick species infesting sheep and goats on the University of Maiduguri Research farm was conducted. An overall prevalence of 64(64.0%) with 39 (78.0%) for sheep and 25 (50.1%) for goats was determined. Stereoscopic identification of the 401 ticks collected indicated *Boophilus* species to be most predominant with a prevalence of 225 (56.1%) while *Hyalomma* species had 176 (43.9%) ($p < 0.05$) with most of the ticks found to infest the ears 145 (36.2%) compared to the abdomen 112 (27.9%), tail 85 (21.2%) and the legs 59 (14.7%) ($p<0.05$).

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Keywords: survey, tick fauna, small ruminants, Nigeria.

INTRODUCTION

Ticks as obligate ectoparasites of vertebrates are known vectors of infectious diseases causing significant losses to the livestock industry (Jongejan and Uilenberg 2004).

The University of Maiduguri research farm contains livestock species kept for fattening, breeding and scientific investigations. This paper reports the prevalence of tick species infesting sheep and goats on the farm relating to their predilection sites with a view towards effective control.

MATERIALS and METHODS

Ticks were collected using hand forceps from sheep and goats randomly sampled on the University of Maiduguri, Research farm, and put into 2% formalin as preservative. In the parasitology laboratory, University of Maiduguri, the ticks were then mounted unto clean glass slides using Canada balsam and identified under the light microscope (x 10) using the keys described by Soulsby (1982) to include the shape of mouthparts, presence of festoons, scutum, ornation and leg bands. Tick numbers based on species were compared statistically using the student "t" test at $p = 0.05$ to predict predominance (Dibal, 1991)

RESULTS

The results of this study on prevalence of ticks of small ruminants as shown in Table 1 indicates an overall prevalence of 64(64.0%) with 39 (78.0%) for sheep and 25 (50.1%) for goats ($p < 0.05$). A tick burden of 135 (60.0%) *Boophilus* spp. and 70 (39.8%) *Hyalomma* spp. was found on sheep while 90 (40.0%) *Boophilus* spp. and 106 (60.2%) *Hyalomma* spp. was found on goats. There was more of *Boophilus* spp. on sheep and more of *Hyalomma* spp. on goats. Table 2 shows the prevalence of ticks on sheep and goats based on predilection site. In both sheep and goats more ticks were harvested from the ears while the least numbers was from the legs ($p<0.05$).

Table 1: Prevalence of ticks on sheep and goats examined on the University of Maiduguri Research FARM (UMRF).

Host Species	No. Examined	No(%) Infested	Tick burden (n =401) *Boophilus*	*Hyalomma*
Sheep	50	39(78.0)	135(60.0)	70(39.8)
Goats	50	25(50.1)	90(40.0)	106 (60.2)
Total	100	64 (64.0)	225(56.1)	176(43.9)

Table 2: Prevalence of ticks on sheep and goats based on predilection site.

Predilection Site	Tick burden (%) n = 401 Sheep	Goats	Total
Ear	97 (35.3)	48(38.1)	145(36.2)
Abdomen	78(28.4)	34(26.9)	112(27.9)
Perineum	60 (21.8)	25 (19.8)	85(21.2)
Legs	40 (14.6)	19 (15.1)	59(14.7)

DISCUSSION

The predominance of *Boophilus* over *Hyalomma* species of ticks on sheep and goats in this study though agreeing with the report by Biu and Nwosu (1998), James- Rugu (2004) on cattle in Maiduguri disagrees with the observations from Southwestern Nigeria where *Amblyomma variegatum* was most prevalent (Dipeolu 1975). In this study the tick species were found to Prefer the ears as attachment sites compared to the abdomen, tail and the legs ($p<0.05$). Basu, (1993) and Opara *et al.,* (2005) attributed tick attachment to host temperature variation, ease of penetration by the hypostome, accessibility of blood vessels in different parts of the body describing these factors as important determinants.

In general ticks have been reported as having tremendous economic importance as disease vectors (Mbah 1982, Macoluso,2003., Kim *et al.*, 2005) as such serious efforts should be made towards their control on the University Research Farm for an efficient productivity.

REFERENCES

1. Basu, A.K. (1993). Studies on the biology and bioeconomics of *Ornithodorus savignyi* Audoin 1827 and its control. Final research report University of Maiduguri, Nigeria.
2. Biu. A. A. and Nwosu, C.O. (1998). Seasonal prevalence of cattle ticks in Maiduguri, Borno State. Entomological Society of Nigeria Occasional Publication. 31:133-139.
3. Dibal, N.P. (1991). Elementary Statistics. 1st ed. Yiksa Publ. Co. Borno State, Nigeria. 96pp
4. Dipeolu, O.O. (1975). Survey of tick infestation in trade cattle, sheep and goats in Nigeria. Bull Anim Hlth. Prod. Afri. 23:165-172.
5. James – Rugu, N.N. (2004). A survey of ectoparasites of some livestock from some areas of Borno and Yobe State, Nigeria. Nig. Vet. J. 25(2): 48-55.
6. Kim, C.M., Kim, J.Y., Yi, H.Y., Lee, M.J., Cho. M.R., Shah, D.H., Klein, T.A., Song, J. W., Kim, H.C., Chong, S.T., O' Guinn, M.C., Lee, J.S., Lee, I.Y., Park, J.H. and Chae, J.S. (2005).Detection of *Bartonella* species from ticks, mites and small ruminants in Korea. J. Vet. Sc. 6(4): 327-334.
7. Macoluso, K.R., David, J., Alam, U. and Korman, A. (2003). Spotted fever group rickettsia in ticks from the Masai region of Kenya. Am. J. Trop. Med. Hyg. 68:551-553.
8. Mbah, D. A. (1982). Mortalities due to rickettsia trypanosomiasis, piroplasmosis and streptothricosis among six genetic groups of cattle at Wakawa. Revue Sci. Tech. Anim. 2:81-97.
9. Opara, M. N., Abdul, Y. and Okoli, I. C. (2005). Survey of ticks of veterinary importance and tick borne protozoa of cattle grazed in very hot months in Sokoto municipality, Nigeria. Int. J. Agric. & Rural Development 6:168-174.
10. Soulsbly, E. J. L. (1982). Helminths, Arthropods and Protozoa of Domesiticated Animals. 7th ed. Bailliere Tindal, London UK. 809 pp.

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Production of Hygromycin-B antibiotic from *Streptomyces crystallinus*, AZ-A151: II. Parameters Controlling of Antibiotic Production

***Houssam M. Atta [1]; Afifi, M. M. [2]; Elshanawany, A. A. [2]; Abdoul-raouf, U.M. [2] and El-Adly, A.M. [2]**

[1.] Botany and Microbiology Department, Faculty of Science (Boys), Al-Azhar University, Cairo, Egypt. The present address: Biotechnology Department. Faculty of Science and Education - Al-Khurmah, Taif University; KSA.
[2.] Department of Botany and Microbiology, Faculty of Science, Al-Azhar University, Assuit 71524, Egypt.
houssamatta@yahoo.com and houssamatta@hotmail.com; Tel: 00966506917966

Abstract: Growth pattern and antimicrobial profile of *Streptomyces crystallinus,* AZ-A151 were studied on Starch Nitrate (SN) broth medium. An attempt has been made to evaluate the optimal cultural conditions for obtaining high yields of bioactive metabolites. The optimum temperature and pH for bioactive metabolite production of the strain were recorded as 35 °C and 8.0 respectively. Production of bioactive metabolites by the strain was high in Starch nitrate (SN) broth medium as compared to other tested media tested. The strain utilized starch, sodium nitrate and 200 ppm of vitamin H, as good carbon, nitrogen and vitamin sources for the elaboration of bioactive metabolites. The secondary metabolites exhibited high antimicrobial activity against *Staphylococcus aureus*, NCTC 7447; *Escherichia coli*, NCTC 10416; *Klebsiella pneumonia*, NCIMB 9111; *Salmonella typhi*; *Saccharomyces cerevisiae,* ATCC 9763; *Aspergillus flavus*, IMI 111023; *Alternaria alternate* and *Fusarium verticillioides*. This is the first report on the optimization studies of bioactive metabolites by *Streptomyces crystallinus,* AZ-A151.
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Keywords: Effect of Environmental Conditions and Nutritional Requirements

1. Introduction

Most of the antibiotics in use today are derivatives of natural products of actinomycetes and fungi [Newman and Cragg, 2007]. Antibiotics produced by actinomycetes and other microbes have been evolving for one billion years [Baltz, 2005] and their activity has been tested against microbes based on their ability to inhibit target enzymes and macromolecules. Actinomycetes can be isolated from soil and marine environments. Since collecting soil is relatively inexpensive, much is known about the distribution and abundance of terrestrial actinomycetes. Although soils have been screened by the pharmaceutical industry for the past five decades, only a small fraction of actinomycetes have been discovered [Baltz, 2005]. Actinomycetes from unexplored habitats have gained considerable attention in recent years for the production of bioactive metabolites. The list of novel actinomycetes and products derived from poorly explored areas of the world stresses the importance of investigating new habitats [Nolan and Cross, 1988].

The search for novel natural products with useful pharmacological activities often includes the isolation of actinomycetes, such as *Streptomyces* species, from soil samples [Ritacco *et al.,* 2003; Sembiring and Goodfellow, 2008]. Actinomycetes have been especially useful to the pharmaceutical industry for their seemingly unlimited capacity to produce secondary metabolites with diverse chemical structures and biological activities. Searching for novel actinomycetes constitutes an essential component in natural product-based drug discovery [Valan Arasu *et al.,* 2008]. Actinomycetes are also the focus of attention due to their production of secondary metabolites that may have a range of pharmaceutical and biotechnological applications. Microbial natural products still appear to be the most promising source of the future antibiotics that society expects to be developed and they are the origin of most of the antibiotics on the market today [Kaltenpoth, 2009; Thumar *et al*., 2010]. The search for new antibiotics or new microorganism strains producing antibiotics continues to be of utmost importance in research programs around the world, because of the increase of resistant pathogens and toxicity of some used chemical antibiotics. Therefore, there is an alarming scarcity of new antibiotics currently under development in the pharmaceutical industry. Still, microbial natural products remain the most promising source of novel antibiotics, although new approaches are required to improve the efficiency of the discovery process (Thumar *et al.,* 2010). In the past two decades however, there has been a decline in the discovery of new lead compounds from common soil-derived actinomycetes [Valan Arasu *et al.,* 2008]. It is well known that designing an appropriate fermentation medium is of critical importance in the production of secondary metabolites [Gao *et al.,* 2009]. Prior knowledge and

experience in developing a suitable basal medium may play an important role in further medium optimization [Jia *et al.,* 2008]. Production of secondary metabolites through fermentation is influenced by various environmental factors including nutrients (nitrogen, phosphorous and carbon source), growth rate, feedback control, enzyme inactivation and variable conditions (oxygen supply, temperature, light & pH) [Lin *et al.,* 2010; Ruiz *et al.,* 2010; Sánchez *et al.,* 2010]. In addition, production of valuable metabolites by actinomycetes differs qualitatively and quantitatively depending on the strains used in fermentation. As one of the most significant components in the medium, carbon source plays a critical role as sources of precursors and energies for synthesis of biomass building blocks and secondary metabolite production [Wang *et al.,* 2008 & 2010; Jia *et al.,* 2009]. Therefore, influences of medium components and environmental conditions are an initial and important step to improve metabolite production of the genus *Streptomyces*.

In the present study, optimal conditions for the production of bioactive metabolites by *Streptomyces crystallinus,* AZ-A151 were determined and the metabolites thus extracted showed good antimicrobial activity against Gram positive, Gram negative bacteria and unicellular and filamentous fungi.

2. Material and Methods

2.2. Test organisms

2.2.1. Gram Positive: *Staphylococcus aureus*, NCTC 7447.

2.2.2. Gram Negative: *Escherichia coli*, NCTC 10416; *Klebsiella pneumonia*, NCIMB 9111; *Salmonella typhi*.

2.2.3. Unicellular fungi: *Saccharomyces cerevisiae,* ATCC 9763.

2.2.4. Filamentous fungi: *Aspergillus flavus*, IMI 111023 and *Alternaria alternata*.

2.3. Effect of environmental conditions

2.3. 1. Incubation period:

For such a purpose the spores of cultures were allowed to grow on a Basal Starch Nitrate Medium (BSNM) as mentioned before.

Fifty mls of the medium were dispensed among conical flasks of 250 ml. three flasks were used for each particular incubation period. The flasks were then sterilized, cooled, inoculated and incubated on a rotary shaker of 120 rpm. at 30°C. Cultures were removed after 2, 4, 6, 8, 10, 12, 14, 16, 18 and 20 days of incubation and tested for antimicrobial biosynthesis.

2.3.2. Initial pH values:

The initial pH values of the basal starch nitrate broth media were adjusted to cover the range from 4, 5, 6, 7, 8, 9, 10 and 11 before sterilization.

Three flasks were always used for each particular pH value. The experiment was terminated after maximum biosynthesis of metabolite was attained and the broth filtrate was used for assessing the antimicrobial potency.

2.3.3. Incubation temperatures:

Most antibiotic producing microorganisms are mesophilic that is the optimum temperature for their growth in the range of 23-37°C. This experiment was constructed to determine the optimum growth temperature at which maximum biosynthesis of the active agent occurred. The liquid nutrient media were inoculated as previously mentioned and incubated at temperatures range from 15, 20, 25, 30, 35, 40, 45, 50 and 55°C. The antimicrobial agent biosynthesis was assessed at each temperature.

2.3.4. Shaking at different speed (rpm):

The inoculated flasks of the previous medium were incubated in incubator shaker at 40, 80, 120, 160 and 200 (rpm). At the end of incubation period, the antibiotic biosynthesis was assessed.

2.3.5. Inoculum age:

Liquid medium of Starch Nitrate (BSNM) used for each particular inoculum age, each flask contained 50 mls of the liquid medium, inoculated with 1.0 ml from suspension of organism using different inocula ages of: 3, 6, 9, 12, 15, 18, 21, 24, 27 and 30 days. At the end of incubation period, antibiotic biosynthesis was assessed.

2.3.6. Inoculum size:

The investigated strains were grown on starch nitrate agar medium plate for 10 days at 28°C. Spores were harvested and re-suspended in water. Spore suspension was inoculated in 250 ml Erlenmeyer flasks containing 50 ml of the basal fermentation medium at 2, 4, 6, 8, 10, 12, 14, 16, 18 and 20% (v/v), and incubated on a rotatory shaker. Then calculate the total colonies forming units (C.F.U./ml) for each studied strain. At the end of incubation period the obtained clear filtrates were tested for their antimicrobial activities.

2.4. Effect of nutritional conditions

2.4.1. Growth media:

For such a purpose the investigated strains were grown on six different growth media media such as starch nitrate, Starch casein, Yeast extract

malt extract, Glycerol asparagines, Inorganic salt starch and tryptone yeast extract (the composition of these media are as mentioned before). Fifty mls of each medium was dispensed among conical flasks of 250 ml. three flasks were used for each medium, sterilized, cooled, inoculated and incubated on a rotary shaker of 120 rpm at 30°C. Cultures were removed after 10 days of incubation and tested for antimicrobial biosynthesis.

2.4.2. Carbon source:

Eleven carbon sources (Starch, Galactose, Arabinose, Trehalose, Glycerol, Glucose, Mannose, Mannitol, Cellulose, *meso*-inositol and Raffinose) were applied. The liquid basal medium (without carbon source) was supplemented with each individual carbon source at an equivalent amount of carbon to that located in starch (2 %). The tested sugars were separately sterilized by diethyl ether and left to dry and then were added to the basal nutrient medium. The initial pH of the various media was adjusted at 7.0 before sterilization. Flasks after incubation filtrated for assayed antibiotic biosynthesis.

2.4.3. Nitrogen source:

The following nitrogenous compounds such as (Ammonium nitrate, Casein, Sodium nitrate, Potassium nitrate, Magnesium nitrate, Ammonium sulphate, Ammonium carbonate) and amino acids such as (L-Phenylalanine, DL-Cystine, DL Methonine, Lysine, L-Leucine, Glycine, Treptophane, Asparagine, Proline, L-Asparatic acid, L-Serine) were supplemented to the basal medium. The liquid basal medium was supplemented with each individual nitrogen source at an equivalent amount to that nitrogen located in 0.2 % ($NaNO_3$).The appropriate level of each amino acid tested was soaking in diethyl ether for overnight and then added to the basal medium. Flasks were inoculated and incubated, and antibiotic biosynthesis was assessed at the end of incubation period.

2.4.4. Vitamins:

The previously mentioned production broth medium (BSNM) was used for studying the effect of different vitamins on antibiotics biosynthesis. Vitamins used were, riboflavin, pantathonic acid, folic acid, vitamin H, thiamin, B12 and D2. Each vitamin was added at three concentrations viz, 50, 100 and 200 ppm. Appropriate weights of these vitamins were sterilized by soaking in 96 % ethyl alcohol for 24 hours, flasks were inoculated, incubated, filtrated and then the antibiotic biosynthesis was assessed at the end of incubation period.

2.4.5. Potassium monohydrogen phosphate Concentration:

Various concentrations (g/L) of Potassium monohydrogen phosphate: 0.2, 0.4, 0.6, 0.8, 1.0, 2.0 and 3.0 were supplemented to basal liquid medium. The flasks were sterilized, inoculated, and incubated at 30 °C. At the end of incubation period, the antibiotic biosynthesis was assessed.

2.4.6. Magnesium sulphate Concentration:

Various concentrations (g/L) of Magnesium sulphate: 0.1, 0.3, 0.5, 0.7, 1.0 and 2.0 were supplemented to basal liquid medium. The flasks were sterilized, inoculated, and assessed as mentioned before.

3. Results

3.1. Effect of environmental conditions

3.1.1. Effect of incubation periods:

The Effect of incubation periods on biomass and bioactive metabolite production of *Streptomyces crystallinus*, AZ-A151 was recorded (Fig. 1). Cell growth and the yield of bioactive metabolites were found to be optimum when the strain was cultured at incubation period (day) of 10 and given highly potency against all test organisms in series *Staphylococcus aureus* (35), gram-negative bacteria *Klebsiella pnumoniae* (24.5), *Alternaria alternata* (20.5), and *Saccharomyces cerevisiae* (16.8) respectively.

3.1.2. Effect of different pH values:

Data recorded in Fig. (2), contained that maximum biosynthesis level of antimicrobial agents by *Streptomyces crystallinus*, AZ-A151 could be recorded within an pH value 8 and given highly potency against bacterial test organism*s* *Staphylococcus aureus* (34.5mm), *Klebsiella pnumoniae* (24mm), followed by pH 7 in *Alternaria alternata* (21mm) and *Saccharomyces cerevisiae* (16.5mm).

3.1.3. Effect of incubation temperatures:

The Effect of incubation temperatures on biomass and bioactive metabolite production of *Streptomyces crystallinus*, AZ-A151 was recorded (Fig. 3). Cell growth and the yield of bioactive metabolites were found to be optimum when the strain was cultured at 35°C indicating its mesophilic nature. This was declared by the higher activity in relation to *Staphylococcus aureus* (37.5), *Klebsiella pnumoniae* (28.0), *Alternaria alternata* (23.5), and *Saccharomyces cerevisiae* (19.5) in AZ-A151.

3.1.4. Effect of shaking at different speeds (rpm):

Effect of shaking at different speeds (rpm) on biomass and bioactive metabolite production of *Streptomyces crystallinus*, AZ-A151 was recorded (Fig. 4). The maximum biosynthesis level of antimicrobial agents could be recorded within an shaking speed (rpm) at 160, and given the highest potency against all test organisms *Staphylococcus aureus* (36.5), *Klebsiella pnumoniae* (25.5), *Alternaria alternata* (21.5) and *Saccharomyces cerevisiae* (18.8).

3.1.5. Effect of inoculum age:

Effect of inoculum age on biomass and bioactive metabolite production of *Streptomyces crystallinus*, AZ-A151 was recorded (Fig. 5). The maximum biosynthesis level of antimicrobial agents was recorded within an inoculums age (days) at 12 and 15, as it was detected by the highest potency against *Staphylococcus aureus* (36.5), *Klebsiella pnumoniae* (26.0), *Alternaria alternata* (22.5) and *Saccharomyces cerevisiae* (18.5) tested in AZ-A151.

3.1.6. Effect of inoculum size:

Data recorded in Fig. (6), determined that the maximum biosynthesis level of antimicrobial agents by *Streptomyces crystallinus*, AZ-A151 could be represented within 10 % (v/v) inoculum size concentration and given highest potencies (mm) against *Staphylococcus aureus* (44) and *Klebsiella pnumoniae* (32) compared to (25.5) of *Alternaria alternata* and (22.5) of *Saccharomyces cerevisiae* at 8 % (v/v) inoculum size concentration.

3.2. Effect of nutritional requirements

3.2.1. Effect of different growth media:

Data recorded in Fig. (7), the maximum biosynthesis level of antimicrobial agent(s), could be recorded on Starch nitrate (SN) medium which given a highly potency against all test organisms as inhibition zone (mm) such as *Staphylococcus aureus* (35.8 and 33.5), *Klebsiella pnumoniae* (24.5 and 24.0), *Alternaria alternata* (20.3 and 21.0) and *Saccharomyces cerevisiae* (16.8 and 16.5) in case of *Streptomyces crystallinus*, AZ-A151. This was followed by Inorganic salts nitrate medium. On the other hand, a decrease of antimicrobial agent(s) productivity was detected in the presence of other tested growth media, while antimicrobial production was not produced in tryptone yeast extract (TYE).

3.2.2. Effect of various carbon sources:

Impact of several carbon sources on biomass and bioactive metabolite yield was shown in Fig. (8). Among the carbon sources tested, starch and glycerol are the best carbon source for productivity of antimicrobial agent(s) which exhibited the highest potencies (i.e. inhibition zone in mm) as follows: against *Staphylococcus aureus* (38), *Klebsiella pnumoniae* (26.5), *Alternaria alternata* (23) and *Saccharomyces cerevisiae* (20.5) in case of AZ-A151. On the other hand, a decrease of biosynthesis antimicrobial agent(s) was detected in the presence of other tested carbon sources.

3.2.3. Effect of various nitrogen sources:

The effect of different nitrogen sources on the production of biomass and bioactive metabolites of the strain was studied (Fig. 9). Among the nitrogen sources tested, sodium nitrate is the best nitrogen source for productivity of antimicrobial agent(s) by AZ-A151 given high potency inhibition zone (mm) against all test organisms as *Staphylococcus aureus* (34.5), *Klebsiella pnumoniae* (24.8), *Alternaria alternata* (21.0), and *Saccharomyces cerevisiae* (16.5) in case of AZ-A151. This was followed by Ammonium sulphate. On the other hand, a decrease of antimicrobial agent(s) productivity was detected in the presence of other tested nitrogen sources.

3.2.4. Effect of different vitamins:

The effect of different vitamins sources on the production of biomass and bioactive metabolites of the strain was studied (Fig. 10). The maximum activity of antimicrobial agent(s) produced by AZ-A151 was detected in the presence of 200 ppm of vitamin H and highest potencies against *Staphylococcus aureus* (42.5) *Klebsiella pnumoniae* (30.5), followed by Riboflavine which declared (25) in *Alternaria alternata* and (19) in *Saccharomyces cerevisiae* at the same concentration, comparable to control (which contained no vitamins).

3.2.5. Effect of various amino acids:

The effect of various amino acids on the production of biomass and bioactive metabolites of the strain was studied (Fig. 11). Among the nitrogen sources tested, Asparagine are given highly potency i.e., inhibition zone (mm) against *Staphylococcus aureus* (30), *Klebsiella pnumoniae* (22.3), *Alternaria alternata* (18.5) and *Saccharomyces cerevisiae* (14). This was followed by Trptophane, DL-Cystine, Lysine and Proline respectively.

3.2.6. Effect of various K_2HPO_4 concentrations:

Data recorded in Fig. (12), the highest yield of the antimicrobial agent biosynthesis produced by *Streptomyces crystallinus*, AZ-A151 was achieved in a medium fortified with 0.08 % (w/v) concentrations of K_2HPO_4, that recorded a high potency against *Staphylococcus aureus* (37.0 mm) and *Klebsiella pnumoniae* (26.0 mm) and found maximum

inhibition zone at 0.06 % (w/v) against *Alternaria alternata* (23.0 mm) and *Saccharomyces cerevisiae* (19.5 mm).

3.2.7. Effect of $MgSO_4$. $7H_2O$ concentrations:

Data recorded in Fig. (13), the highest yield of the antimicrobial agent biosynthesis was attained in a medium fortified with 0.7 $MgSO_4.7H_2O$ and given highly potency against all test organisms as follows *Staphylococcus aureus* (36.0), *Klebsiella pnumoniae* (25.5), *Alternaria alternata* (21.5) and *Saccharomyces cerevisiae* (18.0) in the case of AZ-A151.

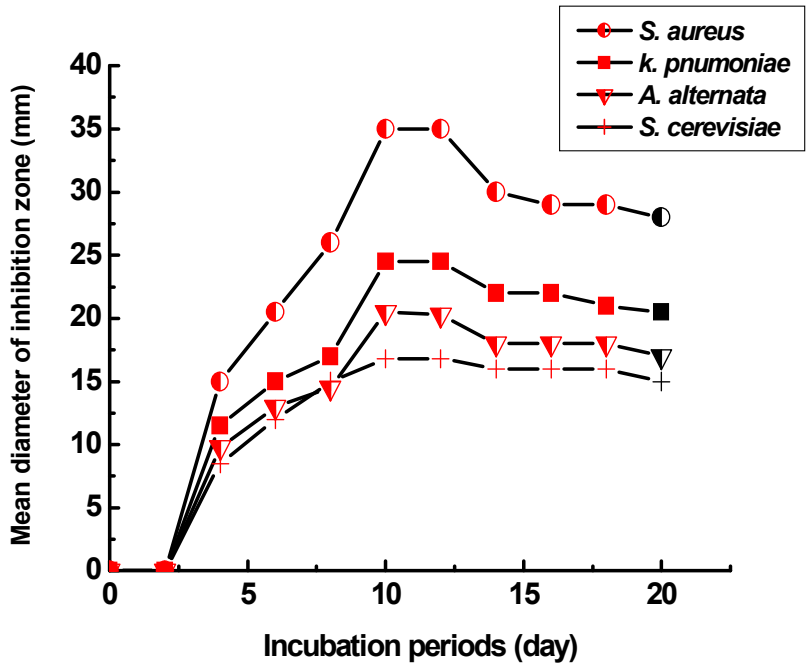


Figure 1. Effect of different incubation periods on antimicrobial agent biosynthesized by *Streptomyces crystallinus*, AZ-A151.

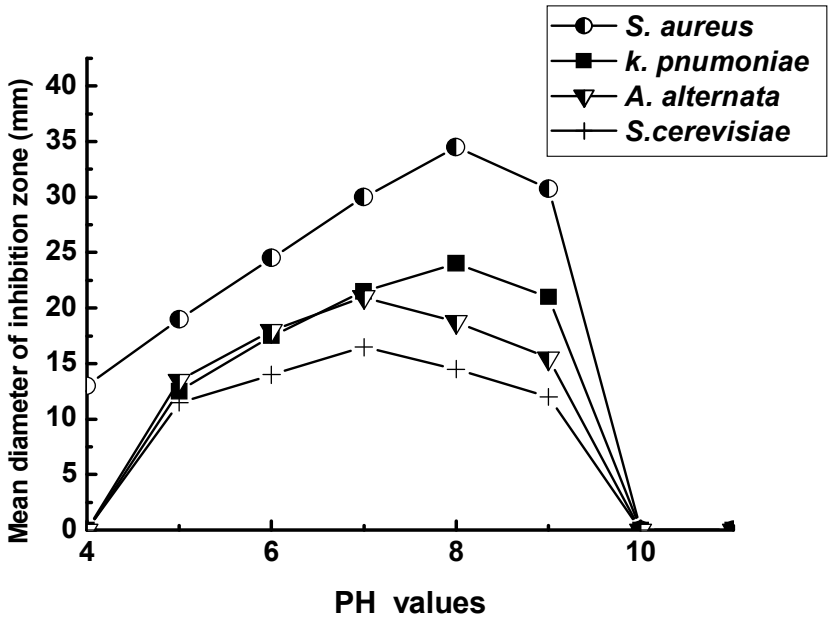


Figure 2. Effect of pH values on the biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.

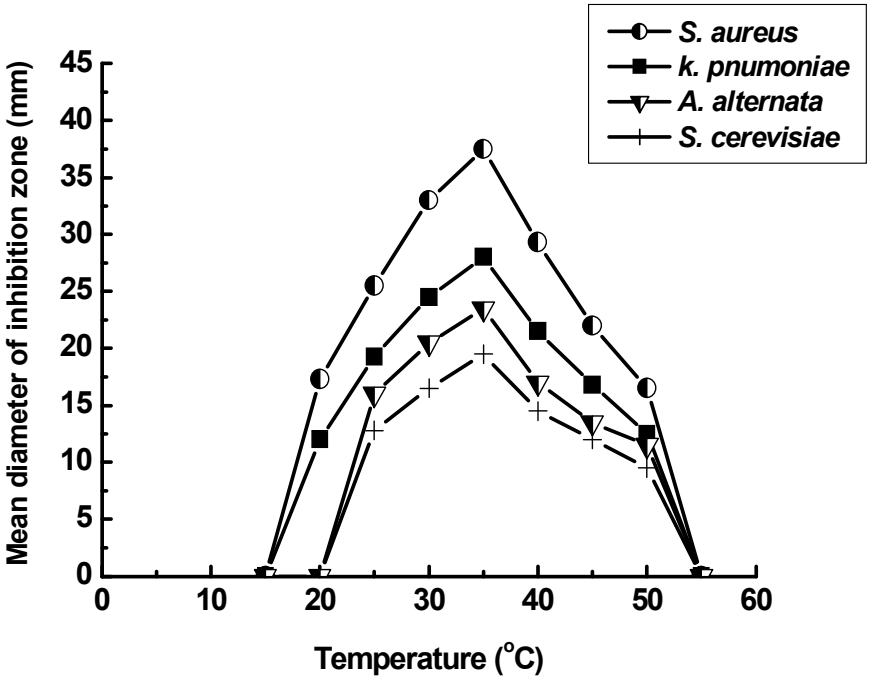


Figure 3. Effect of incubation temperatures (°C) on biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.

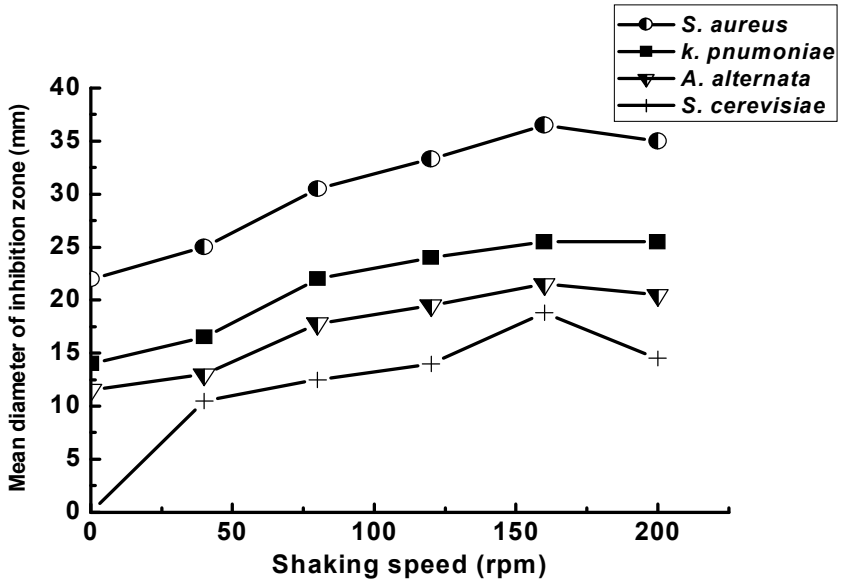


Figure 4. Effect of various shaking speed (rpm) on biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.

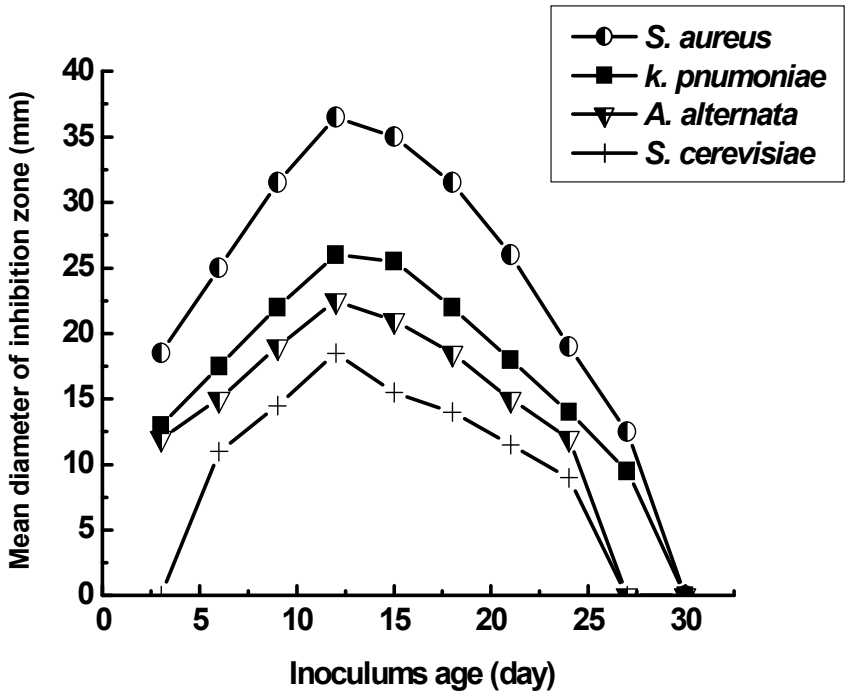


Figure 5. Effect of inocula ages on biosynthesis level of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.

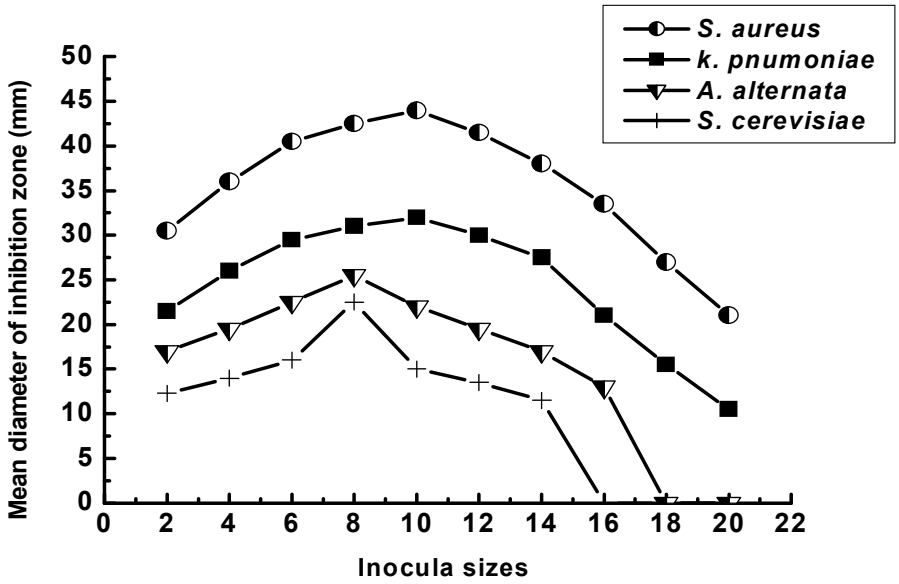


Figure 6. Effect of inocula sizes on biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ- A151.

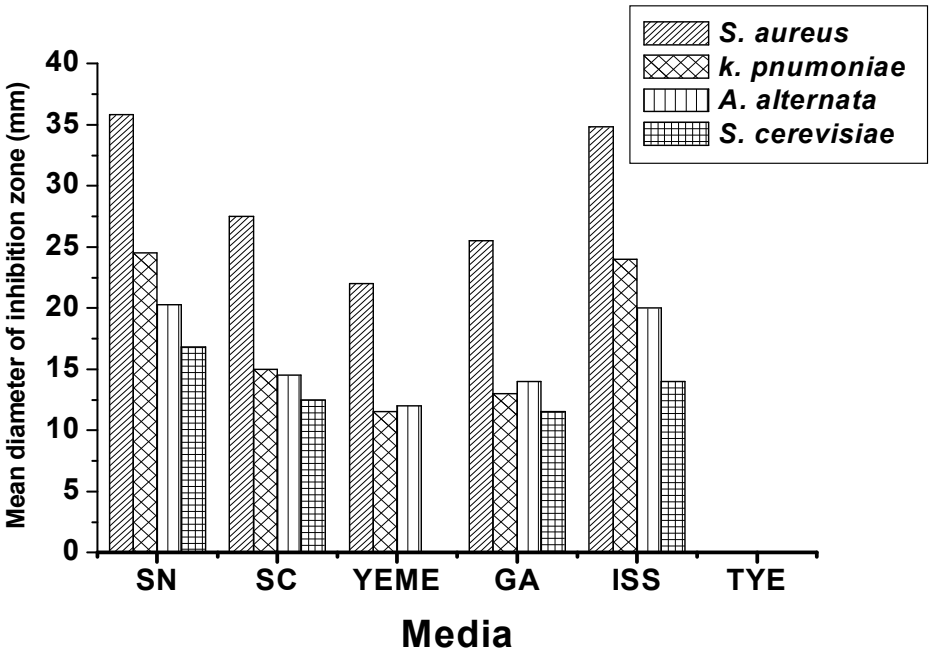


Figure 7. Effect of different media on the biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ- A151.

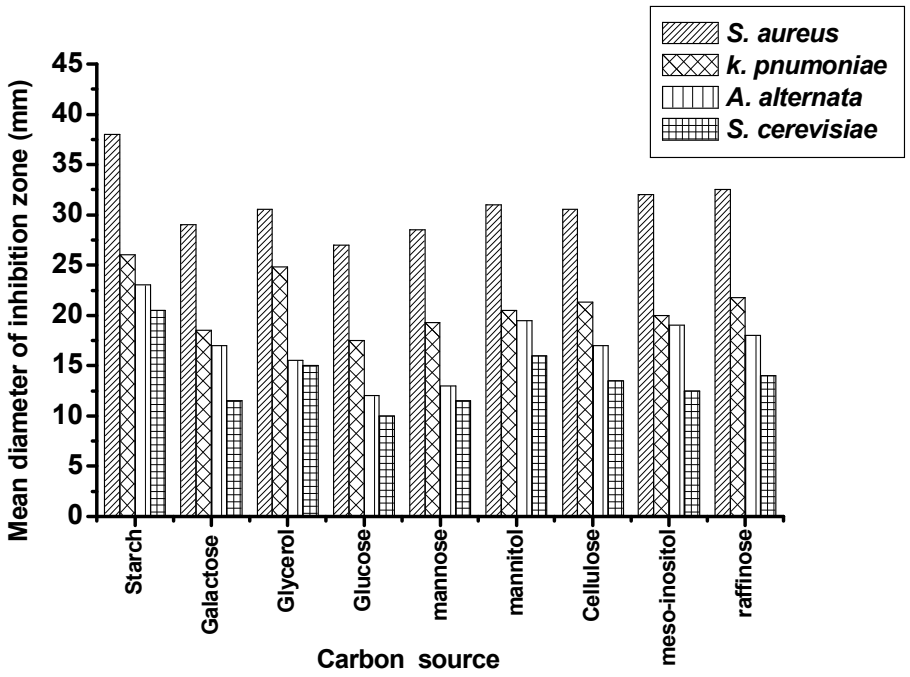


Figure 8. Effect of Carbon sources on biosynthesis of antimicrobial agent by *Streptomyces crystallinus*, AZ-A151.

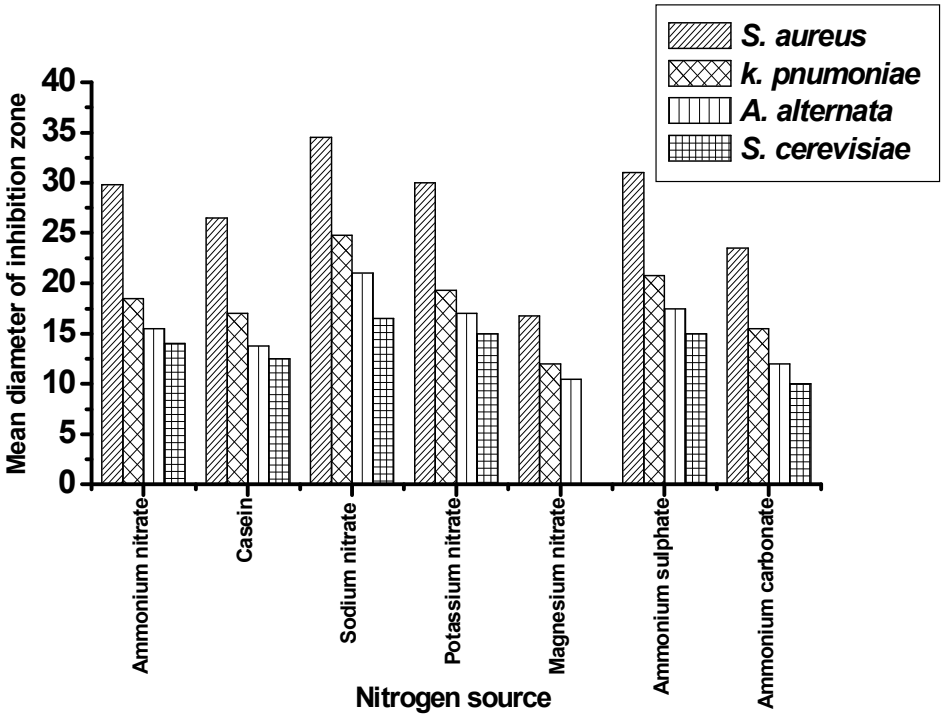
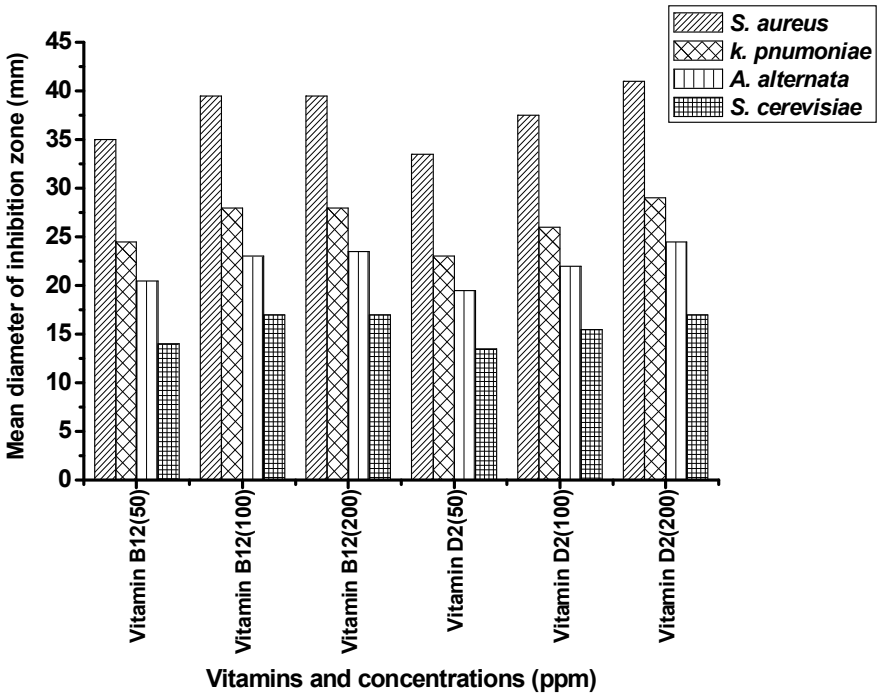
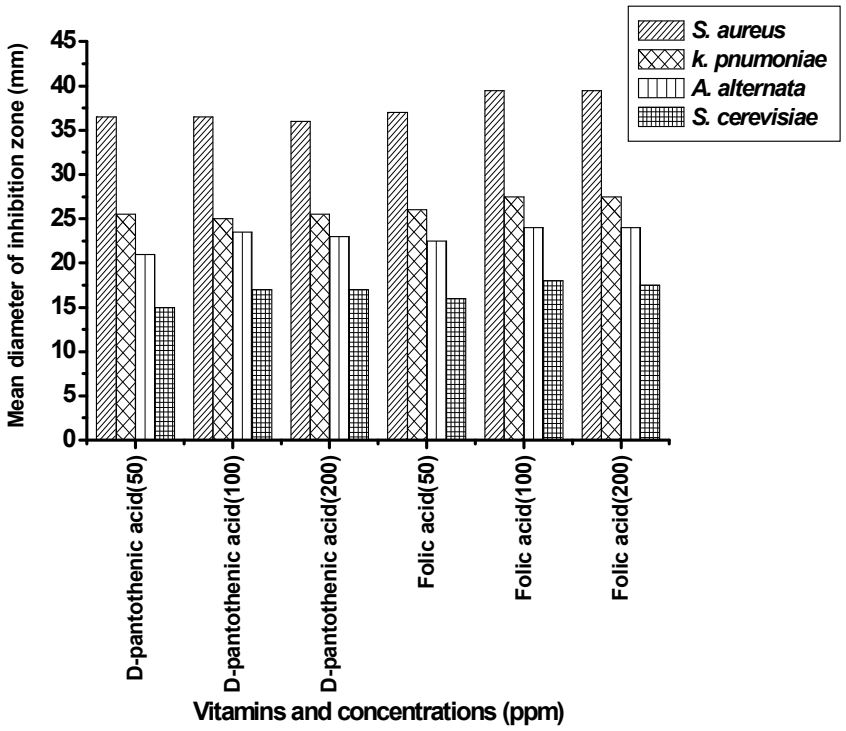


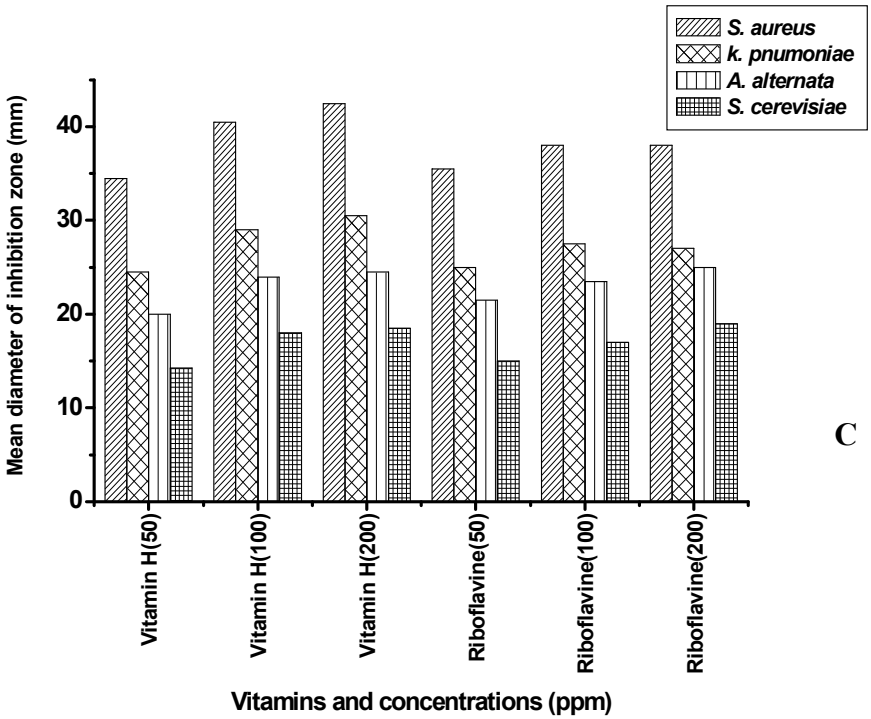
Figure 9. Effect of different nitrogen sources on the biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.



A


S. aureus
k. pnumoniae
A. alternata
S. cerevisiae
Mean diameter of inhibition zone (mm)
0
5
10
15
20
25
30
35
40
45
D-pantothenic acid(50)
D-pantothenic acid(100)
D-pantothenic acid(200)
Folic acid(50)
Folic acid(100)
Folic acid(200)
Vitamins and concentrations (ppm)

B


S. aureus
k. pnumoniae
A. alternata
S. cerevisiae
Mean diameter of inhibition zone (mm)
0
10
20
30
40
Vitamin H(50)
Vitamin H(100)
Vitamin H(200)
Riboflavine(50)
Riboflavine(100)
Riboflavine(200)
Vitamins and concentrations (ppm)

C

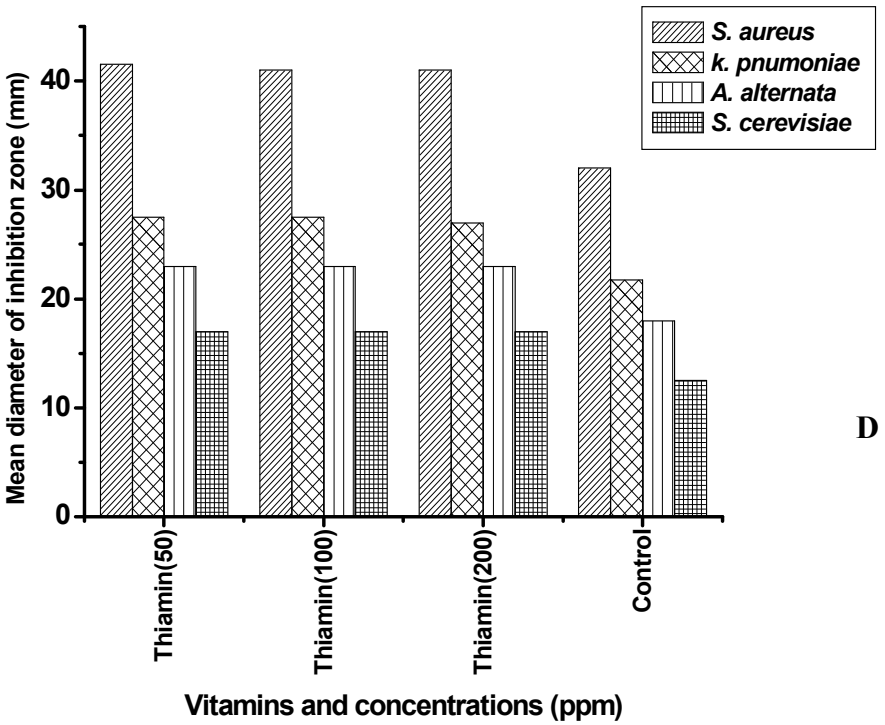


Figure 10. Effect of different vitamins and their concentrations on biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.

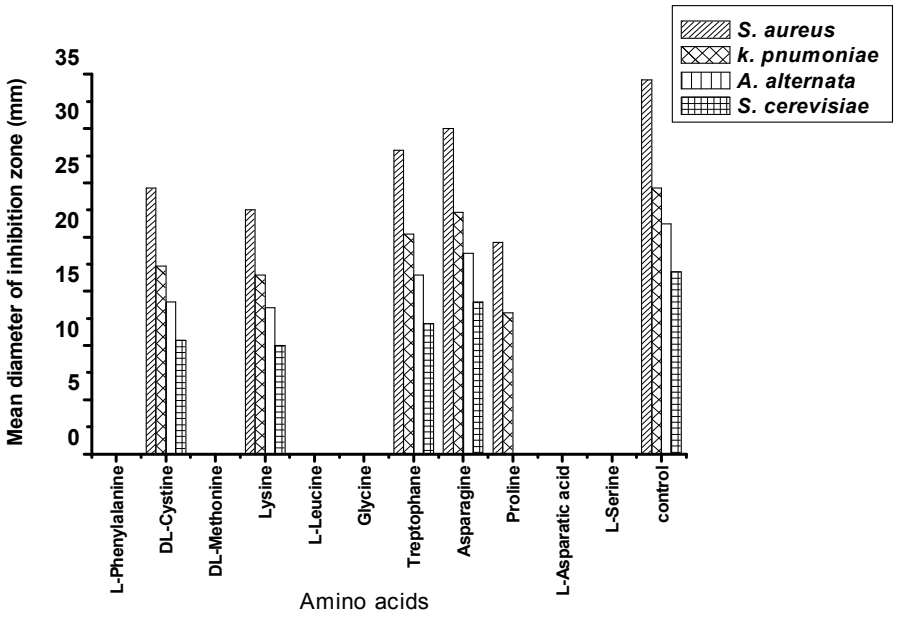


Figure 11. Effect of amino acids on the biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.

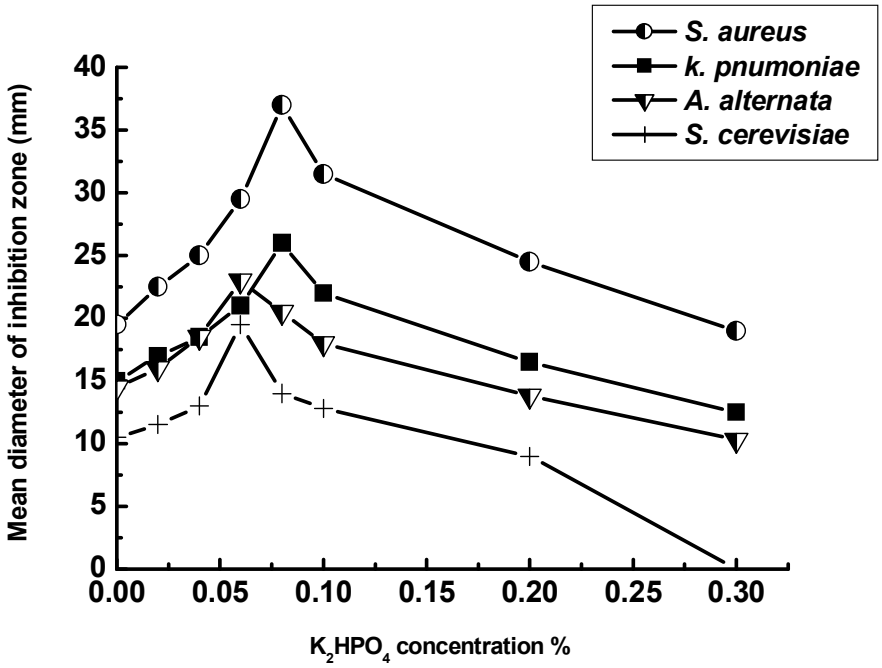


Figure 12. Effect of various K_2HPO_4 concentrations on the biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ- A151.

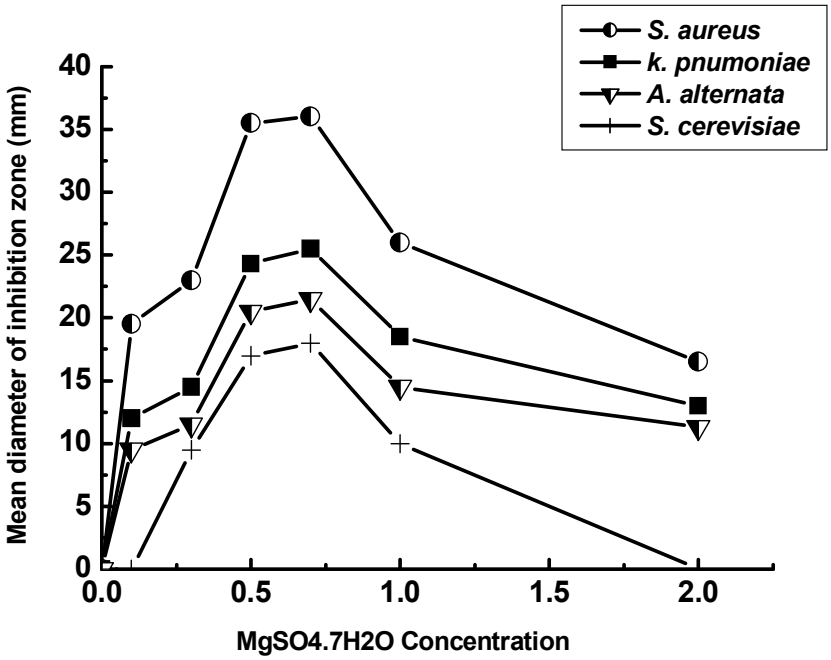


Figure 13. Effect of various concentrations of $MgSO_4.7H_2O$ on the biosynthesis of antimicrobial agent produced by *Streptomyces crystallinus*, AZ-A151.

4. Discussions

The effect of different environmental and nutritional factors on the antimicrobial activity was studied for optimizing the cultural conditions to obtain the highest quantities of antimicrobial compounds produced by *Streptomyces crystallinus*, AZ-A151. The maximum biosynthesis of the antimicrobial activities produced by *Streptomyces crystallinus,* AZ-A151 were obtained after incubation 10 days. Similar result was obtained by [Martin *et al.,* 1979]. Our results agreed with [El-Naggar *et al.,* 2006] who stated that the maximum Meroparamycin production by the three isolated *Streptomyces* sp. strain MAR01 were obtained after days 5, 6 and 7. Also [Bruheim *et al.,* 2002] stated that high-yield actinorhodin production was occurred during 5 days of cultivation. [Barun *et al.,* 1997] reported that the best antibiotic yield was recorded when fermentation was carried out for 5 days. [Sousa *et al.,* 2002] showed that the production of actinomycin-D by *S. parvulus* reached their maximum values at around 144 h. Maximum antibiotic production by *Streptomyces albidoflavus* was observed on the 8th day of incubation [Augustine *et al.,* 2005] found that peak antibiotic production by *Streptomyces sp.* occurred at 72 h in a batch culture.

The maximum antibiotic production was obtained at incubation temperature 35ºC for *Streptomyces crystallinus,* AZ-A151. These results are in agreement with [Hassan *et al.,* 2001] that showed that maximum antibiotic production was obtained by *S. violatus* at 30ºC. Also [Adinarayana *et al.,* 2003] stated that maximum neomycin production by *Streptomyces marinensis* was obtained at 30ºC. [Suetsuna and Osajima, 1990] showed that 28ºC is the optimum temperature for griseorhodin production by *S. californicus* JCM6910. [Augustine *et al.,* 2004] reported that deviation from optimum temperature for antifungal metabolite production severely affected the yield of antifungal metabolite.

The antagonistic activities were found to be influenced by the pH of the medium. The optimum pH value for the antimicrobial metabolite biosynthesis varied from acidic, neutral and alkaline environments were reported to have a great effect in this respect [Egorov, 1985]. The initial pH value of the present data showed a significant influence on the maximum productivity of the antibiotic as well as on the growth of the test organism. The isolate *Streptomyces crystallinus,* AZ-A151 showed the maximum antibiotic activity was obtained at an initial pH of 8.0. Our results were comparable with some *Streptomyces* species recorded to secrete antibiotics against Gram posistive and gram negative bacteria and unicellular and filamentous fungi; actinorhodin, a blue pigment-antibiotic, was produced extracellularly in *S. coelicolor* cultures at pH values around 8 [Bystrykh *et al.,* 1996]. [Sathi *et al.,* 2001] found that pH 7- 8 was the most suitable for large scale production of antibiotics *from Streptomyces* Species.

The ability of Streptomycete to form antibiotic was not a fixed property but can be greatly increased or completely lost under different conditions of nutrition and cultivation [Waksman, 1961]. Therefore, the medium constitution together with the metabolic capacity of the producing organism greatly affected antibiotic biosynthesis [Barratt and Oliver, 1994; Abbanat *et al.,* 1999].

The choice of carbon source greatly influenced secondary metabolism and therefore antibiotic production [Spizek and Tichy, 1995]. A quickly metabolized substrate such as glucose may often achieved maximum cell growth rates, but it was known to inhibit the production of many secondary metabolites. This “catabolite repression” was thought to be due to intermediates generated from the rapid catabolism of glucose interfering with enzymes in the secondary metabolism process.

We explored the effect of carbon sources on antibiotic production by inoculating the selected isolates on the basal medium having different sugars like Sucrose, Cellulose, Mannitol, Galactose, Lactose, Maltose, Glucose, starch, and Fructose. The maximal cell efficiency for antibiotic production was in the following manner (starch > cellulose> raffinose> meso-inositol> mannitol>glycerol> galactose> glucose >) by *Streptomyces crystallinus.* AZ- A151. These results indicated that starch was the excellent carbon source for antibiotic production by *Streptomyces crystallinus.*

The present study agreed with [Atta *et al.*, 2011] who stated that glycerol, starch, and maltose were excellent carbon sources for neomycin production by *Streptomyces fradiae*. Also [Sousa *et al.,* 2002] stated that when glucose was substituted by fructose in 30 g/L concentrations, all the actinomycins antibiotic concentrations produced by the three tested species of *Streptomyces*, *S. parvulus*, *S. felleus* and *S. regensis*, were higher than with glucose. [Bandi *et al.,* 2003] found that effective neomycin production by *Streptomyces marinensis* (6920 mg/L) was achieved with maltose. [Sultan *et al.,* 2002] reported that glycerol as a carbon source was the most suitable for large scale production of antibiotic by *Streptomyces* Species. [Ramadan, 2000] showed that glucose was the most adequate carbon source followed by starch for antibiotic production. [Mellouli *et al.,* 2003] reported that Antibiotic production was only observed when starch was used as carbon source.

The use of unsuitable amino acids as a nitrogen source can inhibit the biosynthesis of

secondary metabolites [Ahronowitz, 1980 and Martain and Demain, 1980]. Conversely, specific amino acids can, in some cases, enhanced antibiotic production.

The best nitrogen source for the biosynthesis of antimicrobial agent(s) produced by Streptomyces *crystallinus,* AZ-A151 were obtained at $NaNO_3$. Similar results were obtained by other workers on other metabolites produced by other microorganisms, e.g.: [Atta *et al.,* 2011].

Sources of nitrogen were important for the production of antibiotic by microorganisms. [Hobbs *et al.,* 1990] reported that the carbon and nitrogen sources affected actinorhodin production by *S. coelicolor*. Similarly, growth and pristinamycin production in *Streptomyces pristinaespiralis* had been recorded to be governed by nitrogen sources [Francois and Stephane, 2001]. In *Streptomyces clavuligerus*, amino nitrogen as well as urea support cephalosporin production [Aharonowitz and Demain, 1979]. Optimization of cultural conditions for antibiotic production had also been attempted [Haque *et al.,* 1995] in *Streptomyces antibioticus* Sr15.4 and *S. californicus* JCM6910. However, [Lee and Hwang, 2002] reported that inoganic nitrogen sources played an important role in determining the production profile of rifamycin B with KNO_3 showing a positive influence on antibiotic production. [Vasavada *et al.,* 2006] reported that *S. kananmyceticus* M27 yielded maximum antibiotic production with sodium nitrate. [Farid *et al.,* 2000] ammonium sulphate, sodium nitrate was the suitable nitrogen sources in supporting the antibiotic production.

In the present data the favorable level of K_2HPO_4 for antimicrobial agent(s) production was 0.8g/l in case of *Streptomyces crystallinus*. AZ-A151. The antimicrobial agent(s) production was decreased by increasing concentration of K_2HPO_4. These results agree with [El-Tayeb *et al.,* 2004b] who stated that, increasing the concentration of KH_2PO_4 above 0.1% caused a marked decrease in rifamycin B production (36- 45%), while total elimination of KH_2PO_4 caused only 12% decreased. [Sujatha *et al.,* 2004] also reported that K_2HPO_4 at a concentration of 1.2 g/l gave maximum yield of antibiotic.

The final consideration in terms of basic media composition for secondary metabolic production was which trace elements to add [Weinberg, 1970]. The present results indicated that the optimal level of $MgSO_4.7H_2O$ for antibiotic production was 0.7 g/l in case of *Streptomyces crystallinus,* AZ-A151. The optimal level of vitamins for antimicrobial agent(s) biosynthesis was 200 ppm from vitamin H at shaking speed 160 r.p.m in case of *Streptomyces crystallinus,* AZ- A151. These results agree with [Hassan *et al.,* 2001] who showed that addition of 0.5g/l magnesium sulphate to the culture medium was optimal for the production of a maximum yield of antibiotic by *S. violatus*. [Sujatha *et al.,* 2004] also showed that the addition of 0.5 g/l of magnesium sulfate to the culture medium was optimal for antibiotic production.

5. Conclusion

Growth pattern and antimicrobial profile of *Streptomyces crystallinus,* AZ-A151 were studied on Starch Nitrate (SN) broth medium. An attempt has been made to evaluate the optimal cultural conditions for obtaining high yields of bioactive metabolites against *Staphylococcus aureus*, NCTC 7447; *Escherichia coli*, NCTC 10416; *Klebsiella pneumonia*, NCIMB 9111; *Salmonella typhi*; *Saccharomyces cerevisiae,* ATCC 9763; *Aspergillus flavus*, IMI 111023; *Alternaria alternate* and *Fusarium verticillioides*.

6. Corresponding Author:
Prof. Dr. Houssam M. Atta
Botany and Microbiology Department, Faculty of Science (Boys), Al-Azhar University, Cairo, Egypt. The present address: Biotechnology Department. Faculty of Science and Education- Al-Khurmah, Taif University; KSA.
E-mail: houssamatta@yahoo.com
houssamatta@hotmail.com
Tel: 00966506917966

7. References

1. **Abbanat, D.; Maiese, W.; and Greenstein M. (1999).** Biosynthesis of the pyrroindomycins by *Streptomyces rugosporus* LL-42D005; Characterization of nutrient requirements. *Journal of Antibiotics* 52(2): 117-126.
2. **Adinarayana, K.; Ellaiah, P.; Srinivasulu, B.; Bhavani, R. and Adinarayana, G. (2003).** Response surface methodological approach to optimize the nutritional parameters for neomycin production by *Streptomyces marinensis* under solid-state fermentation. Andhra University, Process Biochemistry 38, 1565-1572.
3. **Aharonowitz, Y. (1980)**. Nitrogen metabolite regulation of antibiotic biosynthesis. *Annual Review of Microbiology,* 34: 209-233.
4. **Aharonowitz, Y. and Demain, A.L. (1979)**. Carbon catabolite regulation of cephalosporin production in *Streptomyces clavuligerus*. Antimicrobial Agents and Chemotherapy 14(2): 159-164.
5. **Atta, H.M.; El-Sehrawi, M. H.; Awny, N.M. and El-Mesady, N.I. (2011).** Microbiological Studies on Cultural, Physiological Characteristics and Antimicrobial Activities of

Streptomyces Cyaneus-AZ-13Zc. Researcher, 2011;3 (2): 80-90.

6. **Augustine, S. K.; Bhavsar, S. P. and Kapadnis, B. P. (2005).** A non-polyene antifungal antibiotic from *Streptomyces albidoflavus* PU 23; *J. Biosci.* 30 201–211.
7. **Augustine, S.K.; Bhavsar, S.P. and Kapadnis, B.P. (2004).** Production of a growth dependent metabolite active against dermatophytes by *Streptomyces rochei* AK 39, University of Pune, India : 164-170.
8. **Baltz, R.H. (2005)**. Antibiotic discovery from actinomycetes: will a renaissance follow the decline and fall? SIM News 2005;55:186-96.
9. **Bandi, S.; Kunamneni, A. and Poluri, E. (2003).** Investigations on Neomycin Production With Immobilized Cells of *Streptomyces marinensis* Nuv-5 in Calcium Alginate Matrix. Andhra University, Visakhapatnam – 530 003, India, article 57.
10. **Barratt, E.M. and Oliver, S.G. (1994).** The effects of nutrient limitation on the synthesis of stress proteins in *Streptomyces lividans. Biotechnology Letters* 16(12): 1231-1234.
11. **Bruheim, P.; Sletta, H.; Bibb, M.J.; White, J. and Levine, D.W. (2002).** High-yield actinorhodin production in fed-batch culture by a Streptomyces lividans strain overexpressing the pathway-specific activator gene actII-ORF4. Norwegian University. Journal of Industrial Microbiology & Biotechnology 28, 103 – 111.
12. **Bystrykh, L.V.; Fernander-Moreno, M.A.; Herrema, J.K.; Malportida, F.; Hopwood, D.A. and Dijkhuizen, L. (1996).** Production of actinorhodin-related blue pigments by *Streptomyces coelicolor* A3(2). *Journal of Bacteriology* 178: 2238-2244.
13. **Egorov, N.S. (1985).** Antibiotics, a scientific approach MIR publisher, Moscow.
14. **El-Naggar, M.Y.; El-Assar, S.A. and Abdul-Gawad, S.M. (2006).** Meroparamycin Production by Newly Isolated *Streptomyces* sp. Strain MAR01: Taxonomy, Fermentation, Purification and Structural Elucidation. *Alexandria University,* The Journal of Microbiology, 432-438.
15. **El-Tayeb, O.M.; Salama, A.; Hussein, M. and El-Sedawy, H.F. (2004b).** Optimization of industrial production of rifamycin B by Amycolatopsis mediterranei I. The role of colony morphology and nitrogen sources in productivity. Afr. J. Biotechnol. 3: 266-272.
16. **Farid, M.A.; El- Enshasy, H.A.; El- Diwany, E.A. and El- Sayed, A.E. (2000).** Optimization of the cultivation medium for natamycin production by *Streptomyces natalensis,* J. Basic Microbiol. 40 3, 157–166.
17. **Francois, V. and Stephane**, **A. (2001).** Nitrogen source governs the patterns of growth and pristinamycin production in '*Streptomyces pristinaespiralis*'. *Microbiology*, **147**, 2447–2459.
18. **Gao, H., M. Liu, J. Liu, H. Dai, X. Zhou, X. Liu, Y. Zhuo, W. Zhang and L. Zhang, 2009.** Medium optimization for the production of avermectin B1a by *Streptomyces avermitilis* 14-12A using response surface methodology. *Bioresour. Technol.,* 100: 4012–4016
19. **Haque, S. F.; Sen, S. K. and Pal, S. (1995).** Nutrient optimization for production of broad spectrum antibiotics by *Streptomyces antibioticus* Sr15.4. *Acta Microbiol. Hung.*, 42, 155–162.
20. **Hassan, M.A.; El-Naggar, M.Y. and Said, W.Y. (2001).** Physiological factors affecting the production of an antimicrobial substance by *Streptomyces violatus* in batch cultures. Alexandria University, Egyptian Journal of Biology, Vol. 3, pp 1-10.
21. **Hobbs, G.; Catherine, M.; Frazer, C.; David, C.J.; Gardner, F.F. and Oliver, S.G. (1990).** Pigmented antibiotic production by *Streptomyces coelicolor* A3(2): Kinetics and the influence of nutrients. *Journal of General Microbiology* 136: 2291-2296.
22. **Jia, B., Z.H. Jin and L.H. Mei, 2008.** Medium Optimization Based on Statistical Methodologies for Pristinamycins Production by *Streptomyces pristinaespiralis*. *Appl. Biochem. Biotechnol.,* 144:133–143.
23. **Jia, Z., X. Zhang and X. Cao, 2009.** Effects of carbon sources on fungal morphology and lovastatin biosynthesis by submerged cultivation of *Aspergillus terreus. Asia-Pac. J. Chem. Eng.,* 4: 672–677.
24. **Kaltenpoth, M., 2009.** Actinobacteria as mutualists: general healthcare for insects? *Trends Microbiol.,* 17: 529–535.
25. **Lee, J.Y. and Hwang, B.K. (2002)**. Diversity of antifungal actinomycetes in various vegetative soils of Korea. Canadian J. Microbiol., 48: 407-417.
26. **Lin, J., L. Bai, Z. Deng and J.J. Zhong, 2010.** Effect of Ammonium in Medium on Ansamitocin P-3 Production by *Actinosynnema pretiosum*. *Biotechnol. Biopro. Engineer.,* 15: 119–125.
27. **Martín, J. F. and Demain, A.L. (1980).** Control of antibiotic biosynthesis. Microbiol. Rev. 44:230-251.

28. **Mellouli, L.; Ameur-Mehdi, R.B.; Sioud, S.; Salem, M. and Bejar S. (2003).** Isolation, purification and partial characterization of antibacterial activities produced by a newly isolated *Streptomyces* sp. US24 strain. Research in Microbiology 154, 345–352.
29. **Newman, D..J and Cragg, G.M. (2007).** Natural products as sources of new drugs over the last 25 years. J Nat Prod 2007;70:461-77.
30. **Nolan, R. and Cross, T. (1988).** Isolation and screening of actinomycetes. In: Goodfellow M, Williams ST, Mordarski M, editors. Actinomycetes in biotechnology. London: Academic Press; 1988. p. 1-32.
31. **Ramadan, A. M. (2000).** Microbiological studies on some antimicrobial agents. M. Sc. Thesis, Botany and Microbiology. Dep. Faculty of science, Al- zhar Univ., Egypt.
32. **Ritacco, F.V., B. Haltli, J.E. Janso, M. Greenstein and V.S. Bernan, 2003.** Dereplication of *Streptomyces* soil isolates and detection of specific biosynthetic genes using an automated ribotyping instrument. *J. Indian Microbiol. Biotechnol.,* 30: 472–479
33. **Ruiz, B., A. Chávez, A. Forero, Y. García-Huante, A. Romero, M. Sánchez, D. Rocha, B. Sánchez, R. Rodríguez-Sanoja, S. Sánchez and E. Langley, 2010.** Production of microbial secondary metabolites: Regulation by the carbon source. *Critical Rev. Microbiol.*, 36: 146–167.
34. **Sánchez, S., A. Chavez, A. Forero, Y. Garcıa-Huante, A. Romero, M. Sánchez, D. Rocha, B. Sánchez, M. Avalos, S. Guzman-Trampe, R. Rodrıguez-Sanoja, E. Langley and B. Ruiz, 2010.** Carbon source regulation of antibiotic production. *J. Antibiot.,* 63: 442–459.
35. **Sathi, Z.S.; Md. Abdu-Rahman, A. and Gafur, M.A. (2001).** Identification and In vitro Antimicrobial Activity of a Compound Isolated from Streptomyces Species. Pakistan Journal of Biological Sciences 4 (12): 1523-1525.
36. **Sembiring, L. and M. Goodfellow, 2008.** Ecological Approach to Unravel Streptomycete Diversity as an Unsurpassed Sources of Natural Bioactive Products. *Microbiol. Indones,* 2:49–56.
37. **Sousa, M.F.V.Q.; Lopes, C.E and Pereira, Jr. N. (2002).** Development of a bio process for the Production of actinomycin-D. Brazilian Journal of Chemical Engineering pp. 277 – 285.
38. **Spizek, J. and Tichy, P. (1995).** Some aspects of overproduction of secondary metabolites. *Floia Microbiol* 40:43–50.
39. **Suetsuna, K. and Osajima, Y. (1990).** Cultural conditions for production of griseorhodin by a culture of *Streptomyces californicus* JCM6910. *Suisan Diagakkakenkyn Hokoku*, 38: 17-22.
40. **Sujatha, P.; Bapi Raju, K.V.V.S.N. and Ramana, T. (2004)** Studies on a new marine streptomycete BT-408 producing polyketide antibiotic SBR-22 effective against methicillin resistant *Staphylococcus aureus*. Andhra University, 0944-5013.
41. **Sultan, Z.M.; Khatune, N.A.; Sathi, Z.S.; Alam Bhuiyan, Md. S.; Sadik, M.G.; Choudury, M.A.; Gafur, M. A. and Md. Rahman, A.A. (2002).** In vitro Antibacterial Activity of an Active Metabolite Isolated from *Streptomyces* Species. University of Rajshahi, Biotechnology, 2-4: 100-106.
42. **Thumar, J.T., K. Dhulia and S.P. Singh, 2010.** Isolation and partial purification of an antimicrobial agent from halotolerant alkaliphilic *Streptomyces aburaviensis* strain Kut-8. *World J. Microbiol. Biotechnol*., 26: 2081–2087.
43. **Valan Arasu, M, V. Duraipandiyan, P. Agastian and S. Ignacimuthu, 2008.** Antimicrobial activity of *Streptomyces* spp. ERI-26 recovered from Western Ghats of Tamil Nadu. *Mycmed.,* 18: 147–153
44. **Vasavada, S.H.; Thumar, J.T. and Singh, S. P. (2006).** Secretion of a potent antibiotic by salt-tolerant and alkaliphilic actinomycete *Streptomyces sannanensis* strain RJT-1. Saurashtra University, Rajkot 360 005, India 10, 25.
45. **Waksman, S.A. (1961).** The Actinomycetes, Classification, Identification and Description of Genera and Species. Baltimore: The Williams and Wilkins Company. Vo.l.2, pp.61-292.
46. **Wang, X., L. Huang, Z. Kang, H. Buchenauer and X. Gao, 2010.** Optimization of the Fermentation Process of Actinomycete Strain Hhs.015T. *J. Biomed. Biotechnol.,* doi:10.1155/2010/141876
47. **Wang, Y.H., Y.P. Li, Q. Zhang and X. Zhang, 2008.** Enhanced antibiotic activity of *Xenorhabdus nematophila* by medium optimization. *Bioresour. Technol.,* 99: 1708–1715.
48. **Weinberg, E. D. (1974).** Secondary metabolism. Control by temperature and inorganic phosphate. Dev. Ind. Microbiol., **15**, 70–81.

2/1/2012

Emotional Maturity and Adjustment Level of College Students

Armin Mahmoudi

Department of Studies in Education, Yasouj branch, Islamic Azad University, Yasouj,Iran
Email: dehlidena@yahoo.com

Abstract: The present study was conducted to see the adjustment level of the post graduate Students of Yasouj city. Emotional maturity was measured by Singh's emotional maturity Scale (EMS). While asthenia's adjustment inventory was used to measure the adjustment Level of the students. For this study a sample of 160 female students of age range 18-22years Studying in post graduate closes were selected from different colleges of Yasouj city. High Positive correlation was obtained between emotional maturity and overall adjustment.
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Keywords: adjustment, maturity, Emotional, Yasouj.

1. Introduction

Adjustment is a process through which requirements and situations. A person does not always Get success according to his desires and efforts. The reason for this lies either in unfavorable situation or in the limited capacities of the individual. When he fails in this effort some abnormality may appear in his behavior. there are so many factors which can influence the process of adjustment level of aspiration , socioeconomic status, family environment, school environment, anxiety, frustration and above all his emotional maturity ,Kaplan and baron (1986) elaborated the characteristics of an emotionally mature person say that he has the capacity to withstand delay in satisfaction of needs . He has belief in long term planning and is capable of delaying or revising his expectations in terms of demands of situation. An emotionally mature child has the capacity to make effective adjustment with himself. Members of his family, his pears in the school, society and culture. But maturity means not merely the capacity for such attitude and functioning but also the ability to enjoy them fully. Therefore, the emotionally mature is not one who necessarily has resolved all conditions that Aroused anxiety and hostility but it is continuously in process of seeing himself in clearer perspective. Continual involved in a struggle to gain healthy integration of feeling, thinking and action. So emotional maturity can be called as the process of impulse control through the agency of self or ego. The main objective of the present study is to see the correlation between the emotional maturity and The level of adjustment of female students of post graduate classes.

2.Methodology

2.1.Sample

For this study a sample of 160 post graduate students were selected from different colleges of Yasouj city through convenience sampling method. All the students were females belonging to lower Middle class families and their age ranged between 18-22 years.

2.2. Design

The present study is a correlation research where the dependent variable is level of adjustment the dependent is their emotional maturity the manipulation in independent variable is done through selection method not by direct manipulation. The design used here is one group repeated trial correlation research design.

2.3.Tool

Emotional maturity scale developed by yashvir singh avd Mahesh bhargava (1984) was used to Study the emotional maturity of the students while asthana's (1967) adjustment Inventory was used to measure the adjustment level of the students.

3.Analysis of the data

Mean, standard deviation and Pearson's product moment correlation method was used to see the Correlation between the emotional mature Acores and adjustment scores obtained by the students.

4.Results and Discussion

The result shows that in the emotional maturity scale the mean score of the female students were found to be significantly correlated with the mean acore obtained by the students on the adjustment inventory. Both in emotional maturity scale and in adjustment inventory norms refer that less mean score indicates higher emotional maturity and adjustment while higher mean score indicates less emotional maturity and less level of adjustment. There are a number of studies on emotional maturity, adjustment and other related variables.

Gakhar (2003) Studied the relationship between emotional maturity self concept and academic achievements Of students at secondary stage. Richards et al., (2003) compared the emotional and behavioral Development of intellectually gifted adolescents have significantly fewer depressive symptoms, a better attitude Towards teachers, greater self reliance and a greater sense of adequacy. It has also been revealed In the study of hanged and aminabhavi (2007) that the adolescents children of employed mothers have Greater emotional maturity than that of housewives. The results indicate that students having less scores in emotional maturity scale (m = 87.7) have less scores in adjustment inventory (m = 139.9) also it means that when emotional maturity is high the general level of adjustment is also good enough. The obtained correlation between the two is 0.78, which means that the two concerned variables are highly correlated to each other.

Actually, emotional maturity is very intimately related to individuals health, adjustment and behavior. So it becomes necessary that a child should have a healthy emotional development. It means that Ones pleasant and unpleasant emotions should develop in such a ratio so that unpleasant emotions Could not influence his mental health. There should be proper development of the ability of emotional catharsis through which he could minimize the intensity of his mental tensions and imbalances ,which arise due to unpleasant emotions.

2/5/12

References

1. Asthana, H. S. Manual of adjustment inventory, rupa psychological centre, Varanasi. 1967.
2. Gakhar, S, C. Emotional maturity of students at secondary stage, self concept and academic achievement, J, of Indian education2003; XXXIX(1), 100-106.
3. Goleman, D. Emotional intelligence, New York, bantom books; 1995.
4. Goleman Working with emotional intelligence,New York, bantom books; 1998.
5. Mangal, suneetha and aminabhavi, V. A. Self concept, emotional maturity and achievement Motivation of the adolescent children of employed mothers and home-makers, J, of the Indian academy Of applied psy. ;2007;33(1), 103-110.
6. Richards, J. ; encel, J. and shute, R. The emotional and behavioural adjustment of intellectually Gifted adolescents, a multi dimensional, multi informant approach, high ability studies;2003, 14(2),153-164.
7. Singh, V. R. Emotional maturity in swadhyayee youths associated with divine brain trust and Non-swadhyayee youths, behavioural acientist;2002, 3(2),81-90.
8. Singh, Y. and bhargava, M. Manual for emotional maturity scale, national psychological Corporation, agra; 1990.
9. Strongman, K. T. The psychology of emotion (2nd edition). New York, john wiley & sons; 1981.

Study of Security and Fraud Detection in Mobile and Wireless Network Technology

Deepak & Ranbeer Singh

(Assistant Prof. Dept. of Computer Science)
I.E.T. Group Of Institution, Alwar

Abstract: The fusion of computer and telecommunication technologies has heralded the age of in- formation superhighway over wire line and wireless networks. Mobile cellular communication systems and wireless networking technologies are growing at an ever faster rate, and this is likely to continue in the foreseeable future. Wireless technology is presently being used to link portable computer equipment to corporate distributed computing and other sources of necessary information. Wide-area cellular systems and wireless LANs promise to make integrated networks a reality and provide fully distributed and ubiquitous mobile communications, thus bringing an end to the tyranny of geography. Higher reliability, better coverage and services, higher capacity, mobility management, power and complexity for channel acquisition, handover decisions, security management, and wireless multimedia are all parts of the potpourri.
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Keyword: Security; Fraud Detection; Mobile, Wireless ;Network Technology.

Introduction:

Wireless technology is presently being used to link portable computer equipment to corporate distributed computing and other sources of necessary information. Wide-area cellular systems and wireless LANs promise to make integrated networks a reality and provide fully distributed and ubiquitous mobile communications, thus bringing an end to the tyranny of geography. Higher reliability, better coverage and services, higher capacity, mobility management, power and complexity for channel acquisition, handover decisions, security management.

Further increases in network security are necessary before the promise of mobile telecommunication can be fulfilled. Safety and security management against fraud, intrusions, and cloned mobile phones, just to mention a few, will be one of the major issues in the next wireless and mobile generations. A "safe" system provides protection against errors of trusted users, whereas a "secure" system protects against errors introduced by D. S. Alexander, W. A. Arbaugh, etc. [1]. Therefore, rather than ignoring the security concerns of potential users, merchants, and telecommunication companies need to acknowledge these concerns and deal with them in a straightforward manner. Indeed, in order to convince the public to use mobile and wireless technology in the next and future generations of wireless systems, telecom companies and all organizations will need to explain how they have addressed the security of their mobile/wireless systems. Manufacturers, M-business, service providers, and entrepreneurs who can visualize this monumental change and effectively leverage their experiences on both wireless and Internet will stand to benefit from it.

Concerns about network security in general (mobile and wired) are growing, and so is research to match these growing concerns. Indeed, since the seminal work by D. Denning [2] , many intrusion-detection prototypes, for instance, have been created. Intrusion-detection systems aim at detecting attacks against computer systems and wired networks, or against information systems in general. However, intrusion detection in mobile telecommunication networks has received very little attention. It is our belief that this issue will play a major role in future generations of wireless systems. Several telecom carriers are already complaining about the loss due to impostors and malicious intruders. Mobile network security, V. Gupta and G. Montenegro [3] in this work we will discuss the intrusion detection systems and describe several aspects of wireless and wired and wireless networks and identify the new challenges and opportunities posed by the ad hoc network, a new wireless paradigm for mobile hosts. Unlike traditional mobile wireless networks, ad hoc networks do not rely on any fixed infrastructure. Instead, they rely on each other to keep the network connected. Next, we will examine the authentication problem of mobile users. Further we shall discuss the problems of cloning and fraud detection in mobile phone operations.

WIRELESS SECURITY PROBLEMS

Security is an essential part of wired and wireless network communications. Interestingly enough, these systems are designed to provide open

access across vast networked environments. Today's technologies are usually network-operation-intrusive, i.e., they often limit the connectivity and inhibit easier access to data and services. With the increasing popularity of wireless networks, the security issue for mobile users could be even more serious than we expect. The traditional analogue cellular phones are very insecure. The 32-bit serial number, the 34-bit phone number, and the conversation in a cell can be scanned easily by an all-band receiver. The widely used advanced mobile phone system (AMPS) is an analogue phone system. Therefore, sending a password or a host name through this system can be a serious security issue. Other security issues in wireless networks that have been studied extensively are anonymity and location privacy in mobile networks; these have received a great deal of interest recently S. P. Shieh, C. T. Lin, and J. T. Hsueh, [4]. A typical situation is one in which a mobile user registered in a certain home domain requests services while visiting a foreign do-main. Concerned about security and privacy, the user would prefer to remain anonymous with respect to the foreign domain. That is, only the home domain authority should be in- formed as to the mobile user's real identity, itinerary, whereabouts, etc. Another important issue, namely cloning phones, raises a number of concerns to many telecom carriers. In- deed, many telecommunication companies are losing money due to the use of clones or genuine mobile phones by impostors. One might argue that although it is rather easy to clone an AMPS phone, it is much trickier to clone a D-AMPS, a GSM, or an IS-95 phone. However, the security issue remains, and needs to be resolved in the next wireless network generation. Consequently, there has been a great deal of interest recently in designing mo- bile phones using new technologies, such as Boot Block flash technology used by Intel Corporation, that will make it much more difficult to clone cellular phones. However, to the best of our knowledge there is very little work being done at the software level. To combat cloning, cellular operators analyze usage to check for unusual patterns. Most obviously, they know that genuine phone cannot be in two places at once. If a phone is making more than one call at a time, it has definitely been cloned. Furthermore, to verify if a call is out of the client patterns, current software (i) does not have an efficient automatic process to warn clients about the impostors using their mobile phones; in most of these systems, human staff are used to do that (only lists of large bills are reviewed to identify cloned phones); (ii) has no efficient ways to control/identify impostors; and (iii) uses an "experimental satisfaction" to prove the correctness of the security framework. Some systems provide the billing process via the Web. However, the identification of a cloned phone is done only at the end of the month. This, unfortunately, is not quite efficient and may lead to a big loss of revenue for the carrier.

The wireless Web opens up many new business opportunities, the most important of which use location-based technology. Ever since the mobile Internet was first suggested, antivirus companies have warned that viruses could attack cellular phones and PDSs. Timofonica was among the first viruses that attacked cell phones. Timofonica was an ordinary virus programmed to send abusive messages to random users of Spanish Telefonica mo bile systems. Viruses are a threat to any computing platform and may be a threat to wire- less terminals that include processing and memory akin to those of modern computers.

WIRELESS SECURITY MANAGEMENT PLAN

An adequate security system management policy has long been an important issue. A comprehensive network security plan must also consider losses of privacy when we define authentication and authorization as well as losses of performance when we define key management and security protocols. Therefore, a security plan must encompass all of the elements that make up the wireless and/or wired network, and provide important services such as:

1. Access control, i.e., authorization by capability list, wrappers, and firewalls (access control matrix)
2. Confidentiality, i.e., we must ensure that information and transmitted messages are accessible only for reading by authorized parties
3. Authentication, i.e., the receiver must be able to confirm that the message is indeed from the right sender
4. Nonrepudiation, i.e., the sender cannot deny that the message was indeed sent by him/her
5. Integrity, i.e., the message has not been modified in transit
6. Availability, i.e., making sure that the system is available to authorized parties when needed
7. Security administration, i.e., checking audit trails, encryption and password management, maintenance of security equipment and services, and informing users of their responsibilities.

INTRUSION DETECTION SYSTEMS (IDS)

Intrusion is most probably one of the key issues that wireless and mobile systems will have to deal with. The nature of wireless ad hoc networks makes them very vulnerable to an adversary's malicious

attacks. Generally speaking, an intrusion can be defined as an act of a person or proxy attempting to break into or misuse your system in violation of an established policy. Very little research work dealing with the intrusion problem has been done for wireless networks.

In our work, we shall describe the intrusion problem in general. We hope that re- searchers will pick up what has been done in related areas, and find efficient approaches on how to deal with this problem in an ad hoc network environment. There are many different intrusion systems available in the marketplace. Expert systems are based on knowledge-based intrusion detection techniques. Each attack is identified by a set of rules. Rule-based languages N. Habra et al., Asax: [5] are used for modeling the knowledge that experts have accumulated about attacks/frauds. Information regarding some intruders has also been added to these systems. A major drawback of knowledge-based intrusion systems is the difficulty of gathering the information on the known attacks (which should be updated regularly) and developing a comprehensive set of rules that can be used to identify intrusive behaviors. Some systems use a combination of several approaches to cover both the normal and proper behavior schemes T. Lunt, Automated audit trail analysis intrusion: and detection [6].

SECUREING DATA TRANSFER IN DIGITAL MOBILE SYSTEMS AND AD- HOC NETWORK

All digital mobile systems provide security through some kind of encryption. Data can be encrypted in many ways, but algorithms used for secure data transfer fall into two categories: symmetric and asymmetric. Both rely on performing mathematical operations using a secret number known as a key. The difficulty with symmetric algorithms is that both parties need to have a copy of the key. On the other hand, asymmetric techniques use two separate keys for encryption and decryption. Usually, the encryption key can be publicly distributed, whereas the decryption key is held securely by the recipient.

The most widely used symmetric algorithm in DES (data encryption standard), developed by IBM in 1977. It uses a 56-bit key, which seemed unbreakable at that time. In 1997, a group of Internet users managed to read a DES-coded message. Most organization now use triple-DES, which uses 112 bits. Many WLANs in use today need an infrastructure network. Infrastructure networks not only provide access to other networks, but also include forwarding functions, medium access control, etc. In these infrastructure-based wireless networks, communication typically takes place only between the wireless nodes and the access point, but not directly between the wireless nodes. Ad hoc wireless networks, however, do not need any infrastructure to work. Each node can communicate with another node; no access point controlling medium access is necessary. Mobile nodes within each other's radio range communicate directly via wireless links, whereas those that are far apart rely on other nodes to relay messages as routers. Node mobility in an ad hoc network causes frequent changes of the network topology.

AUTHENTICATION AND FRAUD DETECTION FOR MOBILE SYSTEM

Some wireless communications systems protocols such as GSM S. P. Shieh, C. T. Lin, and J. T. Hsueh, S. P. Shieh, C. T. Lin, and J. T. Hsueh, [8] and IS-41 S. Mohan [7] use the secret key crypto-system for authentication. Although the authentication of these systems is only unilateral, and the user's identity and location are not anonymous, the protocols provide more security functions, such as identity, confidentiality, and mutual authentication. The drawback of the above schemes is that they all need a third party, i.e., a third trusted server such as the home location register (HLR) and old visitor location register (VLR). Although HLR creates a record that contains the mobile station's (MS) directory number, profile information, current location, and validation period, etc., whenever the MS subscribes to the service of a mobile system, VLR records the temporal information for the MS when it visits a mobile system other than the home system. HLR acts as the CA; VLR is responsible for authenticating the MS.

With the increasing popularity of wireless networks, the security issue for mobile users could be even more serious than we expect. Before the mobile phones became widely popular, the greatest threat to the network security in most organizations was dial- up lines. While dial-up lines still merit attention, the risks they pose are minor when com-pared to wireless and mobile connections. To break the system, one need only buy a piece of portable radio equipment, such as a scanner, to program a mobile cloned to debit calls from genuine mobile phone, and register the frequencies at which mobile phones operate in surrounding areas. Then the person committing the fraud may, for example, park his car in a shopping mall, jot down various frequencies, transfer the data to clones, and then pass them to whoever may be interested in these cloned mobiles.

Conclusion:

In this paper we studied about the fraud detection of wireless application when any unwanted person entered in this application. We can capture the fraud person who entered without person. Because in this theory we can implemented the wireless application.

Reference:

1. D. S. Alexander, W. A. Arbaugh, A. D. Keromytis, and J. M. Smith, Safety and security of pro-gram able networks infrastructures, *IEEE* Communications *Magazine, 36,* 10, 84–92.
2. D. Denning, An intrusion-detection model, *IEEE Transactions on Software Eng.,*
3. V. Gupta and G. Montenegro, Secure and mobile networking, ACM*/Baltzer MONET, 3,381*–390, 1999.
4. 14. S. P. Shieh, C. T. Lin, and J. T. Hsueh, Secure communication in global systems for mobile telecommunication, in *Proceedings of the First IEEE Workshop on Mobile Computing*, 1994
5. 15. N. Habra et al., Asax: Software architecture and rule-based language for universal audit trail analysis, in *Proceedings 2nd European Symposium on Research in Computer Security*, LNCS, vol. 648, 1992.
6. 16. T. Lunt, Automated audit trail analysis and intrusion : detectionA survey, in *Proceedings 11th* International Computer Security Conference, 1988
7. 17. S. Mohan, Privacy and authentication protocol for PCS, *IEEE Personnel Communication*, 1996,
8. 18. S. P. Shieh, C. T. Lin, and J. T. Hsueh, Secure communication in global systems for mobile telecommunication, in *Proceedings of the First IEEE Workshop on Mobile Computing*, 1994.

2/5/12

Transmission Power Control Techniques in the Adaptive S-MAC protocol

Gaurav Sharma[1], Dharmbeer Singh[2], Garima Bhardwaj[3]

1. Associate Professor, at Lord Krishna Group of institution, Ghaziabad
2. Associate Professor, at Lord Krishna Group of institution, Ghaziabad
3. Associate Professor, at Lord Krishna Group of institution, Ghaziabad

gaurav21.leo@gmail.com, dharm033@gmail.com, gari2787@gmail.com

Abstract: Because of the difficulty in recharging or replacing the batteries of each node in a Wireless Sensor Network, the *energy efficiency* of the system is a major issue in the area of network design. Other critical parameters such as delay, adaptability to traffic conditions, scalability, system fairness, and throughput and bandwidth utilization are mostly dealt as secondary objectives. Some sensor network applications adopt IEEE 802.11-like MAC protocol, which is however, not a good solution for sensor network applications because it suffers from energy inefficiency problem. The adaptive Sensor-MAC (S-MAC) proposes enhanced schemes such as periodic sleep and overhearing avoidance to provide a better choice for different sensor network applications. In this research paper we propose an energy efficient MAC (EE-MAC) protocol, which is based on adaptive S-MAC with added transmission power control techniques. The main contribution of our work is to introduce a controlled power transmission of RTS, CTS, DATA and ACK frames according to the adaptive S-MAC protocol. We simulate our proposed protocol i.e., EE-MAC protocol using ns-2.33 simulator for two parameters *energy consumption* and *throughput,* for determining the behavior of the proposed protocol. The simulation results show that our proposed EE-MAC protocol performs better than adaptive S-MAC protocol in terms of energy consumption and throughput.
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Key words: Wireless Sensor Network, IEEE 802.11,S-Mac Protocol, Transmission Power Control(TPC)

Introduction

Wireless sensor networks (WSNs) have gained world-wide attention in recent years due to the current advancements in the area of digital circuitry (i.e., micro-electro-mechanical systems (MEMS) technology) that has facilitated the development of smart sensors. The sensor networks are highly distributed networks of small, lightweight wireless nodes, deployed in large numbers to sense, measure, and gather information about some physical parameters such as temperature, pressure, or relative humidity, and characteristics of objects and their motion from the environment and based on some local decision process; they can transmit the sensed data to the user.

Each node of the sensor network consists of following four subsystems:

- **Sensor Subsystem:** It senses the environment.
- **Processing Subsystem:** It performs local computations on the sensed data.
- **Communication Subsystem:** It is responsible for message exchange between neighboring sensor nodes.
- **Power Subsystem:** It provides power for accomplishing above tasks.

Unlike, traditional networks, a WSN have its own design and resource constraints. Design constraints are application dependent and are based on the monitoring environment. Resource constraints include a limited amount of energy, short communication range, bandwidth, limited processing and storage in each node. The distinct features that makes wireless sensor network different from traditional wireless ad hoc networks are outlined below:

- The number of sensor nodes in a sensor network can be of several orders of magnitude higher than the nodes in an ad hoc network.
- Sensor nodes are usually densely deployed.
- Sensor nodes are more prone to failures.
- Network topology changes very frequently.

- Sensor nodes mainly use broadcast communication pattern whereas most ad hoc networks are based on point-to-point communications.
- Sensor nodes are limited in power, computational capacities, and memory.

Fundamentals of MAC Protocol for WSNs

For maximizing the network lifetime, the proposed MAC protocol must be energy efficient. This can be achieved by reducing the potential energy wastes. Types of communication patterns present the behavior of the sensor network traffic that has to be handled by a given MAC protocol; the properties that must be possessed by a MAC protocol to suit a sensor network environment are outlined below.

- COMMUNICATION PATTERNS
- PERFORMANCE REQUIREMENTS
- SOURCES OF ENERGY WASTE

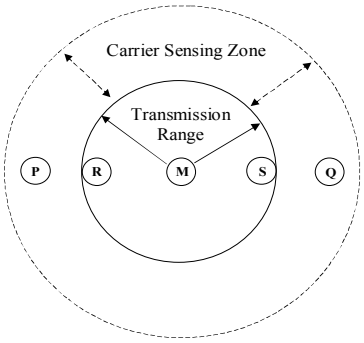
Related Work

IEEE 802.11

IEEE 802.11 is the standard MAC layer protocol which is proposed for wireless LANs. This scheme is a contention-based protocol which employs RTS/CTS control packets in order to reduce collision which may occur due to hidden and exposed node problem. Beside, this, it uses both physical and virtual carrier sense mechanism to indicate the free channel. Now we define the terms *transmission range* and *carrier sensing zone* which are used for clear understanding of the proposed protocol.

- *Transmission range:* It is the distance between sender node and its neighboring nodes that can receive and correctly decode the packets coming from the sender node. The level of power used in transmission and radio propagation properties (i.e., attenuation) determines the transmission range.
- *Carrier sensing zone:* When a node is within the carrier sensing zone, it can sense the signal but cannot decode it correctly. It does not include transmission range because nodes in transmission range can definitely sense the transmission as well as decode it correctly.

However, the IEEE 802.11 technique suffers from energy inefficiency problem. This problem is solved by S-MAC protocol which combines the features of both Contention based as well as TDMA protocols which have been considered as the best provider for energy saving. The TDMA approach schedule transmission times of neighboring nodes to occur at different times. However, the major disadvantage of this technique is that it is not well adaptable to topology changes.



Nodes in the transmission range can receive and decode packets correctly, whereas nodes in the carrier sensing zone can sense a transmission, but cannot decode it correctly.

S-MAC Protocol

The S-MAC protocol is considered to be the first standard MAC protocol which is proposed for WSNs in order to reduce energy consumption by all the sources of energy wastage i.e., idle listening, collision, control overhead, overhearing, and over emitting that were discussed earlier. In exchange the protocol incurs some performance reduction in per-hop fairness and latency. The S-MAC uses multiple techniques to reduce energy consumption, control overhead, and latency, in order to improve application-level performance.

1. Periodic listen and sleep: In S-MAC the energy lost caused by idle listening is reduced by letting nodes to go to in sleep mode periodically (as shown in below *fig.*), instead of constantly listening to an idle channel. When a node is in sleep mode its radio will be turned off, thus conserving energy.

Periodic listen and sleep

We call a complete cycle of the listen and sleep intervals, a frame. So,

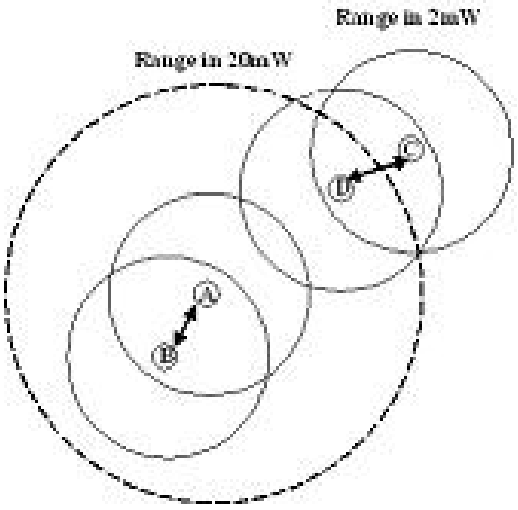
$$T_{Frame} = T_{Listen} + T_{Sleep}$$

2. Synchronizing schedules: Synchronization between neighboring nodes is accomplished by means of broadcasting SYNC packets which are exchanged periodically between neighboring nodes. In this way, nodes make a

cluster sharing in the same schedule. This mechanism allows S-MAC to reduce control packets overhead. Each node in the network is free to choose its own or other nodes schedule by following the steps mentioned below:

3. Listen to sufficient amount of time to hear the existing schedule, if not, then, the node chooses its own schedule and broadcasts to its neighbors.
4. If a schedule is reserved, it will be followed by the node, then broadcast after a random amount of time to avoid collisions between SYNC packets issued from nodes which select the same schedule.
5. Two schedules will be followed if a new schedule is received, and another is followed and broadcasted.
6. Overhearing avoidance: radios are turned off while the shared media is used for transmission between other nodes. However, when a node hears a RTS or a CTS packet and doesn't present the data recipient, it goes to sleep until the current transmission ends.
7. Message passing: This scheme is used to reduce contention latency for sensor network applications requiring store-and-forward processing as data are moved through the network. In S-MAC, the RTS packet allocates the shared medium for transmitting the entire message instead of reserving the medium just for the first fragment like in IEEE 802.11. In later, each fragment and its ACK play the role of RTS/CTS sequence for the next fragment.

A closer look at the periodic listen and sleep scheme reveals that a message may incur increased latency as it is stored and forwarded between adjacent network nodes. To address this shortcoming, the protocol uses a technique referred to as adaptive listening. The basic idea is to let the node which overhears its neighbor's transmissions (ideally only RTS or CTS) wake up for a short period of time at the end of the transmission. In this way, if the node is the next-hop node, its neighbor is able to immediately pass the data to it instead of waiting for its scheduled listen time. If the node does not receive anything during the adaptive listening, it will go back to sleep until its next scheduled listen time.



The need for power control

Transmission Power Control (TPC)

To further reduce the energy consumption TPC techniques need to be applied. It is important in WSN for at least two reasons:

1. It can affect the battery life of the nodes.
2. It can affect the traffic carrying capacity of the network.

TPC techniques improve the performance of the network in several aspects:

1. It improves the reliability of a link by increasing the transmission power upon detecting that the link reliability is below a certain threshold.
2. Only nodes which share the same space will contend to access the medium thereby decreasing the amount of collisions, latency, hidden and exposed terminal in the network while enhancing network utilization.
3. By using a higher transmission power, the physical layer increase the bandwidth in the presence of heavy traffic and by decreasing, it maximizes the energy savings.

A power control mechanism that can be incorporated into the IEEE 802.11 RTS-CTS handshake is proposed in to perform the handshake at the maximum initial power level to avoid packet collision from the interfering nodes. However DATA and ACK packet may be sent at a lower power level. BASIC scheme consumes less energy than IEEE 802.11 MAC protocol.

Uptil now, the primary goal for wireless sensor networks in general and mainly in MAC has been energy efficiency. Although TPC techniques present an effective mechanism to reduce energy consumption they

are still not implemented in any existing MAC protocol because of highly imprecise nature of transceiver readings and limited resources of sensor nodes. This enables us to propose a new *Energy Efficiency MAC (EE-MAC)* protocol which uses the techniques employed in adaptive SMAC with added transmission power control functionality to combine the strengths while offsetting their weaknesses.

Proposed Energy Efficient MAC (EE-MAC) Protocol

It is based on adaptive S-MAC protocol with transmission power control mechanism. It consist of following steps-

1. Firstly node A in the network broadcast SYNC packet with maximum transmission power i.e. P_{TX_MAX} in order to synchronize its schedule for reducing control overhead. After choosing its schedule either by receiving SYNC-REC packet from one of its neighbors or according to conditions. However, here we assume that each time the node selects its own schedule.
2. When synchronization is done, we divide the transmission power to different levels i.e., from P_{TX_MIN} to P_{TX_MAX}; node A sends an RTS packet to node B, using maximum power.

The power received by destination node separated from sender node by distance *d* is calculated by two-ray ground or two-path model which is as follows:

$$P_r = P_t G_t G_r h_t^2 h_r^2 / d^4 L$$

Where,

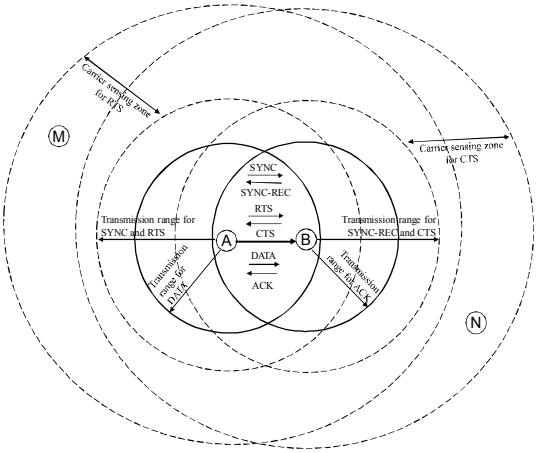
P_t = Transmission power
P_r = Receiving power
G_t = Antenna gains of transmitter
G_r = Antenna gains of receiver
h_t = Height of transmitting antenna
h_r = Height of receiving antenna
L = System loss

The minimum transmission power P_{TX_MIN} that can be received by a node must satisfy the equation (1) and (2):

$$P_{TX\_MAX}/P_r = P_{TX\_MIN}/P_{r\_threshold} \text{ ---------- (1)}$$
$$P_{TX\_MIN} = (P_{TX\_MAX} * P_{r\_threshold})/P\text{--- ----- (2)}$$

Where,
$P_{r\_threshold}$ is the minimum necessary received signal strength,
P_{TX_MAX} is the maximum power transmitted, and
P_{TX_MIN} is the minimum power transmitted.

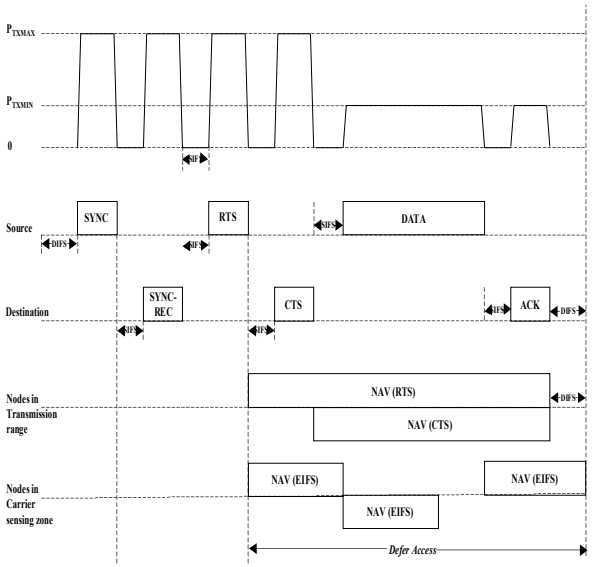
3. The receiver upon receiving the RTS packet calculates the minimum required transmission power level of it i.e., $P_{TX\ MIN}$ by using equation (2).The receiver sends the CTS frame with maximum power along with $P_{TX\ MIN}$. Thus nodes M and N that are located in the carrier sensing zones of nodes A and B defer their transmission for a sufficient period of time i.e., EIFS so as not to interfere with the RTS-CTS exchange as illustrated in *fig.*



Packet Transmission in EE-MAC Protocol

4. After the RTS-CTS handshake the sender node has the information of the required minimum transmission power. Therefore the DATA and ACK frames are transmitted at minimum required power level.

When source and destination nodes transmit RTS and CTS packets, nodes in the transmission range correctly receive these packets and set their NAVs for the duration of the whole packet transmission. However, nodes in the carrier sensing zone only sense the signal and cannot decode it correctly, so these nodes set their NAVs for EIFS duration (when they sense the channel changing state from busy to idle). The purpose of EIFS is to protect an ACK frame at the source node. The NAV setting and the power level changes for SYNC-SYNC-REC-RTS-CTS-DATA-ACK transmissions are depicted in *fig.*



NAV setting and Transmission Power Pattern in EE-MAC Protocol

5. ***Building and Updating Power Control Table*:** Each sensor node stores the values of P_{TX_MIN} for its neighbor and the corresponding P_{TX_MIN} to transmit DATA and ACK frames in the next communication cycle. For this we need power control table as shown in *fig.* below:

neigh_node_id	power_level

Transmission Power Control Table

Modified Energy Model

To support the simulation of our proposed EE-MAC protocol, we have modified the extended energy model. Major changes have been made in the physical layer (ns-2/mac/wireless-phy.{h, cc}) and the energy model (ns-2/mobile/energy-model.{h, cc}). Energy model is a node attribute that has an initial value which represents the level of energy, the node has at the beginning of the simulation known as *initialEnergy_*. It also gives energy usage for every packet it transmits and receives, known as *txPower_* and *rxPower_* respectively.

The energy model is used through the node configuration API which consists of the type of addressing structure used in the simulation, defining the network components for mobile nodes, turning on/off trace options at Agent/Router/MAC levels, selecting the type of adhoc routing protocol wireless nodes or defining their energy model.

Conclusion

Wireless sensor networks must be designed keeping energy efficiency in mind. Several protocols have been developed for this purpose, but none can actually fulfill the changing application needs. The S-MAC protocol which is a standard protocol, has received considerable attention due to its energy saving schemes designed for sensor network. The S-MAC protocol saves energy but sacrifices latency. To improve latency, adaptive S-MAC protocol has been developed. In order to further increase the energy savings, we add the transmission power control to the adaptive S-MAC protocol. The adjustment of the transmission power, performed by TPC protocols, is a technique to lessen energy consumption in the communication.

Keeping the same idea in mind, we propose an energy efficient MAC (EE-MAC) protocol which saves energy by broadcasting RTS and CTS packets using full transmission power whereas DATA and ACK packets are sent using minimum required transmission power. For this purpose, we change the energy model of the adaptive S-MAC protocol. We simulate our proposed EE-MAC protocol using ns-2. Our experimental results show that in comparison to adaptive S-MAC protocol, EE-MAC protocol achieves more energy saving and higher throughput.

The work carried out in this research paper gives insight into the performance of the adaptive S-MAC protocol after modifying it by adding transmission power control technique. It can be concluded that current work can contribute to the knowledge in a modest way by simulating and realizing that adaptive S-MAC protocol, indeed will perform better by using controlled transmission power, both by saving energy and increasing throughput.

Future Work

We modified the adaptive S-MAC protocol by adding transmission power control technique and evaluated its performance in a limited scenario. However, further modifications can be made to evaluate its performance in a larger network context. Some of the modifications are suggested below:

- The number of nodes can be increased to investigate the protocol behavior under realistic sensor network environments.
- The proposed protocol can be evaluated for mobile scenarios.
- TPC algorithm can be devised in mobile application environment.

Correspondence to:
Gaurav Sharma[1], Dharmbeer Singh[2], Garima Bhardwaj[3]
Associate Professor, at Lord Krishna Group of institution, Ghaziabad

Associate Professor, at Lord Krishna Group of institution, Ghaziabad

Associate Professor, at Lord Krishna Group of institution, Ghaziabad

Cellular phone: 091-09718798021;
091-09811178033;
091-09999077085;
Emails: gaurav21.leo@gmail.com ;
dharm033@gmail.com , gari2787@gmail.com

References

1. J. Yick, B. Mukherjee, and D. Ghosal, "Wireless sensor network survey," Copyright © 2008 Elsevier, pp. 2292-2330.

2. C. Shiva Ram Murthy, and B. S. Manoj, "Ad-hoc Wireless Networks: Architectures and Protocols," Copyright © 2004 by Pearson education, Inc.

3. S. S. Kulkarni, "TDMA Services for Sensor Networks," Proc. 24th Int'l. Conf. Distrib. Comp. Sys. Wksps., Mar. 2004, pp. 604-09.

4. Wei Ye, John Heidmann, "Medium Access Control in Wireless Sensor Networks" USC/ISI TECHNICAL REPORT ISI-TR-580, OCTOBER 2003.

5. I. Demirkol, C. Ersoy, F. Alagoz. "MAC protocols for Wireless Sensor Networks: A Survey" IEEE communication magazine, pages 115-121, April 2006.

6. Koen Langendoen, "Medium access control in wireless sensor networks," Vol. II: Practice and Standards edited by H. Wu and Y. Pan, published by Nova Science Publishers © 2007.

7. P. Naik, K. Sivalingam, "A Survey of MAC Protocols for Wireless Sensor Networks," in: C. Raghavendra, K. Sivalingam, T. Znati (Eds.), Wireless Sensor Networks, Kluwer Academic Publishers, 2004.

8. W. Ye, J. Heidemann, and D. Estrin, "An energy efficient MAC protocol for Wireless Sensor Networks," in Proceedings of the 21st International Annual Joint Conference of the IEEE Computer and Communication Societies (INFOCOM 2002), New York, USA, June 2002, pp. 1567-1576.

9. IEEE 802.11, Wireless LAN media access controls (MAC) and physical layer (PHY) specifications, 1999.

10. W. Ye, J. Heidemann, and D. Estrin, "Medium Access Control with Coordinated Adaptive Sleeping for Wireless Sensor Networks," in IEEE/ACM Transactions on Networking, June 2004, pp. 493-506.

11. Jian Xiao, and Fengqi Yu, "An Efficient Transmission Power Control Algorithm in Wireless Sensor Networks," in Proceedings of, 2007, pp. 2767-2770.

12. H. W. Tseng, S. H. Yang, P. Y. Chuang, E. H. Kuang Wu and G. H. Chen, "An Energy Consumption Analytic Model for A Wireless Sensor MAC Protocol", in Proceedings of the IEEE Vehicular Technology Conference (VTC'2004), September 2004, pp. 4533-4537.

13. T. Ezzedine, M. Miladi, and R. Bouallegue, "An Energy-Latency-Efficient MAC Protocol for Wireless Sensor Networks," in Proceedings of International Journal of Electronics, Communications and Computer Engineering, January 2009, pp. 30-35.

14. J. Gomez and A.T. Campbell, M. Naghshineh, and C. Bisdikian, "Conserving Transmission Power in Wireless Ad Hoc Networks," in ICNP'01, November 2001.

15. S. Agarwal, S. Krishnamurthy, R. H. Katz, and S. K. Dao, "Distributed Power Control in Ad-hoc Wireless Networks," in PIMRC, 2001.

16. M. B. Pursley, H. B. Russell, and J. S. Wysocarski, "Energy Efficient Transmission and Routing Protocols for Wireless Multiple-hop Networks and Spread-Spectrum Radios" in EUROCOMM, 2000.

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