Past Studies

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Life is good for only two things, discovering mathematics and teaching mathematics.

Siméon Denis Poisson

Er tut das Notwendige, das Not wendet.

Lao Tze

1. Summary

As a child, I dreamed to become Einstein No 2. And still this is my lifetime goal. In any case I shall keep myself competitive technically and scientifically in one way or another. Unfortunately I didn't continue with my PH.D. studies at one of the best universities in the world for private reason. My then girlfriend was a Taiwanese and her English or German or French was near zero, therefore I gave up my doctoral study plan and instead got a job in Taiwan (Bechtel's joint venture with the Ministry of Science in Taiwan). I also didn't go to work in Taiwan due to dramatical change later on.

Nevertheless, I have been able to pursue a master study of thermophysics at one of the best universities in China, have learned four or five foreign languages, paving the way for to acquire information of the outside world without any difficulty and obstacle from any organizations. I have also learned almost all software and Internet technologies, enabling me design websites and related functions, so that I may promote my business without a third hand. Of course I've also learned a lot of other stuff, some are still useful, the majority is sleeping forever.
Over the last years I've completed my master degree at one of the best universities in China, acquired four or five foreign languages, acquired wide spectrum of knowledge power, energy, IT and Internet, aviation and other industries. My knowledge is mainly based on three pillars – thermophysics, IT and languages.

My past researches and studies were centered around the above three, with special attention to solar technology, thermal science and Internet technologies.

And in the future, I will more or less concentrate on thermodynamics, starting from solar applications, and later to be extended to all other areas of human knowledge.

2. Change Records

研究			
数学			
	数学-**数论**为主 其它数学 ■ 泛函分析以计算泛函为主 ■ 数理方程/微分积分方程 ■ 数值计算 ■ 密码学 ■ 线性与复杂性科学 ■ 其它	3.5 months	2010.1.30-2010/3/14, 2011-9-28 -
	数学 ■ **数理方程/微分积分方程** ■ 数值计算 ■ 线性与复杂性科学 ■ 数论与密码学 ■ 泛函分析以计算泛函为主	2.5 months	2011-7-12 - 2011-9-28
	1）数学（**泛函分析以计算泛函为主**/数理方程/微分方程数论/密码学，数值计算/线性与复杂性科学） 2）燃烧与污染控制	11 days	2011-3-20- 2011-3-31
	数学 ■ **泛函分析以计算泛函为主** ■ 数理方程/微分方程 ■ 数论与密码学 ■ 数值计算 ■ 线性与复杂性科学	6 months	2010-9-11 – 2010-9-22， 2010-12-23 - 2011-1-24， 2011-2-22 – 2011-3-20， 2011-3-31 – 2011-7-12
	主 - 数学（**泛函分析**，数理方程微分方程，及数值计算）+ 副-流体力学 （纳米/ /细胞等）	20 days	2011-1-4 – 2011-1-24
	计算数学	5 days	2010-9-11 - 2010-9-16
	数学-**微分方程和数值计算为主**	1 days	2010.1.29 – 2010/1/30
流体力学	纳米/ /细胞/流体力学	0	2010-12-19 – 2010-12-23
6	纳米/小系统/生物/非牛顿流体力学/热物理/物理/科学	5	2010.8.1-2010-9-26, 2010-10-10 – 2010-12-19
	计算流体力学	1	2010-9-22 – 2010-10-10
热力学	癌症热力学	1	10.1,10.3, 10.5-7
17	不可逆热力学/不平衡不可逆热力学及其在健康，寿命，社会发展，疾	0	10.1

	病和癌症中的应用		
	生物热力学	4	09.10-10.2
	热力学-太阳相关	**12**	08.10-09.10
太阳	太阳能航空航天	2	07.6-07.7, 07.9-07.10
15	太阳能航空，私人宇航，私人飞机	4	07.3-07.6
	太阳辐射与电磁辐射.太阳物理	**9**	06.3, 07.10-08.6
密码学	**密码学与网络安全加密**	**6**	09.3-09.8, 10.1， 10.3-10.5
6			
德语文学	**德语文学**	1	2007-11
1			
学习			
	IT 与互联网技术	**84**	98-2003， 2010/1/-
	热物理	37	86-89, 06.3
	热泵技术		
	热能工程		
	国际贸易		
	国际金融		
	政治		
	小提琴练习		
	绘画		
	外语		
	英语		
	德语		
	法语		
	俄语		
	希腊语		2009.3
	希伯来语		2009.3
	拉丁语		2009.3
	世界语		

3. Introduction

数学-数论为主
其它数学

? 泛函分析以计算泛函为主
? 数理方程/微分积分方程
? 数值计算
? 密码学
? 线性与复杂性科学

流体力学

6 纳米/细胞/小系统/生物/非牛顿流体力学/热物理/物理/科学
计算流体力学
? 湍流理论
? 一般流体-力学/科学

热力学

? 非平衡非线性/不可逆
17 不平衡不可逆热力学及其在健康，寿命，社会发展，疾病和癌症中的应用
? 生物，细胞
? 健康/疾病/癌症热力学
生物热力学
热力学-太阳相关
? 太阳，
? 黑洞，
? 天体，
? 宇宙，
? 太阳能/光伏，
? 热经济，
? 小系统/纳米，
? 燃烧热力学

燃烧传热

? 传热及计算传热
? 燃烧及计算燃烧/污染控制
? 火电系统/核电系统/
? 热能动力机械[/透平机械(汽轮机/燃气轮机)/锅炉]

热物理
热能工程
热泵技术

太阳

太阳辐射与电磁辐射

? 太阳辐射测量
? 太阳物理
? 太阳光伏
15 太阳能航空，私人宇航，私人飞机

密码学

密码学与网络安全加密

? 网络加密技术
? 加密技术与协议，
? VPN 技术
? 翻墙技术
? 网络隐私
? 加密应用
? VPN 软件和应用

IT 与互联网技术

? 密码学网络安全及破网技术
? 程序开发
? 多媒体
? 数据库
? 网络通信
? 服务器
? 互联网
? WAP
? 操作系统
? 行业软件企业信息化（CRM, ERP, MIS, OA, SCM, powernet）等

外语

英语
德语/德语文学
法语
俄语
希腊语
希伯来语
拉丁语
世界语

^^^

国际贸易
国际金融
政治
小提琴练习
绘画

Today – Academic
Studies and researches

Try to be academic
Acquired Master Degree but
Distant from a Top Scientist

Introduction

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4. WHY SCIENCE?

People may be curious about my decision to turn to scientific research after long career in the business. In fact, I can summarize it as follows:

- Business and politics are full of lies, betrays and crimes
- Science is the only area which can find something exciting to me.
- It is also the best profession fit to my personality
- My desire to understand the Nature better and to know GOD better
- My continuous learning desire

Why do I plan to return to Universities or institutes for scientific researches?

The main reason of this fundamental change of my life and career is my firm belief that only the acquaintance with science and studies of the Nature can give me some sort of satisfaction and happiness. In my childhood, I have always been thinking about becoming a top scientist and this is still my unrealized dream. I am thirsty to learn everything about the Nature and her principles. All branches of sciences are attracting me – mathematics, physics, chemistry…. When dived into the realm of science, I forget the rest of the world.

Secondly, I've found the industry, commerce and politics all full of crimes, evils, lies, corruption and injustice (in fact they are synonyms) , and I hate all these, therefore, after so many years there, I want to keep myself distant away from them and concentrate myself on pure scientific researches.

Thirdly, my personality is very fit for scientific researches. Although working in the industry and business over the last two decades, I am still maintaining my habit to learn new sciences every day without interruption. My reading and study capability is unique. Each day I might read more than 100 pages of books of various kinds. I am able to read papers in English, German and French and I am still improving my Russian.

And lastly, I should have been among the top scientists if I have accepted the Ph.D studies I won from several European and N. American universities such as University of Glasgow (gas turbine combustion), University of Paris (surface chemistry), Laval University, and universities of Germany and other countries during 1991-1992 shortly after graduation as a master of science. I was unable to attend these universities because of private reasons Further in 1996, I was nearly admitted by Harvard to pursue a MPA when my former boss told me that the job at Alstom was worth more than a Harvard MPA, a wrong judgment of course.

For short, only a scientific career can fulfill my dream of lifetime endeavors.

5. SELF-MOTIVATED RESEARCHES & STUDIES

Many years of researches in the following areas

- Mathematics – Numerical computation, functional analysis and now numer theory
- Fluiddynamics - Micro/Nano Flows, CFD - computational fluid dynamics
- Thermal Physics & Thermodynamics - Nanothermodynamics, Thermodynamics Of Cancers, Mesoscopic Thermodynamics (Thermodynamics Of Small Structures), Thermodynamics & Thermophysics Of Life, Cosmic Thermodynamics Or Thermodynamics Of The Universe, Solar Thermodynamics & Thermophysics, Thermodynamics And Thermophysics In Solar Radiation And Measurement, Thermodynamics Of Solar Energy Systems, Solar Technology, Industry And Applications
- Solar Physics, Solar Radiation, Solar Aviation And Aerospace, Solar Photovoltaics

6. Past Studies and Researches Last update: 2011-07-18

Over the past years I've been intensively engaged in studies and researches in different fields, centered around thermal science, solar technology and Internet technologies.

And in the future, I will more or less concentrate on mathematics, focusing on differential equations.

Below is the list of fields where I've studied heavily over the last years:

Fluiddynamics - Micro/Nano Flows, CFD - computational fluid dynamics

Thermal Physics & Thermodynamics - Nanothermodynamics, Thermodynamics Of Cancers, Mesoscopic Thermodynamics (Thermodynamics Of Small Structures), Thermodynamics & Thermophysics Of Life, Cosmic Thermodynamics Or Thermodynamics Of The Universe, Solar Thermodynamics & Thermophysics, Thermodynamics And Thermophysics In Solar Radiation And Measurement, Thermodynamics Of Solar Energy Systems, Solar Technology, Industry And Applications

Solar Physics, Solar Radiation, Solar Aviation And Aerospace, Solar Photovoltaics

German Literature

Refer to this document for some details: Paststudies.pdf ()

7. Unsolved Problems

7.1. 热力学

7.1.1. Can we calculate the human life with thermodynamics?

7.1.2. $dS = dS_i + dS_e$

$dS_i >= 0$????????

7.1.3. $S=kLn\Omega$

Ω是微观状态数， 是针对分子，原子还是其他微观粒子？ 是否可以推广到宏观体系？

7.1.4. 绝对零度达不到吗？

在真空中没有物质，情况又如何？

7.1.5.负温度的问题

7.1.5.1. 负热力学温度

作者：网络 发布时间：2008-09-29 02:31:07 来源：网络

1 温度及其值的正负

温 度是反映热力学系统之间热平衡关系的物理量，处于热平衡的诸系统具有相同的温度。由于就热平衡来说，两个系统的关系只有是否处于热平衡之别，所以温度也只 有相等和不相等之别。不同温度在物理本质上本来无所谓高低的区分，为了定量地比较温度而人为地建立了温标，例如理想气体温标 Tg 定义为

$$PV \propto T_g \qquad (1)$$

热力学温标 T 用卡诺循环定义为

$$Q_1 / Q_2 = T_1 / T_2 \qquad (2)$$

可以证明，Tg ＝ T 。由于温度基准为水的三相点温度，规定为正数 273.16 ，所以按上式定义的热力学温度 T 值总为正数，其最小值为零。而且 T 值越大，我们就认为温度越高，越热。实际上，温度高低或热冷的物理含义在于：两个温度不同的物体接触后，相互间以传热方式交换能量。给出能量的物体称为温度高，或比较热；接收能量的物体称为温度低，比较冷。这样判定的温度高低和 T 值的大小是相对应的。

但是，温标既然是人为规定的，在用理想气体规定温标的情形下，我们也不妨规定一个“负倒温标”，以“L”标记，而按下述二式定义：

$$PV \propto -1 / L \qquad (3)$$

以及 $Q_1 / Q_2 = L_1 / L_2$ （4）

并把水的三相点的温度规定为 $-1 / 273.16 = -0.00366$ 。这样定义的温标 L 与热力学温标 T 将有下述关系：

$L = -1 / T$

（5） 这样，在通常 T 值为正数的范围内，“负倒温度”的值将总小于零，而且当 $T \to 0$ 时，$L \to -\infty$ ；当 $T \to \infty$ 时，$L \to 0-$ 。较大的 T 值，对应于 L 的较大的代数值，而较大的 L 值也就对应于较高的温度（图 1）。这就说明温度的正负值和原来规定温标时采取的定义有关系。

以下讨论的不是人为规定的负温标，而是负的热力学温度，即温标仍用（2）式和基准值 +273.16 规定，但 $T < 0$ 的情况。我们将说明，$T < 0$ 的系统状态是存在的。但是 $T < 0$ 的温度并不比 $T > 0$ 的温度更低，而是更高，甚至比 $T \to +\infty$ 还要高。在负热力学温度范围内，仍然是代数值大的表示温度高，而 0- K 是最高的温度（图 1 中的温标 T）。为什么会是这种情况呢？

对于温度的认识，通常都知道它反映物体的冷热程度。进一步的认识是把它和能量联系起来，认识到它是物体内分子热运动的平均动能大小的标志。其实，按（2）式定义的热力学温度还有一个重要的意义：它反映了系统微观无序度随系统能量变化的情况，因为根据热力学基本关系式式

$$TdS = dE + PdV$$

可得 = （6）

这一公式说明系统的微观无序度（以熵 S 表示）随其内能（E）增大而增大时，系统处于正热力学温度（$T > 0$）的状态。如果系统微观无序度随其内能的增大而减小，则系统的热力学温度将为负值（$T < 0$）。一般的热力学系统，当增加其能量时（如对气体加热使其温度升高，或对晶体加热使之熔化），它的微观无序度总是增大的，因而总是处于正热力学温度的常态。但如果能使系统的熵随能量的增大而减小，就可能得到负热力学温度的状态。

2、实际的负热力学温度

实际的具有负热力学温度的状态可以用自旋系统来说明。

现在已确认原子核都具有自旋角动量，好像它们都围绕自己的轴线旋转运动。这种运动就叫自旋（图 2），自旋角动量是量子化的。在磁场中其自旋轴的方向只能取某些特定的方向，如与外磁场平行或反平行的方向。由于原子核具有电荷，所以伴随着自旋，它们就有自旋磁矩，如小磁针那样。通常以 表示自旋磁矩。磁矩在磁场中具有和磁场相联系的能量。例如， 和磁场 B 平行时能量为 - ，其值较低； 和磁场 B 反平行时能量为 + ，其值较高。

现在考虑某种晶体中由 N 个原子核组成的系统，并假定其磁矩只能取与外磁场平行或反平行两个方向。对此系统加一磁场 B 后，最低能量的状态应是所有磁矩的方向都平行于磁场 B 的状态， 如图 3 （a）所示，其中小箭头表示核的磁矩。这时系统的总能量为 E = - N 。当逐渐增大系统的能量时（如用频率适当的电磁波照射），磁矩与 B 的方向相同的粒子数 n 将逐渐减少，而磁矩与 B 反平行的能量较高的粒子的数目将增多，如图 3（b），（c），（d）依次所示。当所有粒子的磁矩方向都和磁场 B 相反时（图 3（e）），系统的能量到了最大值 E = + N ，系统不可能具有更大的能量了。

至于图 3 各图中粒子排列的无序程度，由（a）到（c），随着方向相反的磁矩的数目的差别的减小，系统的微观无序增大，即系统的熵增大；由（c）到（e），随着与磁场反平行的磁矩数目的增加，无序度减小，因而熵减小。（a）和（e）都是排列整齐的最有序状态，而（c） 是最无序的状态。这表示这种能量有上限的自旋系统，随着它的能量的增大，它的熵可以增大也可以减小。它的熵 S 随能量 E 变化的情况，如图 4 中 S-E 曲线 abcde 所示，其上各点与图 3 中各图对应。

根据（6）式，系统的热力学温度的正负由 S-E 曲线的斜率的正负决定，所以对应于曲线左半部，系统具有正热力学温度，而对应于曲线右半部，系统就具有负热力学温度。具体来说，当系统的能量由 - 逐渐增大到 + 的过程中，它的热力学温度变化如下（图 4 中 T-E 曲线）：

在 E = 时，T = 0+ K，这时系统的能量最低，已无法再从系统取出能量，所以温度是最低的。

E 从 增大到 0（即与 B 平行和反平行的粒子数相等）的过程中，T > 0，而且逐渐增大。到达 E = 0 时，熵取最大值。在 E < 0 的一侧， ；在 E > 0 的一侧，T → -∞，E 从 0 增大到 N 的过程中，T < 0，而且也逐渐增大（代数值）。

E = N 为最大值时，T = 0- K，这时系统的能量最大，它已不可能再接收能量，所以温度是最高的。

由此可知，负热力学温度比正热力学温度更高，或说更热。0+ K 和 0- K 是两个完全不同的物理状态，是两个极端。正负温度并不是通过 0K 而相互过渡的。相反，是通过无穷大而相互过渡的。除了负温度高于正温度这一点的数学和物理含义有点矛盾外，在正的或负的温度范围内，代数值大的温度都表示较高的或较热的温度。

核自旋系统的这种负热力学温度状态在 1950 年被莱姆西、庞德和帕塞尔等在实验室实现了。他们先把 LiF 晶体在通常温度（T ＞ 0）T 置于磁场中。这时晶体内只包括核组成的自旋系统处于类似于图 3（b）所示的状态，磁矩与外磁场平行的核的数目较多。然后突然使外磁场方向改变 180° ，这时由于核磁矩来不及转向，与外磁场反平行的核磁矩的数目就比平行的核磁矩的数目多了（这就类似于图 3（d）所示的情形），而核自旋系统就处于负热力学温度的状态了。不过由于此时核自旋系统的能量很高，它在和晶体中其它运动形式如晶格的振动交换能量的过程中容易损失能量，而最后又会和整个晶体达到热平衡状态而回到正热力学温度，这时磁矩相对于外磁场方向的排列又回到了图 3（b）所示的情况。注意这种从负温度到正温度的过渡是通过了从 -∞ 到 +∞ 的“连续转变点”的。莱姆西等在实验中得到的核自旋系统处于负温度的时间不过几分钟。

现代光源激光管内的气体（或固体）发射激光时，其分子或原子在统计上处于“粒子数反转”的状态的，即具有高能量的分子数比具有低能量的分子数多。在通常的正热力学温度下，由玻耳兹曼定律决定，高能量的分子数应比低能量的分子数少。所以“粒子数反转”的状态也是一种负热力学温度状态。

3、负温度下的热力学定律

负温度下系统的状态变化还应该遵守热力学第一定律，因为能量守恒在任何情况下都应该被遵守。

热力学第二定律指出孤立系的无序性总是增大的，即熵总是增大的。这也是一条基本的自然规律，在负温度下也应成立。但要注意，在负温度区域，由于 T < 0，而 ，所以当吸热时（ ），dS < 0，即系统的熵是减少的。而放热时系统的熵增加（参看图 4 右半部）。由于这个原因，第二定律的两种表述需要审查一下。

第二定律的克氏表述为：热量不能自动地由低温（冷处）传向高温（热处）。在负温度区域，高（热）和冷

（冷）温仍用 T 的代数值的大小来区别，例如 - 100K 为高温， - 300K 为低温（图 5)。热量 Q 由 TA 传到 TB 时，总熵的变化为

$$\Delta S = - Q / TA + Q / TB = Q (1 / TB - 1 / TA) > 0$$

总熵是增加的。从微观上说，这表示在负温度区域热量由高温物体传向低温物体，总的无序度是增加的。这是自然界可能自动进行的情况。反向传热，则 ，是不可能的，即热量不可能自动地由低温传向高温。克氏表述仍适用于负温度区域。

第二定律的开氏表述为：不可能把热全部转变为功而不引起其它变化。在负温度下又如何呢？设想一个卡诺循环，工质从高温吸热 QA，对外做功 A 而把热量 QB 传给低温，其效率为

$$= 1 - QB / QA = 1 - TB / TA$$

现在 $TB / TA > 1$，因而 为负值。这意味着这样的卡诺循环不可能利用热来做功，而是相反，把功转变成了热，即工质从高温吸热 QA，接收外界做功 A，二者和以热量 QB 的形式送入低温，如图 6 所示。这也就是说，要想把一部分功变成热，则必须同时使一定的热量由高温传到低温。这一点和正温度下的情况正相反，那里是要把一部分热转变成功，必须使一定的热量由高温传到低温。

如果进行和上述循环相反的循环过程，从低温热库吸热 QB，则有可能对外做功 A 而把剩余能量 送给高温热库 （图 7)。这一循环的效率为

$$= 1 - QA / QB = 1 - TA / TB$$

由于 $TA / TB < 1$，所以 为正值，且总小于 1 。这和正温度下的卡诺循环一样。但还应注意的是，由于在负温度情况下，热量可以自行由高温 TA 传给低温 TB，所以 QA 可以通过传热直接传回低温热库。这样，当循环进行一周后，其总效果将是工质从热库 TB 吸收（ ）这样多的能量并把它转化为功而没有引起其它变化。这一点也恰和正温度范围内功热转换的规律相反。

因此，在负温度的范围内，热力学第二定律的开氏说法必须改成：使一定的功全部转变成热而不引起其它变化是不可能的。这和正温度范围内的开氏表述正相反，但它并不违背熵增加原理。在功 A 变成热 Q（Q＝ A）而为温度 T 的热库所吸收的情况下，总熵的增加为 $Q / T = \Delta S$，当 $T < 0$ 时，$\Delta S < 0$，熵要减小，因而是不可能的。相反的过程，即从一个负温度热库吸热全部转变为功而不引起其它变化倒是可能的。因为这时 $\Delta S = - Q / T > 0$。从微观上说，这是由于热库放热而无序度增大了。在负温度区域，热比功显得更“贵重”一些。这一点对于总想得到功的工程师来说，的确是非常诱人的。

热力学第三定律说的是绝对零度不能用有限过程达到。这里应推广为不但对绝对冷的 +0K 是如此，而且对绝对热的 -0K 也是如此。因此，在负温度区域热力学第三定律仍有效，只是还应包括 0-K 在内。可以附带指出的是，如用（5）式定义的“负倒温标”L， 则 0+K 相当于 $L = -\infty$ ，0-K 相当于 $L = +\infty$ 。这样第三定律应该说成是正、负无穷大的温度是不可能达到的。这种说法在形式上似乎更容易被人们所接受。

最 后可以指出的是，尽管负热力学温度是存在的，而且负温度热力学有许多引人入胜的地方，但实际上的负温度现象及其应用是非常稀少的，目前几乎没有什么实用价 值。现在实际上遇到的热力学系统，它们的能级都没有上限，因而它们也总处于正热力学温度区域。当然，科学发展是无止境的，也许有一天负温度区域能得到有效 的开发。

7.2. 太阳辐射与光

7.2.1.光速加速问题

光子从辐射体发射开始，到离开速度达到 C 是否从速度零增加到 C？加速过程如何？

7.2.2.$E=\hbar w$ 当 $w \to \infty$ $E \to \infty$???

7.2.3.超光速问题

对光速极限这个结论要加几点注解。
有一种不正确的理解，认为光速极限是一切速度的极限。实际上，光速只是物体运动速度的一种极限，或能量传递速度的一种极限。如果不注意这个条件，一般地谈速度。那么，超光速的现象在物理学中是存在的。

举一个极常见的例子。在节日的晚上，当探照灯射向高空的云层时，由于云层的反射，你会在云层上看到一个亮点。当地面上的探照灯慢慢转动时，亮点却以极快的速度在运动。如果能有足够高的云层，这个亮点的速度就可以超过光速。这时，沿着亮点运动的轨道并没有能量的传递，所以它的速度并不受光速极限的限制。

七十年代以来，射电天文观测的分辨率大大提高。利用所谓甚长基线干涉仪，则其分辨率相当于站在拉萨古城可以看清哈尔滨的一张邮票。用这种技术发现，许多类星体中包含两个相对称的射电子源。更有趣的是，发现有的类星体两个子源的间距在不断地增大。由间距增大的速率可以推算出两个子源的分离速度。对于 3C345，3C273，3C279 等几个类星体，这个分离速度都超过光速，有的甚至达到光速的十倍！

有一种解释这种超光速的模型，就是认为类星体的中心母体喷射出两股相反方向的粒子流（相当于探照灯的光），它照射在星系际介质上（相当于高空中的云），从而激起射电辐射（相当于亮点）。因此，只要中心母体有小的摆动。粒子流照射所激起的辐射区就会迅速地移动。光速不是这种辐射区移动速度的极限，因而超过光速是许可的。

当然，“探照灯”模型只是超光速运动的一种可能的解释。还有许多其它模型也都可以解释超光速现象。目前这个问题还没有公认的合理解释，需要进一步的观测以检验哪一种机制更加合理 。

量子力学

7.2.4.光速在不同引力场中速度一样吗？

7.2.5.光子有尺寸大小吗

光子有大小吗

光有体积吗

7.2.5.1. 光有體積嗎 ?

請問一下:

光具有"粒子性" , 光在空氣中的速度不比在真空中快 , 而且光有"光壓" , 那是不是說光有體積呢 ? 如果沒有體積那為什麼在空氣中速度比真空中慢 ? 而且會產生光壓 ?

如果光有體積 , 那一個充滿氣體分子的容器內打入一道光 , 不就容不下了嗎 ?

還有 , 光若有體積 , 那麼在真空狀況下打入一道光 , 但是持續的抽成真空狀態 , 那光會被抽走嗎 ?

光具有波動性，與粒子性，但是要視實驗的情況來討論
何時是粒子？？？還是波動？？？
愛因斯坦的光電效應，使我們知道光可以「視為」粒子，具有能量。
康普吞效應證明了，光與電子的碰撞過程中，能量要守恆，動量要守恆，就如同在作古典力學的碰撞討論是一模一樣。在討論質點碰撞的問題時，基本上是不用討論其體積或是其大小。如果要有大小，則就應該有質量，現今知道光子的質量是小於 10 的負 32 次方公斤。確切的數值不知。不過大多數的教科書上的理論，光子質量為零。要知道光子的大小，應先知道光子是否有質量。

7.2.5.2. 光子的質量

http://210.60.224.4/ct/content/1977/00090093/0006.htm

【摘要】電磁輻射的粒子常被認為是無質量的，然而物理定律並不需要如此的假設。只是，若光子有質量的話，倒也必是微乎其微的。

一、楔子——光子沒有質量嗎?

光子，亦即光或其他電磁輻射的量子，通常被認為是無質量的粒子。它可攜帶能量和動量，且會因大質量物體的重力影響而偏折，但近代物理裏一般的說法，都把光子的「靜止質量」（rest mass）定為零。如此選定的意義只

是說：光子無法靜止，光不可能是靜止不動的。相反的，只要光子的靜止質量大於零，我們一定可以（至少在原則上）「捕獲」它而測得其質量。

到底我們根據什麼來假設光子的質量恰恰等於零呢？一種說法是：電磁理論的公式按一般寫法，賦予光量子的質量就是零。不過，若任給光子一個質量，我們仍可建立一組同樣可彼此符合的理論。當然光子不可能有很大的質量，否則這個世界將因此而大大不同了！不過，光子仍然可能具有極小的質量，比質子甚至比電子都小很多，但仍大於零。在這種情況下，這個宇宙和無質量光子的那種宇宙差異就十分細微，也只有藉著偵測那些細微的差異，我們方可找出光子的靜止質量。

本文將討論幾個實驗，這些實驗的結果都相當於是「捕獲」而「秤」出光子質量。在此，我們可先說明，這些實驗沒有一個可證明光子的靜止質量是零，事實上，這種證明也不太可能。實驗無法找出光子質量並不證明質量為零，只可說，光子質量要比實驗精確度的極限還要小。目前這些求得的極限值幾可說小到接近於零，然而仍沒有把握說下一個實驗將不會有固定而不是零的質量出現。

測量光子靜止質量的努力早在兩世紀前就開始了，當時並沒有「靜止質量」的觀念，而所作的實驗也和光子沒有關係。早期的研究者，約在十八世紀及十九世紀初葉，只是研究電場和磁場在靜態及緩慢變化下的行為，而寫出了最初的電磁定律，這些定律描述著電荷或電流，與其他電荷、電流或磁場間的交互作用。與本文有關而最重要的，可能就是大家熟知的庫倫定律，庫倫定律說：兩個電荷間的作用力是沿著連接線的方向而與其距離的平方成反比。

1861 年，馬克斯威爾以他那組微分方程式（圖一），而綜合了一個世紀以來有關電磁的實驗與理論研究，這些方程式用向量（包含有大小及方向的一種量）來描述電場與磁場，這些向量再由電荷密度、電流密度及其在時間與空間的變化率來決定。

當馬克斯威爾導出了這些方程式，他看出來這些方程式有波動形式的解，也就是，即使在真空中，仍准許有振動的電場與磁場的波動存在（圖二）。這些電磁波有一個固定的速度，為真空的性質之一。由於此速度相當接近直接測得的光速，馬克斯威爾就正確地揣測出：光是電磁波（今日，我們知道可見光只佔整個電磁輻射波譜中的一小部份而已）。從此，馬克斯威爾的理論才把光和靜電磁的現象連接在一起。

也正是馬克斯威爾的理論，用來解釋新的實驗結果，導致了二十世紀物理最偉大的進展：相對論和量子力學。電磁學也因而和這些理論交織成現代的理論，稱之為量子電動力學。如果預測實驗結果的準確性可視為判斷的基礎的話，量子電動力學可說是一套傑出而成功的理論；這套理論預測某些實驗測得的量，精確度高達億分之一。

量子力學對電磁學加了一個條件，即光或其他電磁輻射是由稱為光子的不連續的單位物所攜帶著，光子之能量 E 與頻率之關係為 $E=h\nu$，其中，h 為蒲朗克（Planck）引入的量子常數，而 ν（希臘字母 nu）為輻射頻率。因此，原來光用波來描述的，現在還要用帶有能量 E 的粒子描述來輔助。（同時，量子力學對一般構成物質的粒子也引入波的描述。）

光子的假說是愛因斯坦在 1905 年，為了解釋光電效應而提出的，同年，愛因斯坦發表了著名的特殊相對論，這也跟電磁理論有密切的關係，愛因斯坦用來發展相對論的假設，正是馬克斯威爾方程式亦隱含著的「光恒以固定速度 c 傳播」。愛氏發現粒子的速度 v 和其靜止質量 M，以及能量 E，有一個關係：$v^2=c^2[1-(Mc^2/E)^2]$。從這個方程式可看出，任一物體，若具有限的靜止質量，它的速度就完全由其能量決定，因為其他量均為常數。而且，我們也得到一個毫不意外的結果，即粒子的速度只有藉能量增加而增加。這個方程式也意味著：任何有質量的粒子，其運動速度不可能達到光速，如果粒子能達到光速，則 Mc^2/E 必須為零，這樣能量 E 就必為無窮大，那是不可能的。因而我們得到個結論：任何具有限質量的粒子的運動速率不能達到光速 c。

如果粒子質量為零，這個方程式所得的預測就大不相同了，當 M 等於零，則不管能量是多少，Mc2/E 恒為零，因此該粒子恒以速度 c 前進，且不管能量為何，不會慢下來或增快。

愛因斯坦假設光子是這類無質量的粒子，可是相對論並不需要這個假設。事實上只要假設 c 是個常數（不一定是光速），則任何具有限質量的粒子當其能量無限制增加時，其速度將趨近於這個常數，如此就夠了。如果光子有質量的話，則其速度依其能量而定，且恒小於 c（圖三）。

二、若光子有了質量將如何？

光子可能有大於零的質量首先在 1930 年由普洛卡（Alexandre Proca）以數學式表出。普洛卡方程式與馬克斯威爾完全一樣，只是多出了兩項（圖一），這新的項與光子質量的平方成正比，而且改變了很多靜電磁場和電磁輻射的重要性質。

帶質量的光子直接產生的一個效應是：不同頻率的電磁波以不同的速率前進，這是量子力學和特殊相對論的必然結果，相對論說帶質量粒子的速度由能量決定，而量子力學則說光子的能量與相對應電磁波頻率成比例，可知，若光子有質量，光波的速度就一定是由其頻率來決定：高頻率的電磁波比低頻者要快。事實上，當頻率減少到一定程度時，任何質量光子的速度將會減至零，換句話說，光停止不動了，這時的頻率是 Mc2/h。

觀測靜止光子的可能性，提供了一個測量光子質量的明確方法。可是要證明這個波是停止不前的，我們得檢視相當大的空間，至少也得大於 h/Mc 的波長，由目前我們已有的光子質量極限值反過來推算，這個「靜止頻率」將少於每 10 秒一個週期，數值的計算顯示，相對於這個頻率的波長將大於 400 倍的地球半徑，很不幸的，要在這麼大的範圍內找出那麼緩慢的振盪是很難的。

另一種方法，或許我們可由不同頻率而不同波速的光找出其所造成的差異，也就是，令波同時出發，經過長時間旅行後，測量所造成抵達時間的差異。而這種波的理想光源就是波霎（pulsar），因為它可很定時的發出光和無線電波。從波霎發出的無線電波抵達地球所經過的時間，可精確度量，結果發現，低頻波是較高頻波延遲了很多，看來，這個延遲的時間似可由光子具有質量來解釋了！事實并非如此，因為星際空間並非完全真空，它包含著各種的物質，其中的自由電子，可使低頻電磁波的速率減慢，我們由其他的證據看出，是星際物質而非光子的質量造成低頻信號的延遲。

非零的靜止質量也會影響光子的偏極化。馬克斯威爾方程式指出，光子可在與運動方向垂直的兩個方向偏極化，普洛卡方程式則允許它有三個偏極化方向，除了前述兩種外，這第三個方向，便是沿著運動的路徑，我們稱為縱向光子（longitudinal photon）。

偏極化可被測出，所以尋找第三個偏極化方向似是決定光子靜止質量的另一可行方法。可是普洛卡的理論認為縱向光子的速度越快，則其電場便越弱；當其速度到達 c 時，其電磁場也就跟著消失。換言之，質量為零的縱向光子是沒有電磁場的，因此無法觀察到；而在馬克斯威爾的理論中本就沒有縱向光子，因此兩者對沒有質量的光子而言是一致的。由縱向光子可能帶的質量看來，它幾乎不和物質作用，譬如，太陽對縱向無線電波就是幾乎完全透明，因此要造個探測器來追蹤這種波又似乎極為困難。

三、由庫倫定律的驗證精確度來看光子的質量

那麼，到底什麼效應才是能觀測到的呢？又我們如何來求得這些有質量光子的極限呢？由上節的事實顯示，拿運動中的電磁波來做實驗，遠較兩百年前科學家所做的靜態場實驗不容易。因此，唯一實際的方法便是找出庫倫定

律及安培定律由帶質量光子所造成的偏差。這兩個定律是第一個正式被提出的電磁學原理，包含在馬克斯威爾方程式的第一及第四公式裡，而這正是普洛卡修改後，所顯出有質量光子的兩個公式。公式的圖解意義可看圖四。

庫倫定律早在庫倫的發現之前，至少有三個人發現了它，所以在物理史上，將庫倫這個名字用在這個定律是個很有趣的故事。導至這個定律的發現，始於 1755 年，富蘭克林觀察到放置在一個充電的金屬杯中的軟木球，並不被吸引到杯子的內表面，他就寫信告訴了普力斯萊（Joseph Priestley），普力斯萊也重複了這個實驗，將這個結果在 1767 年，在他所著的電學的古與今（The History and Present State of Electricity, with Original Experiments）中報告出來。為解釋此現象，普力斯萊想起了牛頓在導出重力的平方反比中所做的推理。牛頓早指出只要重力是隨著距離平方而減少的話，則一個均勻物質的球殼，對其內的物體並不施以重力。普力斯萊很聰明地看出這個現象的類似之處，而指出電場也應該遵守平方反比定律。

第一個有關庫倫定律的定量測量是在兩年後，由一個蘇格蘭人羅比遜（John Robison）所做的，可是在一些科學聚會中討論他的實驗後，羅比遜居然直到 1801 年才出版他的報告，當時，庫倫早已發表了他的工作報告。不過羅比遜的論文仍因對英倫的工作者研習電學有深遠重大的影響而居要。我們應該記得，電磁理論發展的顛峰便是羅比遜的同鄉蘇格蘭人馬克斯威爾的成就。

羅比遜的實驗也是由富蘭克林的想法而得到靈感的，雖然過程是相當的迂迴。富蘭克林曾提出了有兩種電荷（正、負），這個概念引起了德國的亞彼那斯（Franz Aepinus）在他 1759 年以拉丁文出版的書裡，提出了平方反比的假想，恰巧羅比遜這位古文學者，看到這本書，而為亞彼那斯的臆測所吸引，因此設計個實驗來證明。

這個實驗巧妙且簡單（圖五），兩個帶電球間的斥力，由作用在支軸上的重力所平衡，從已知軸棒的重量可算出，各種距離間作用電力的大小，這樣平方反比的定律就可被測出。庫倫定律以數學式表出便是 F=I1I2/r2，F 就是電荷 I1 與 I2 距離 r 時的作用力。羅賓遜將他的結果以修改的形式表示 F=I1I2/r2+q，如果 q 值為 0.06，他將此歸於實驗誤差，而下結論說，電力確實遵守平方反比定律。

另一個早於庫倫發現庫倫定律的是卡文迪斯（Henry Cavendish），1773 年，卡文迪斯所做的一個實驗（圖六），也看得出牛頓有關重力的概念對他的影響，他用兩個以金屬線連接的同心金屬球做實驗，在使外面的球帶電荷後，將連接線切斷，再度量內球的電荷，若平方反比定律正確，那麼在充電球內部應該沒有電荷，若定律不正確，就會有電荷往內跑，用這個技術，卡文迪斯做出了 q 的極限值 0.02，以後所有有關平方反比定律的進一步證明都是卡文迪斯法的變化。

為什麼卡文迪斯得不到他這個證明的榮譽呢？原因仍是出版的拖延。他的結果直到 100 年後才出現，也就是直到馬克斯威爾在他的電磁論文 Treatise on Electricity and Magnetism 裡才提到這個實驗。

最後，我們再看庫倫他自己，庫倫同時測量了吸力和斥力，所用的是如（圖七）的扭秤（torsion balance），由纖維轉離平衡位置的轉距可算出作用力。

庫倫在 1785 年完成了他的實驗，而於 1788 年在巴黎的皇家科學院研究報告中發表。雖然很明顯地，他並非拔頭籌的人，但有兩個理由，使他的名字與定律常存。第一，他對吸力和斥力都作了測量，更重要的是，他及時出版他的發現，這是羅比遜和卡文迪斯所沒做到的。

卡文迪斯的 q 值 0.02 在 1873 年由馬克斯威爾所改進，指出了 q 值不大於 1/21,600，接著的改進則在 1936 年由普林頓（Samuel J. Plimpton）和勞頓（Willard E. Lawton）所完成，他們也是用兩個同心球，配合當時更精確的工具，在半呎的範圍內，得到 q 的值小於或等於 2×10-9。

羅比遜和庫倫的實驗，實際量出作用力的大小，因此似乎提供了直接且明顯的庫倫定律的證明，但是卡文迪斯的方法卻更有力，因為那是個「否定實驗」（null experiment），任何微小違反平方反比的定律，僅可能導致羅比遜和庫倫觀測結果的小改變而已，但是卡文迪斯只須找出是否有電荷存在即可。做個是與否的決定要比做一系列高精確度的測量容易得多了！

現在，我們回頭來討論正題：若以羅比遜的表法，而用庫倫定律上的距離指數的修正項 q 來定義出光子質量是不合邏輯的。早期的研究者當然無法查覺出這個錯誤，畢竟他們只關心著定律本身，而無視於光子的存在，因為當時根本就沒有光子這回事，況且這個錯誤並不使他們的實驗結果失效，我們只要在導出光子的質量以前，先重新解釋以前的數據即可。

在羅比遜和卡文迪斯的時代，並無所謂的基本長度單位（fundamental unit of length）（不同於我們隨便選取的單位，如公尺）。同樣的，也沒有力量的基本單位，因此，合理的假設是：電的現象不管以米制或英制單位來測量，都得相同的形式。這就是「尺度不變」（scale invariance）的原理，只要承認這個原理，兩個不同距離間的作用力比，必定也由距離的比來決定，而且如果作用力是隨著距離的增加而連續地改變，那麼作用力的形式一定是依簡單的距離次方來改變，由此結論，我們就可選擇以 r2+q 的形式來表示。

可是，大約在 40 年前，從普洛卡和湯川秀樹（Hideki Yukawa）的研究，我們可以清楚地看出，「尺度不變」對帶質量的光子或其他基本粒子並不適用。由此指出。如果庫倫定律不正確，那麼這個定律的偏差就會提供我們一個與光子質量有關的長度的基本單位。這樣，電磁現象中的距離與作用力的關係將不能以簡單的冪數法則來表示。

雖然我們不能以修改的簡單冪數定律來表示了，但是毫無疑問的，靜電場的性質將會因光子具有質量而大大改變。電場減弱的速率將由與光子質量有密切關聯的長度來決定。這個長度由量子力學裡的方程式來求出是 h/Mc，因為 h 和 c 是常數，長度也就完全由質量來決定。對一個單獨的電荷，其場強度和距離的關係為指數關係；因此距離每增加 h/Mc 時，通量（flux）（見圖四）就減少了差不多 600 倍。

這個結果，在粒子物理（particle physics）中是常見的，因為有個更廣泛的公式說：力量的作用範圍是與傳遞作用力的粒子之質量成反比。就拿作用於中子和質子間的強作用力來說，它是短程力，範圍大約是 10-13 公分，在三十年代湯川就預測，攜帶強作用力的量子，其質量大約是質子的十分之一，十年後，這種 π 介子（pion）就被找到了，實際上的質量也很接近預測值。其他某些衰變的弱作用力，為更短程距，可能小於 10-15 公分，用來傳遞這種作用力的粒子還未被發現，但是它的質量想來至少是質子質量的 50 倍，用同樣的比例推測，若光子沒有質量，電磁力的作用範圍也必是無限。不過一旦給找出帶有質量，穩定電荷或電流的作用將被限定在一定的球面內。

由於這個指數減少的定律和庫倫定律的平方反比有明顯的不同，所以基於探討是否符合平方反比定律而設計的卡文迪斯實驗，事實上是光子質量的靈敏指示器。依新的理論來重新解釋，從 1936 年普林頓-勞頓（Plimpton-Lawton）的實驗，我們可以求得光子的質量應小於 10-44 克。過去十年來，經不斷地技術改良，到了 1971 年威廉（Edwin. R. Williams），福樂（James. E. Faller）和西爾（Henry A. Hill）用五個二十面體的同心殼來改進靈敏度及消掉遊移電荷所生的誤差（圖八），得到了 2×10-47 克的極限值。

來估計光子質量的上限">四、由磁場來估計光子質量的上限

如果研究磁場，則更可推進這個極限。磁場因為作用範圍可延伸很遠，因此，是個極良好的光子質量指示器。當然原則上（假設光子是無質量的）電場和磁場均可有無限大的作用範圍，可是實際上，一個大的電場會吸引異性電荷而使通量線（line of flux）停止，結果電場給限制住了！可是磁力線卻沒有這個毛病，它是個封閉曲線，且

可大到像銀河那般。因此我們只要檢視廣大範圍的磁場，就可查出因非零質量光子所造成形式上的改變（見圖四之 2 及 6）。這種測量的精確度往往不及實驗室，但由於觀測範圍較大，而彌補了不精確的缺點。

薛丁格（Erwin Schrödinger，量子力學的創始者之一）是第一位利用了上面所談到的現象；他在 1943 年即利用地球磁場得到了有關光子質量的極限。1968 年，我們由進一步測得的地磁場而定出光子質量的極限為 4×10-48 克，較實驗室的極限值小了 5 倍。自此，我們對木星磁場的觀測所得到的更精確值為 8×10-49 克，這是目前所可得到的最小可靠值。

以上所得的極限無可置疑的，是目前所能達的最小值，一個可能改進的方法便是觀測更大的磁場，例如銀河的磁場。可是銀河磁場的測量太困難了，可能的話也是間接的，因此這個想法的改進能好到那裡也不可知的，不過若單由範圍的大小來看，可能好上數億倍，較保守的估計也有一千倍以上的改進。

五、尾聲——為什麼我們仍要探求

最後，利用一個微妙的量子力學論點，我們可知非零質量光子的存在與磁單極（magnetic monopole）的存在是衝突的。因此，目前我們的測定只是提供了個質量的上限，一旦磁單極找到，光子的質量就必定是零。不過，我們仍可反駁說，量子力學在大距離下並不適用，而且，目前磁單極的存在並不確定。前年磁單極的發現報告，由於可用另一種解釋說明，而無法確定。

若我們忽略找到磁單極的可能，那麼目前所得光子質量的極限（圖九）已經小得可以告訴我們：以目前的技術，我們無法探測出非零質量光子的效應。這個事實，引出了個哲學的問題：那就是，我們為何仍如此不厭其煩地求取光子質量呢？除掉我們總希望能有找到光子質量的一天外，最主要的動機是，我們堅持對自然的瞭解必須取決於實驗，且認為在任何未開發的領域之中，都有我們猜測不到的奧秘存在。

編註：本文所稱的光子的質量係指「靜止質量」而言，即在與光子一起前進的慣性系中所應測出的質量。曾經在科學月刊第四卷八期的「讀者的來信」中討論過光子的質量問題，那時是指光子在（以光速）運動中的「質量」。（本文譯自 Scientific American May 1976. Vol. 234, No.5. by Alfred Scharff Goldhaber 和 Michel Martin Nieto）

光量子

物理課本告訴我們，浦郎克是第一位提出「量子」觀念的人。他在 1900 年的那篇不朽的論文裡提出：一個頻率為ｖ的簡諧振子每次只能吸收或放出 hｖ的整數倍的能量，h 為一很小的常數；後來為了紀念他，這一常數稱為浦郎克常數。

但是你也許不知道，最先提出「光量子」觀念的並不是浦郎克，而是當時名不見經傳，年僅 26 歲的愛因斯坦。愛因斯坦在 1905 年共提出了三篇重要論文，一篇是關於狹義相對論的，一篇是關於布朗運動的，另一篇名為「從啟發觀點來看光的產生與傳播」的，就提出光不僅在放射及吸收過程中以 hｖ的能量為單位，在傳播時亦具有粒子性這一理論。這種「粒子」，當時稱為光量子。1926 年 G.N.Lewis 為它取名為 photon,譯為光子。

大家知道，光的粒子說是牛頓時就倡言過的，後來到了十九世紀末期，因為種種實驗的結果及電磁理論的成就，便物理學家深信光是波動。現在愛因斯坦又提出「粒子」的觀念，豈不是復古嗎？但是愛因斯坦知道，光量子並不同於古典觀念的粒子，它具有「物以類聚」的統計特性；而且愛因斯坦也認為，浦郎克所提出的黑體輻射公式顯示，光具有「波動」與「粒子」的性質。

可是後來發展下去，一般量子物理學家的觀念卻不同，他們認為光的「粒子性」與「波動性」不僅是互補的，且

是統計性的。當實驗或觀察方法使光顯示一種性質時，另種性質就隱而不現。

愛因斯坦至死也不肯接受這一觀點。他在 1951 年 12 月 12 日（註）寫給少時好友的一封信裡寫道：

這將近五十年來對「光量子到底是什麼」的深思，並沒有使我更接近答案。現在每一個人，像湯姆、阿丁、昭子等，都以為他們了解，可是他們錯了！

你認為如何呢？

註：愛因斯坦死於 1955 年 4 月 18 日。

7.2.6. 不同光源的光发光距离一样吗，衰减速率一样吗？

7.2.7. 不同光源的光发出的光一样吗？

7.2.8. 电磁波在真空中和介质中传播的机理是一样的吗

7.2.9. 电磁波/光波在传播中的电场和磁场强度的测量

7.2.10. 连续光谱：光谱是连续的吗？

7.2.11. 太阳光谱的暗线是元素吗而不是光谱不连续的证据？

7.2.12. 太阳常数本身是否变化的问题

太阳常数本身是否变化的问题，至今仍未研究清楚。太阳表面活动在辐射方面引起的瞬间变化(例如太阳耀斑引起的辐射增强)至少比太阳常数小 4 个数量级，完全可以忽略，因此太阳常数的变化是指太阳总辐射能量的平稳缓慢变化。五十年代以前史密森天文台在长达半个世纪所作的测量表明，其变化在观测精度(±1％)之内。1969 年发射的行星际探测器“水手”6 号和 7 号以及 1975 年发射的人造卫星“雨云”6 号的观测结果，分别表明其变化范围不超过仪器的测量精度的 0.25％和 0.20％。最近的研究还表明 1969～1975 年间太阳常数的变化不超过 0.75％。因此，目前并不排除有小于 1％的变化。

7.2.13. 物体的颜色是如何形成的

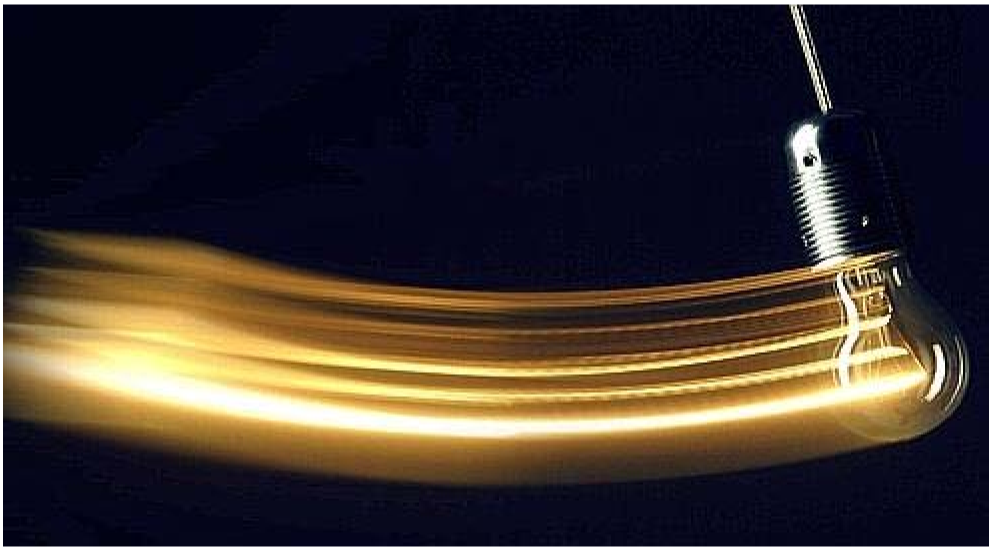
7.2.14. 光的本质，发光原理!!!!!!!!!!!!!

7.2.15. Wave particle duality criteria

波粒二象性判据

7.2.16. Ray traveling time in the Sun – how long???

7.2.17. Où va la lumière quand on l'éteint ? 10/06/2008



Depuis l'Antiquité, les hommes s'interrogent sur la nature corpusculaire ou ondulatoire de la lumière.
Depuis l'Antiquité, les hommes s'interrogent sur la nature corpusculaire ou ondulatoire de la lumière.
Crédits photo : Dethier/Reporters-REA

HISTOIRES DE SAVOIR - La chronique de Jean-Luc Nothias du 11 juin.

Elle était là, fière et brillante, et tout à coup, «saint Interrupteur» intervenant, elle disparaît. Va-t-elle dans un trou noir ? Dans un réservoir ? Rebrousse-t-elle chemin ? Où se cache-t-elle ? Encore faudrait-il savoir ce qu'est réellement la lumière. Quelle est sa nature, son vrai visage ? Depuis que l'homme a compris qu'il était bon de se poser des questions, il essaie de faire… la lumière sur ce problème.

Commençons par le commencement. Juste après que Dieu eut créé la terre et le ciel, voyant que tout était plongé dans les ténèbres, il dit : «Que la lumière soit !» Et la lumière fut. C'est ainsi que le premier livre de la Bible, la Genèse, décrit la naissance de la lumière. Et son importance.

Dès l'Antiquité, les savants s'interrogent sur sa nature. On trouve ainsi sur un bas-relief égyptien la représentation des rayons solaires comme un flux de fleurs multicolores. La grande querelle était déjà presque lancée. La lumière est-elle une onde qui se propage dans l'espace comme des vagues à la surface de l'eau, ou est-elle un flux de particules matérielles ?

Au XVIIe siècle, Descartes puis Newton développent des modèles corpusculaires de la lumière à partir d'observations faites avec les premiers instruments d'optique fort rudimentaires mais déjà très efficaces. En réponse, le grand savant Christiaan Huygens développe un système où la lumière est une onde, permettant ainsi d'expliquer les phénomènes de diffraction et de réfraction de la lumière. Mais le poids scientifique de Newton l'emporte, ses expériences sur la décomposition de la lumière blanche et son télescope à miroir étant très convaincantes. La lumière va donc rester pendant près de deux siècles un flux de particules ayant chacune une couleur déterminée.

Compter les photons

Ce n'est qu'au XIXe siècle que la balance penche du côté ondulatoire grâce aux travaux de Thomas Young en Angleterre et d'Augustin Fresnel en France. Leur démonstration est si pertinente que la nature ondulatoire de la lumière emporte tous les suffrages. Exit les particules. Surtout quand Heinrich Hertz réussit à émettre les ondes appelées aujourd'hui «hertziennes» qui ne diffèrent de la lumière que par leur longueur d'onde plus élevée. Il faudra attendre le début du XXe siècle pour voir le retour des particules de lumière. Et ce grâce aux travaux de Max Planck, avec la naissance de la physique quantique, et d'Albert Einstein qui fait l'hypothèse que la lumière est elle aussi, comme la matière, quantifiée, c'est-à-dire qu'elle est formée de grains d'énergie qui se comportent comme des corpuscules. Cette idée mettra des années à s'imposer.

Mais le plus extraordinaire est qu'il sera démontré que tout le monde avait en partie raison et en partie tort. Car la lumière est à la fois onde et particules, les fameux «photons». La difficulté est qu'on ne peut pas vraiment les dessiner. Dans le monde quantique, les lois et les représentations physiques n'ont rien à voir avec celui que nous percevons par nos sens. S'ils devaient ressembler à quelque chose, c'est plus à un fantomatique nuage d'énergie qu'à une boule de billard.

Mais on peut tout de même les compter. Et les flux de photons sont en général moins nombreux que les flux de matière. Ainsi, un robinet débite de l'ordre de un million de milliards de milliards de molécules d'eau par seconde. Allongé(e) sur la plage pour bronzer, vous recevez 300 fois moins de photons par seconde. En regardant la pleine lune, votre œil ne reçoit «que» 10 milliards de photons par seconde. Des expériences ont montré que chacune des cellules tapissant la rétine (elles sont de l'ordre de 100 millions) n'a besoin que de 2 à 3 photons pour produire un influx nerveux. Nous «voyons» donc presque, sans le savoir, les photons un par un.

La connaissance de la nature véritable de la lumière a permis de la domestiquer. Dans les lasers par exemple mais aussi dans les détecteurs des appareils photo et caméras vidéo numériques, dans les lecteurs de codes-barres, dans les lecteurs et graveurs de CD, dans les imprimantes ou dans la transmission de l'information par fibre optique.

Et aujourd'hui, on est même capable de ralentir la lumière. Ainsi, à la fin des années 1990, des chercheurs ont réussi à la freiner jusqu'à 17 m/s, soit 61 km/h. D'autres équipes ont réussi à la ralentir jusqu'à 3 m/s. Voire à la stopper quelques fractions de seconde. Alors qu'elle voyage dans l'espace à 300 000 km/s. Et que cette vitesse est une barrière indépassable dans notre univers.

Mais on commence à soupçonner que les règles qui s'ap-pliquent dans notre monde macroscopique ne sont peut-être pas les mêmes que dans le monde quantique dont font partie les photons.

7.3. 太阳物理/太阳模型

7.3.1. 太阳数据来龙去脉

谁
过程
方法技术设施

7.3.2. 太阳热物理

solar thermophysics

7.3.3. 太阳热力学

solar thermodynamics

7.3.4. 太阳能是氢氦核聚变产生的吗

太阳的能量主要是太阳内部热核反应提供的

氢离子聚合成氦离子反应有质量亏损吗?

7.3.5. 太阳两极温差之谜

2007 年 2 月 20 日：太阳的一极比另一极要冷些。今天，参与欧空局与 NASA 合作的尤利西斯探测器数据处理

的科学家宣布了这一令人吃惊的结论。

尤利西斯首次飞过太阳极区是在 1994 年和 1995 年，揭示了不对称现象——“温度方面存在 7%至 8%的差异，”尤利西斯科学小组的成员、马里兰大学的 George Gloeckler 说道。测量结果神秘又有些难以相信。是什么导致了太阳温度如此的不平衡？

这一问题仍没有确定的答案，不过现在研究人员至少知道的是，这一现象是真实的。2007 年，尤利西斯返回了太阳南极，而 Gloeckler 说：“新近的观测表明，平均温度……实际上与我们 12 年前所见的相同。”

测量太阳的温度是很巧妙的事情。探测器不能直接降落到表面并插入一支温度计。相反，尤利西斯在 3 亿公里的安全距离上取样太阳风。Gloeckler 解释说：“我们测量太阳风中两种氧离子的丰度。O6+/O7+的比值能告诉我们气体的温度。”他是尤利西斯上进行此项工作的仪器——太阳风离子成分谱仪暨“SWICS”的首席研究人员。

根据 SWICS 的结果，极区太阳风的平均温度是 100 万摄氏度。但一个极点上空的太阳风温度比另一极低 80000 度。

再回到最初的问题：温度差意味着什么？他猜测：“也许两极上空的太阳大气结构不同。”

7.3.6. 太阳磁场的来源还不清楚

7.3.7. 光球表层下面潜伏磁场的存在和变化，是一个非常复杂的问题，具体的理论远未成熟

解释太阳活动的基本规律，如太阳活动的 11 年、22 年、80 年周期以及太阳活动区的日面分布规则等，都有待于这个问题的解决。

7.3.8. 日珥的运动很复杂

具有许多特征。例如，在日珥不断地向上抛射或落下时，若干个节点的运动轨迹往往是一致的；当日珥离开太阳运动时，速度会不断增加，而这种加速是突发式的，在 2 次加速之间速度保持不变；在日珥节点突然加速时亮度也会增加。对于这些现象还没有满意的解释。主要问题是：日珥的密度远大于日冕，但宁静日珥可长期存在于日冕中，即不坠落也不瓦解。是什么力量支撑和维持着它呢？活动日珥和爆发日珥的速度可高达每秒几百公里，动力从何而来？日珥运动往往突然加速，甚至宁静日珥会一下子转变为活动日珥，原因是什么？这些问题都有待于进一步研究。一般认为，除重力和气体压力外，电磁力在日珥运动中是一个重要因素。日珥运动状态的突变可能与磁场的变化有关。

7.3.9.黑子的本质

对于黑子的本质，目前还没有肯定性的结论。

关于黑子的变暗有以下两种不同的看法：

早在 1941 年比尔曼就首先提出：黑子的变暗是由于强磁场抑制光球深处热量通过对流向上传输造成的。
1974 年帕克提出的另一种看法是：黑子的变冷是由于非辐射能量传输的增强，把黑子中的能量大量转移到黑子之外造成的。

关于黑子的形成问题，1961 年巴布科克作出如下解释：在光球下面 0.05 个太阳半径内有一个偶极场，这个磁场冻结在太阳物质中，因而磁力线被太阳自转所带动。由于较差自转，磁力线慢慢缠绕太阳本体，这时局部的不规则性[如气体湍流] 可造成磁力线管扭转现象，这样磁力线管的磁通量密度可达几千高斯。当磁压达到或超过周围气体时，磁力线管就获得磁浮力并上升到表面，以拱状浮现出来，形成可见的黑子。

7.3.9.1. Sunspots

are caused by complicated and not very well understood interactions with the Sun's magnetic field.

7.3.10. 但是至今人们仍然不清楚太阳风是怎样起源和怎样加速的

可是太阳风是怎样得到等离子体的供应及能量的供应的问题是空间物理学领域中经长期研究仍悬而未决的一大基本课题。

7.3.11. 中微子之迷

即著名的中微子之迷。这就使人们怀疑上述太阳内部结构图象是否正确。但到目前为止，还没有人提出能够解决此矛盾的新理论。

7.3.12. If neutrino has mass????????

What is the mass?
Its diameter???
Velocity = light?
Energy

7.3.13. 太阳温度分布!!!!!!!!!!!!!!!!!!

7.3.13.1. 太阳内部的温度

早在１８７０年美国物理学家莱恩（Ｌａｎｅ）就已经计算过太阳内部的温度，他假定里面各处都在一种平衡的状态中。太阳内部每一点上物质的全部重量都完全被下面热气体的膨胀力所支持。问题便是算出内部要热到什么程度才可以使太阳不致被自己的重量压碎。

7.3.13.2. 日冕的温度

日冕的温度非常高,可达二百万度以上,如此高的温度,可能是经由储存在太阳磁场中的能量加热而成的,但确切的过程为何,乃待进一步的研究.

日冕的增温

观测表明，太阳大气的温度具有反常的分布，即从光球的 5770K 慢慢降到光球顶部 [光球与色球交界处] 的 4600K，然后缓慢上升到光球之上约 2000 公里处的几万度，再向上延伸约 1000 公里形成了色球日冕过渡层，温度陡升至几十万度，到达低日冕区已是百万度以上的高温区了。究竟是什么原因造成这种反常增温，仍是太阳物理学中多年来未解决的最重要问题之一。
ftp://ftp.hq.nasa.gov/pub/pao/pressrel/1997/97-256.txt

Donald Savage
Headquarters, Washington, DC November 5, 1997
(Phone: 202/358-1547) EMBARGOED UNTIL 1 P.M. EST

Bill Steigerwald
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-5017)

RELEASE: 97-256

SOLAR MYSTERY NEARS SOLUTION WITH DATA FROM SOHO SPACECRAFT

A likely solution to one of the major mysteries of the Sun has emerged from recent observations with the European Space Agency/NASA Solar and Heliospheric Observatory (SOHO) mission.

The new findings seem to account for a substantial part of the energy needed to cause the very high temperature of the corona, the outermost layer of the Sun's atmosphere. Since the corona's temperature was first measured 55 years ago, scientists have lacked a satisfactory explanation for why that temperature is three million degrees while the visible surface of the Sun is only 11,000 degrees Fahrenheit or about 6,000 degrees Celsius.

It is physically impossible to transfer thermal energy from the cooler surface to the much hotter corona, so the energy transfer had to be in the form of waves or magnetic energy, but no measurement to date had found adequate energy to account for the coronal temperature.

"We now have direct evidence for the upward transfer of magnetic energy from the Sun's surface toward the corona above. There is more than enough energy coming up from the loops of the 'magnetic carpet' to heat the corona to its known temperature," said Dr. Alan Title of the Stanford-Lockheed Institute for Space Research, Lockheed Martin Advanced Technology Center, Palo Alto, CA, who led the research. "Each one of these loops carries as much energy as a large hydroelectric plant, such as the Hoover dam, generates in about a million years!"

"We now appear to be closing in on an explanation as to why the solar corona is over 100 times hotter than the solar surface -- the solution to a 55-year old puzzle," said Dr. George Withbroe, Director of the Sun-Earth Connection Program at NASA Headquarters, Washington, DC. "These results underline the importance of long-term study of the changing conditions on the Sun from the superior vantage point of space."

Energy flows from the loops when they interact, producing electrical and magnetic "short circuits." The very strong electric currents in these short circuits are what heats the corona to a temperature of several million degrees. Images from the Extreme ultraviolet Imaging Telescope (EIT) and the Coronal Diagnostics Spectrometer (CDS) on SOHO show the hot gases of the ever-changing corona reacting to the evolving magnetic fields rooted in the solar surface.

The observations with SOHO's Michelson Doppler Imager (MDI) provided long-duration, highly detailed, and well calibrated time-lapse movies of the magnetic fields on the visible surface or "photosphere" of the Sun. These revealed the rapidly changing properties of what Title calls "the Sun's Magnetic Carpet," a sprinkling of tens-of-thousands of magnetic concentrations. These concentrations have both north and south magnetic poles, which are the "foot points" of magnetic loops extending into the solar corona.

Like field biologists who study the populations and life cycles of animal herds, the SOHO researchers analyzed the appearances and disappearances of large numbers of the small magnetic concentrations on the solar surface. "We find that after a typical small magnetic loop emerges, it fragments and drifts around and then disappears in only 40 hours," Title said. "It's very hard to understand how such a short-lived effect could be driven by the magnetic dynamo layer that is over 100,000 miles beneath the surface of the Sun. This may be evidence that unknown processes are at work in or near the solar surface that continuously form these loops all over the Sun."

Professor Phillip Scherrer of Stanford University is the MDI Principal Investigator. MDI was built at the LM Technology Center and is a project of the Stanford-Lockheed Institute for Space Research.

The new observations were made with several instruments on SOHO, which is stationed about 900,000 miles (1.5 million kilometers) sunward of the Earth in interplanetary space, where it has an uninterrupted view of the Sun and of the solar wind particles blown from the Sun. SOHO is operated from a control center at NASA's Goddard Space Flight Center, Greenbelt, MD. SOHO was launched on Dec. 2, 1995 aboard an Atlas-IIAS expendable launch vehicle from Kennedy Space Center, FL.

-end-

NOTE TO EDITORS: Images to support this story can be found at the following internet locations:

ftp://pao.gsfc.nasa.gov/mewsmedia/SSU

http://umbra.nascom.nasa.gov/ssu/magnetic_carpet.html

Information about the SOHO spacecraft and its observations may be found at URL:

http://sohowww.nascom.nasa.gov/

7.3.14. PV=RT still valid?

7.4.其它

7.4.1.所有元素的原子核电子都是一样性质吗？

7.4.2.为什么产生引力目前没有解释

7.4.3.宇宙大爆炸理论

7.4.3.1. 斯蒂芬・威廉姆・霍金（Stephen William Hawking）

Stephen Hawking
Everything you could ever want to know about Stephen Hawking . . . Well, almost! A Brief History of Mine
Stephen William Hawking was born on 8 January 1942 ...
www.hawking.org.uk

宇宙诞生于近 140 亿年前的一次大爆炸中
按照宇宙大爆炸理论，约１４０亿年前（关于宇宙年龄，还有不同的说法），宇宙形成之初，致密物质像笼子一样禁锢了所有辐射，大爆炸后３０万年，随着这些物质密度的下降，微波背景辐射才得以挣脱束缚。就像恐龙化石能让我们认识若干万年前的恐龙一样，这种“化石”光可以不受阻挡地穿越茫茫宇宙，让我们了解宇宙“婴儿时期”的各种信息。

宇宙不仅仅在膨胀，而且速度正在加快

尼尔教授说：“我想，宇宙的年龄可能远远大于万亿年。时间没有开始，根据我们的理论宇宙的年龄是无限大的，而宇宙范围也是无限大的。”

8. 数学

8.1. 数学

数学-数论为主

- primality testing – AKS 1,3,5
- primality testing - Other primality testings 2,4,6

- number theory 1,4
- computational number theory - Eliptic curve number theory, quantum number theory and others 2,5

- 代数/ 泛函分析以计算泛函为主 3,6
- 其它数学
  - 线性与复杂性科学

- 数理方程/微分积分方程
- 数值计算/

- Suspended (科学家) 2012-1-6

数论 Number Theory

✧ *初等数论*
✧ 解析数论
✧ 代数数论
✧ 超越数论
✧ 几何数论
✧ 理想数论

http://math.ntnu.edu.tw/~li/ent-html/
http://vip.du8.com/books/sep42pt.shtml

NumberTheory

NumberTheory Web http://numbertheory.org/
Kevin McCurley's bibliography on computational number theory
ftp://www.cs.sandia.gov/pub/papers/mccurley/open.bib.Z
The Prime Pages (by Chris Caldwell, University of Tennesee) http://www.utm.edu/research/primes/
RSA Factoring by Web Project http://www.npac.syr.edu/factoring.html
RSA Factoring Challenge http://www.rsasecurity.com/rsalabs/challenges/factoring/
NTL--A Library for Doing Number Theory http://www.shoup.net/ntl

抽象代数

概率论 Possibilites & Statistics

组合数学，又称为离散数学（combinatorial mathematics）
www.combinatorics.math.sinica.edu.tw
www.cscgt.org
www.combinatorics.net.cn
http://www.mathdb.org/notes_download/c_combinatorics_el.htm
http://www.combinatorics.org/

数值计算 、數值方法，数值计算方法. 数值分析，數值微分，數值積分，计算数学 Numerical Calculations, Numerical Computation, Numerical Methods, Numerical Analysis, Computational Mathematics

Fotran90 / Fortran
C/ C++

ESI-CFD / CFD++
Python / SciPy / pypar, PyMPI, Scientific Python and pythonMPI
Matlab
Scilab

Principles of Numerical Calsulations
数值计算方法及其程序设计 10

偏微分方程 Partial Diffrential Equations

线性代数 Linear Algebra

变分法 变分原理 calculus of variations，泛函分析（Functional Analysis）

张量分析 Tensor Analysis
http://www.mech.pku.edu.cn/elasweb/course/cha1-1-2.htm
弹性力学与张量分析郭日修
张量

9. IT incl Security & Cryptography

10. 外语

10.1. German Literature Studies (2007)

There was time when I wanted to devote to German language and literature studies and researches, but I gave the plan up after failure to find a research institute to support my plan, such as Goethe Institute. Nevertheless I have spent quite some efforts to study the German literature and to prepare for that studies – see the GermanLiterature.doc attached.

11. Other Sciences 其他科学

11.1. Combustion

11.1.1. Literature

11.1.2. 网站

http://www.100yq.com/archiver/?tid-148920.html
http://www.99zjw.cn/a/jienen/xueshulunwen/2009/1228/29.html
http://tech.bjx.com.cn/html/20090610/120874.shtml
http://www.btpenghe.com/lunwen02-3.htm
http://www.btpenghe.com/lunwen01.htm
http://www.china.com.cn/environment/txt/2005-02/22/content_5792394.htm
http://www.china-heating.com/newsgai/list.asp?unid=8899
http://air.chinaep-tech.com/solutions/55045.htm
http://www.chinajnhb.com/News/8851.html
http://www.ciddte.com/News.asp?ClassId=73&NewsId=126
http://www.cn-hw.net/html/sort071/200903/9724.html
http://bbs.eptchina.cn/archiver/?tid-2192.html
http://www.eptec.cn/fq/fumes/2006-07-17/334.html
http://www.espcn.net/DisplayNews.aspx?_id=316
http://blog.h2o-china.com/html/91/15291-10558.html
http://today.hit.edu.cn/articles/2009/10-29/1009350329.htm
http://www.huanwei.org/keyan/tsljcl/200904/01-431.html
http://www.jianshe99.com/html/2008/3/wa41572638101223800215372.html
http://www.js0515.cn/2009481538239601.html
http://www.nbepb.gov.cn/Info_Show.aspx?ClassID=059dea66-3d2a-42a4-a89a-f748136dc582&InfoID=704b014e-cd43-4563-9607-a35354cfc481
http://old.nengyuan.net/meitan/mhproduct/NY446D3.html

11.1.3. NOx

炉内燃烧控制
低 NOx 燃烧器技术　脱除效率一般仅能达到 50～65％
低氧燃烧　脱除效率一般仅能达到 50～65％
空气分级　脱除效率一般仅能达到 50～65％
再燃烧　脱除效率一般仅能达到 50～65％

燃烧后控制
选择性非催化 SNCR　脱除效率一般仅能达到 50～65％
选择性催化 SCR　脱除效率达到 80％以上　初期投资在 490～1250 元/kw,，运行费用大约为 2100~2800 元/吨 NOx

等离子体技术　较高的能耗
脉冲电晕放电等离子体技术　较高的能耗

电子束技术　　较高的能耗
电催化

11.1.4. 书籍

11.1.4.1. 浙江图书馆

主要责任者 北京博奇电力科技公司 bei jing bo qi dian li ke ji gong si 编著
题名责任说明 湿法脱硫装置维护与检修 shi fa tuo liu zhuang zhi wei hu yu jian xiu / 北京博奇电力科技有限公司编著
出版发行等 北京 : 中国电力出版社, 2010
内容简介 本书共分十二章，主要包括脱硫装置维护与检修概述、脱硫装置日常维护、脱硫装置防腐检修、浆液泵的维护与检修、增压风机的维护与检修、球磨机的维护与检修、真空皮带机的维护与检修等内容。......更多信息>>
目录 序
前言
第一章 脱硫装置维护与检修概述
第二章 脱硫装置日常维护
第一节 日常运行维护的主要项目
第二节 脱硫主要设备润滑
第三节 脱硫装置防磨、防腐
第四节 脱硫装置防冻......更多信息>>
标签 添加标签

地点	索书号	流通状态	条码
中文自科图书借阅室	TM621.7 144 2010	在架上	0000118351238
中外图书保存本查阅室(馆内阅览)	TM621.7 144 2010	在架上	0000118351256

载体形态项 223 页 : 图 ; 23cm
提要文摘附注 本书内容包括：脱硫装置维护与检修概述、脱硫装置日常维护、脱硫装置防腐检修、浆液泵的维护与检修、增压风机的维护与检修、球磨机的维护与检修、真空皮带机的维护与检修、热控仪表的维护与检修及脱硫装置检修的组织、质量与安全管理等。
国际标准书号 978-7-5083-9207-3 CNY28.00
主要责任者 北京博奇电力科技公司 bei jing bo qi dian li ke ji gong si 编著
论题主题 火电厂 -- 湿法 -- 烟气脱硫 -- 附属装置 -- 维护
火电厂 -- 湿法 -- 烟气脱硫 -- 附属装置 -- 检修
载体形态项 223 页 : 图 ; 23cm
提要文摘附注 本书内容包括：脱硫装置维护与检修概述、脱硫装置日常维护、脱硫装置防腐检修、浆液泵的维护与检修、增压风机的维护与检修、球磨机的维护与检修、真空皮带机的维护与检修、热控仪表的维护与检修及脱硫装置检修的组织、质量与安全管理等。

国际标准书号　978-7-5083-9207-3 CNY28.00
主要责任者　北京博奇电力科技公司 bei jing bo qi dian li ke ji gong si 编著
论题主题　火电厂 -- 湿法 -- 烟气脱硫 -- 附属装置 -- 维护
　火电厂 -- 湿法 -- 烟气脱硫 -- 附属装置 -- 检修

地点	索书号	流通状态	条码
中文自科图书借阅室	TM621.7 144 2010	在架上	0000118351238
中外图书保存本查阅室(馆内阅览)	TM621.7 144 2010	在架上	0000118351256

附加信息:

主要责任者　郝吉明 编著 王书肖 编著 陆永琪 编著
题名责任说明　燃煤二氧化硫污染控制技术手册 / 郝吉明等编著
出版发行等　北京 : 化学工业出版社, 2001.4
目录
第一章 中国燃煤二氧化硫污染控制战略与政策
第一节 中国燃煤 SO_2 的污染特征
第二节 中国控制酸雨和 SO_2 污染的重大行动
第三节 中国控制酸雨和 SO_2 污染的政策与措施
第四节 SO_2 排放标准与污染源监测
第五节 中国减排 SO_2 排放战略选择
第二章 煤炭洗选脱硫技术
第一节 煤中硫分的形态及其测定......更多信息>>
标签　添加标签

地点	索书号	流通状态	条码
中外图书保存本查阅室(馆内阅览)	X701.3 446 2001	在架上	0000103556288
中外图书闭架外借	X701.3 446 2001	在架上	0000103556279

载体形态项　465 页 ; 26cm
知识责任附注　郝吉明(1946)，清华大学环境科学与工程研究院院长、教授、博士生导师，著有［大气污染控制工程］等
提要文摘附注　本书围绕燃煤二氧化硫污染控制这一主题，在简要阐述我国燃煤二氧化硫污染控制战略与对策的基础上，着重介绍了煤燃烧前、燃烧中和燃烧后控制 SO_2 排放的各种措施的技术、经济性能以及研究前沿
国际标准书号　7-5025-3179-3 CNY60.00
主要责任者　郝吉明 编著
　王书肖 编著
　陆永琪 编著
论题主题　煤 -- 燃烧 -- 二氧化硫 -- 空气污染控制 -- 技术手册
　二氧化硫 -- 煤 -- 燃烧 -- 空气污染控制 -- 技术手册
　空气污染控制 -- 煤 -- 燃烧 -- 二氧化硫 -- 技术手册
载体形态项　465 页 ; 26cm

知识责任附注　郝吉明(1946)，清华大学环境科学与工程研究院院长、教授、博士生导师，著有［大气污染控制工程］等

提要文摘附注　本书围绕燃煤二氧化硫污染控制这一主题，在简要阐述我国燃煤二氧化硫污染控制战略与对策的基础上，着重介绍了煤燃烧前、燃烧中和燃烧后控制 SO2 排放的各种措施的技术、经济性能以及研究前沿

国际标准书号　7-5025-3179-3 CNY60.00

主要责任者　郝吉明 编著
　王书肖 编著
　陆永琪 编著

论题主题　煤 -- 燃烧 -- 二氧化硫 -- 空气污染控制 -- 技术手册
　二氧化硫 -- 煤 -- 燃烧 -- 空气污染控制 -- 技术手册
　空气污染控制 -- 煤 -- 燃烧 -- 二氧化硫 -- 技术手册

地点	索书号	流通状态	条码
中外图书保存本查阅室(馆内阅览)	X701.3 446 2001	在架上	0000103556288
中外图书闭架外借	X701.3 446 2001	在架上	0000103556279

附加信息:

主要责任者　杨旭中　yang xu zhong 编著

题名责任说明　燃煤电厂脱硫装置 ran mei dian chang tuo liu zhuang zhi / 杨旭中编著

出版发行等　北京 : 中国电力出版社, 2006

标签　添加标签

地点	索书号	流通状态	条码
中文自科图书借阅室	TM621.7 445 2006	到期 09-06-12	0000111281470
中外图书保存本查阅室(馆内阅览)	TM621.7 445 2006	在架上	0000111281489

载体形态项　331 页 ; 21cm

提要文摘附注　本书全面介绍了燃煤电厂炉前、炉内脱硫工艺，特别是烟气脱硫的和种方法，并从设计、制造、施工、运行以及建设管理、相关政策等多个角度进行了阐述，重点介绍了当前最常用的石灰石一石膏湿法脱硫工艺的有关内容。

国际标准书号　7-5083-3788-3 CNY20.00

主要责任者　杨旭中 yang xu zhong 编著

论题主题　火电厂 -- 燃煤锅炉 -- 脱硫 -- 附属装置

载体形态项　331 页 ; 21cm

提要文摘附注　本书全面介绍了燃煤电厂炉前、炉内脱硫工艺，特别是烟气脱硫的和种方法，并从设计、制造、施工、运行以及建设管理、相关政策等多个角度进行了阐述，重点介绍了当前最常用的石灰石一石膏湿法脱硫工艺的有关内容。

国际标准书号　7-5083-3788-3 CNY20.00

主要责任者　杨旭中 yang xu zhong 编著

论题主题　火电厂 -- 燃煤锅炉 -- 脱硫 -- 附属装置

地点　　索书号　流通状态　　条码

中文自科图书借阅室　　TM621.7 445 2006　　到期 09-06-12　　0000111281470

中外图书保存本查阅室(馆内阅览)　TM621.7 445 2006　　在架上　　0000111281489

附加信息:

主要责任者　曾庭华　zeng ting hua 著

题名责任说明　　湿法烟气脱硫系统的安全性及优化 shi fa yan qi tuo liu xi tong de an quan xing ji you hua / 曾庭华等著

出版发行等　北京 : 中国电力出版社, 2004

作者简介　　曾庭华，1969 年生，男，浙江建德人，1997 年 6 月获浙江大学工程热物理专业博士学位，广东省电力试验研究所锅炉高级工程师，主要从事锅炉调试、试验、燃烧优化、FGD 系统调试及洁净煤燃烧技术的研究工作，......更多信息>>

内容简介　　本书在国内首次全面、系统地阐述了火电厂烟气脱硫(FGD)系统对发电机组的综合影响，包括 FGD 系统运行对锅炉运行的影响、对汽轮机运行的影响、对锅炉尾部烟道及烟囱的影响、石膏浆液与灰渣水混合排放对机组灰......更多信息>>

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1 SO2 的危害及我国 SO2 的排放现状

2 我国 SO2 排放的控制历程

3 我国 SO2 控制技术的研究、开发及应用

第 2 章 火电厂 FGD 技术概述

1 FGD 技术的分类

2 湿法 FGD 技术......更多信息>>

标签　　添加标签

地点　　索书号　流通状态　　条码

中外图书保存本查阅室(馆内阅览)　X701.3 802 2004　　在架上　　0000107752003

中文自科图书借阅室　　X701.3 802 2004　　到期 11-03-25　　0000107751987

载体形态项　420 页 ; 26cm

提要文摘附注　　本书阐述了火电厂烟气脱硫(FGD)系统对发电机组的综合影响，包括 FGD 系统运行对锅炉运行的影响、对汽轮机运行的影响、对锅炉尾部烟道及烟囱的影响等内容。

国际标准书号　　7-5083-1794-7 精装 CNY68.00

主要责任者　曾庭华 zeng ting hua 著

论题主题　　湿法 -- 烟气脱硫

　　烟气脱硫

载体形态项　420 页 ; 26cm

提要文摘附注　　本书阐述了火电厂烟气脱硫(FGD)系统对发电机组的综合影响，包括 FGD 系统运行对锅炉运行的影响、对汽轮机运行的影响、对锅炉尾部烟道及烟囱的影响等内容。

国际标准书号　　7-5083-1794-7 精装 CNY68.00

主要责任者　曾庭华 zeng ting hua 著

论题主题　　湿法 -- 烟气脱硫

　　烟气脱硫

地点　　索书号　流通状态　　条码

中外图书保存本查阅室(馆内阅览)　X701.3 802 2004　　在架上　　0000107752003

中文自科图书借阅室　　X701.3 802 2004　　到期 11-03-25　0000107751987

附加信息:

主要责任者　曾庭华　zeng ting hua 著

题名责任说明　　湿法烟气脱硫系统的调试、试验及运行 shi fa yan qi tuo liu xi tong de tiao shi、 shi yan ji yun xing / 曾庭华[等]著

出版发行等　北京 : 中国电力出版社, 2008

作者简介　　曾庭华，1969 年生，男，浙江建德人，1997 年 6 月获浙江大学工程热物理专业博士学位，广东省电力试验研究所锅炉高级工程师，主要从事锅炉调试、试验、燃烧优化、FGD 系统调试及洁净煤燃烧技术的研究工作，......更多信息>>

内容简介　　本书详细介绍了国内外火电厂最新应用的各类石灰石/石膏湿法 FGD 技术，在此基础上，系统地介绍了 FGD 系统的调试技术，包括调试的管理、FGD 典型的单体调试、分系统调试以及整套启动调试等，通过工程实......更多信息>>

目录　　前言

第一章 火电厂 SO2 的排放与控制

第一节 我国电力的发展与 SO2 的排放

第二节 SO2 污染控制状况

第三节 火电厂 SO2 的生成及排放特点

一、煤中硫的存在形式

二、煤燃烧中 So2 的生成

三、火电厂锅炉烟气的特点......更多信息>>

标签　　添加标签

地点　　索书号　流通状态　　条码

中外图书保存本查阅室(馆内阅览)　X773.013 802 2008　在架上　　0000114394110

主要责任者　钟秦编　zhong qin bian 著

题名责任说明　　燃煤烟气脱硫脱硝技术及工程实例 ran mei yan qi tuo liu tuo xiao ji shu ji gong cheng shi li / 钟秦编著

出版发行等　北京 : 化学工业出版社, 2002

内容简介　　本书围绕着燃煤烟气脱硫脱硝这一主题，在简要阐述燃煤二氧化硫和氮氧化物质排放与控制技术的基础上，着重介绍了湿法、半干法和干法烟气脱硫技术，烟气脱硝技术及烟气同时脱硫脱硝技术。

全书分为 7......更多信息>>

目录　　第一章 概论

第一节 燃煤二氧化硫和氮氧化物的排放与控制对策

第二节 燃煤前脱硫技术
第三节 燃煤中脱硫技术
第四节 燃煤后烟气脱硫技术
第五节 煤转化中脱硫技术
第六节 烟气脱硝技术
参考文献......更多信息>>
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中外图书保存本查阅室(馆内阅览)	X701.3 850 2002	在架上	0000104796623
中外图书闭架外借	X701.3 850 2002	在架上	0000104796598

载体形态项 350 页 ; 26cm
提要文摘附注 本书介绍了湿法烟气脱硫技术，干法烟脱硫技术，以及燃煤烟气脱硫脱硝技术经济分析等。
总集 2001 环境工程实例丛书
国际标准书号 7-5025-3694-9 CNY48.00
主要责任者 钟秦编 zhong qin bian 著
论题主题 煤烟污染 -- 烟气脱硫 -- 技术
煤烟污染 -- 烟气 -- 脱硝 -- 技术
载体形态项 350 页 ; 26cm
提要文摘附注 本书介绍了湿法烟气脱硫技术，干法烟脱硫技术，以及燃煤烟气脱硫脱硝技术经济分析等。
总集 2001 环境工程实例丛书
国际标准书号 7-5025-3694-9 CNY48.00
主要责任者 钟秦编 zhong qin bian 著
论题主题 煤烟污染 -- 烟气脱硫 -- 技术
煤烟污染 -- 烟气 -- 脱硝 -- 技术
地点 索书号 流通状态 条码
中外图书保存本查阅室(馆内阅览) X701.3 850 2002 在架上 0000104796623
中外图书闭架外借 X701.3 850 2002 在架上 0000104796598

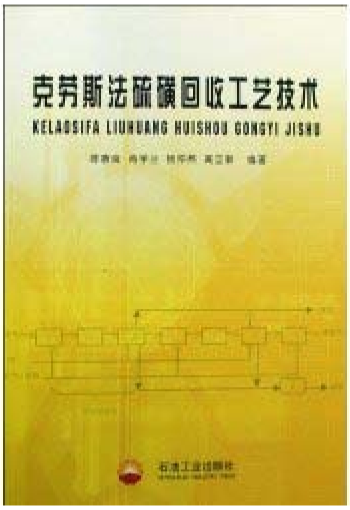
附加信息:

主要责任者 钟秦 zhong qin 编著
题名责任说明 燃煤烟气脱硫脱硝技术及工程实例 ran mei yan qi tuo liu tuo xiao ji shu ji gong cheng shi li / 钟秦编著
出版发行等 北京 : 化学工业出版社, 2007
标签 添加标签
版本说明 2 版

地点	索书号	流通状态	条码
中文自科图书借阅室	X701.3 850 2 2007	刚刚归还	0000113104710
中外图书保存本查阅室(馆内阅览)	X701.3 850 2 2007	在架上	0000113104738

11.1.4.2. 浙江大学图书馆

陈赓良



系统号- 图书 000500665
ISBN Link978-7-5021-6048-7 : CNY60.00
作品语种 chi
题名 Link 克劳斯法硫磺回收工艺技术 / 陈赓良 ... [等] 编著
出版发行 Link 北京 : 石油工业出版社, 2007
载体形态 213 页, [1] 叶图版 : 图 ; 26cm
书目附注 有书目 (第 212-213 页)
摘要 本书对克劳斯法硫磺回收工艺的基本原理、工艺流程、主要设备、操作要点、尾气处理、模拟计算及催化剂的应用作了系统介绍，并讨论了该工艺技术未来的发展方向。
主题 Link 克劳斯硫回收法脱硫
分类号 LinkTQ218
个人著者 Link 陈赓良, 1940-
Link 肖学兰
Link 杨仲熙
Link 高立新

馆藏地:索书号 玉泉理工阅览室 : TQ218/CC1
馆藏地:索书号 玉泉样本书库 : TQ218/CC1
全部馆藏 所有单册

作者简介:
网络摘要: 《克劳斯法硫磺回收工艺技术》根据国内外近期发表的文献资料,结合中国石油西南油气田分

公司天然气研究院多年科研成果与经验,对克劳斯法硫磺回收工艺的基本原理、工艺流程、主要设备、操作要点、尾气处理、模拟计算及催化剂的应用做了系统介绍,并讨论了该工艺技术未来的发展方向。《克劳斯法硫磺回收工艺技术》可供从事天然气、炼厂气净化的工程技术人员参考,也可作为石油大专院校相关专业师生的参考书。
标签:

郭东明

系统号- 图书 000427203
ISBN Link978-7-122-00202-0 : CNY68.00
作品语种 chi
题名 Link 脱硫工程技术与设备 / 郭东明编著
出版发行 Link 北京 : 化学工业出版社, 2007
载体形态 397 页 : 图 ; 26cm
书目附注 有书目 (第 395-397 页)
主题 Link 烟气脱硫 - 基本知识
Link 烟气脱硫 - 设备
分类号 LinkX701.3
个人著者 Link 郭东明

馆藏地:索书号 华家池流通书库 : X701.3/CG1
馆藏地:索书号 紫金港农医流通书库 : X701.3/CG1
全部馆藏 所有单册

作者简介:
网络摘要: 本书详细介绍了各种烟气脱硫工艺技术、脱硫塔核心设计技术、脱硫系统主要设备特点以及脱硫系统的调试与运行技术,同时总结了大量的脱硫实践经验和教训,目的是通过这些技术的介绍,使读者能够改进及提高已有脱硫技术的设计、运营水平,开发出新的脱硫技术,同时提高相关设备的制造水平。

本书可供有关学校、科研院所、电力、化工、冶金及建材等行业的工程技术人员、管理人员参考,亦可作为院校师生参考书。

标签:

李继莲

系统号- 图书 000689427
ISBN Link978-7-5083-7870-1 : CNY43.00
订单号 LinkCEPC090102-0690
作品语种 chi
题名 Link 烟气脱硫实用技术 / 李继莲编
出版发行 Link 北京 : 中国电力出版社, 2008
载体形态 341 页 : 图 ; 24cm
书目附注 有书目 (第 341 页)
摘要 本书介绍了烟气脱硫基本知识、湿法烟气脱硫工艺系统及设备、湿法烟气脱硫系统的运行、半干法烟气脱硫工艺系统及设备、干法烟气脱硫技术、烟气脱硫工艺过程控制与检测、脱硫产物的处置与综合利用、火电厂脱硝技术、烟气脱硫脱硝技术经济分析等内容。
主题 Link 废气治理 - 脱硫
分类号 LinkX701.3
个人著者 Link 李继莲

馆藏地:索书号 华家池流通书库 : X701.3/CL2
馆藏地:索书号 紫金港农医流通书库 : X701.3/CL2
全部馆藏 所有单册

作者简介:

网络摘要: 本书介绍了烟气脱硫基本知识、湿法烟气脱硫工艺系统及设备、湿法烟气脱硫系统的运行、半干法烟气脱硫工艺系统及设备、干法烟气脱硫技术、烟气脱硫工艺过程控制与检测、脱硫产物的处置与综合利用、火电厂脱硝技术、烟气脱硫脱硝技术经济分析等内容。

本书可供相关专业大、中专院校师生使用,也可供电力生产一线的相关专业人员阅读、参考。

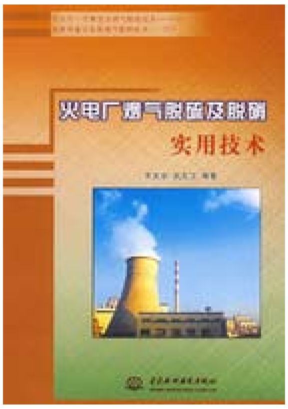
陶有俊

系统号- 图书 000625109
ISBN Link978-7-81107-768-1 : CNY39.00
作品语种 chi
题名 Link 强化重力场中细粒煤脱硫研究 / 陶有俊, 赵跃民著
出版发行 Link 徐州 : 中国矿业大学出版社, 2007
载体形态 199 页 : 图 ; 21cm
书目附注 有书目 (第 193-199 页)
摘要 本书针对-0.5mm 级细粒煤在强化重力场中分选和脱硫进行了研究，通过对细粒高硫煤所进行的脱硫试验，研究了细粒煤在强化重力场中的运动规律。通过利用 Design-Expert 系统，建立了细粒煤分选效果指标与不同操作参数之间的关系模型，并进一步提出了针对不同试验参数的优化方案。
并列正题名 LinkStudy on desulfuration for fine coal in complex physics force field
主题 Link 重力选煤 - 脱硫 - 研究
分类号 LinkTD942.2
LinkTQ536
个人著者 Link 陶有俊
Link 赵跃民

馆藏地:索书号 玉泉理工阅览室 : TD942.2/CT1
馆藏地:索书号 玉泉样本书库 : TD942.2/CT1
全部馆藏 所有单册

作者简介:
网络摘要:
标签:

王文宗



系统号- 图书　　000697143

ISBN　Link978-7-5084-6057-4 : CNY58.00

作品语种　chi

题名　Link 火电厂烟气脱硫及脱硝实用技术 / 王文宗, 武文江编著

出版发行　Link 北京 : 中国水利水电出版社, 2009

载体形态　340 页 : 图 ; 26cm

书目附注　有书目 (第 340 页)

摘要　本书分为两篇，第一篇主要讲述了石灰石一石膏湿法烟气脱硫技术的基本原理、子系统、主要控制环节、方案比较、主要脱硫设备的特点及选型、防腐等内容。第二篇系统讲述了 SCR 脱硝工艺的原理、工艺流程、催化剂、主要设备，并对目前世界上有应用业绩和试验阶段的脱硝工艺进行了介绍。

主题　Link 火电厂 - 烟气脱硫

　Link 火电厂 - 烟气 - 脱硝

分类号　LinkX773.01

个人著者　Link 王文宗

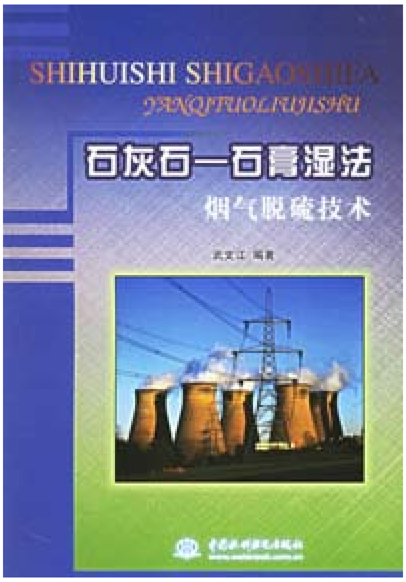
　Link 武文江

作者简介:

网络摘要:　本书分为两篇:第一篇系统讲述了石灰石一石膏湿法烟气脱硫工艺的工作原理、工艺流程、主要设备及特殊工艺,并对石膏炒制及其他典型脱硫工艺进行了介绍;第二篇系统讲述了 SCR 脱硝工艺的原理、工艺流程、催化剂、主要设备及运行维护,并对目前世界上有应用业绩和实验阶段的脱硝工艺进行了简单介绍。本书可供火力发电厂生产技术人员、管理人员及大专院校师生阅读。

标签:

武文江



系统号- 图书 000459036

ISBN Link7-5084-3311-4 : CNY35.00

作品语种 chi

题名 Link 石灰石—石膏湿法烟气脱硫技术 / 武文江编著

出版发行 Link 北京 ： 中国水利水电出版社, 2006

载体形态 182 页 ： 图 ; 26cm

书目附注 有书目 (第 182 页)

摘要 本书介绍了石灰石—石膏湿法烟气脱硫技术的基本原理、子系统、主要控制环节、方案比较、主要脱硫设备的特点及选型、防腐等内容。

主题 Link 火电厂 - 湿法 - 烟气脱硫

分类号 LinkX701.3

个人著者 Link 武文江

馆藏地:索书号 华家池流通书库 : X701.3/CW1

馆藏地:索书号 紫金港农医流通书库 : X701.3/CW1

全部馆藏 所有单册

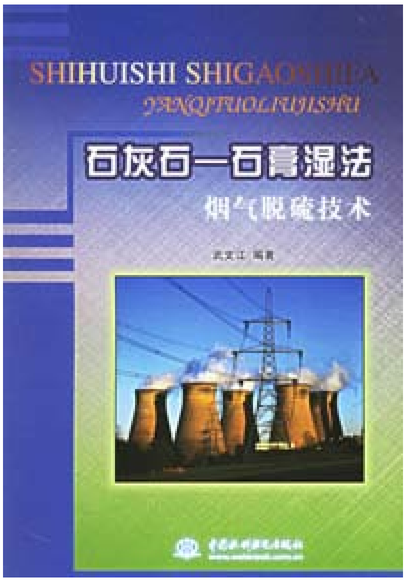
作者简介:

网络摘要: 石灰石—石膏湿法烟气脱硫工艺是目前世界上大型烟气脱硫的主要工艺,我国通过多年来对该技术的引进消化,已经进入推广阶段。自 2002 年从 300MW 机组国产化示范以来,在我国得到广泛的应用。

本书系统讲述了石灰石—石膏湿法烟气脱硫技术的工作原理、工艺流程、主要设备及特殊工艺等,并对石膏炒制及其它典型脱硫工艺进行了介绍。可作为火力发电厂及相关环保企业脱硫技术人员、管理人员及大专院校相关人员的参考书。

标签:

武文江



系统号- 图书 000459036
ISBN Link7-5084-3311-4 : CNY35.00
作品语种 chi
题名 Link 石灰石—石膏湿法烟气脱硫技术 / 武文江编著
出版发行 Link 北京 : 中国水利水电出版社, 2006
载体形态 182 页 : 图 ; 26cm
书目附注 有书目 (第 182 页)
摘要 本书介绍了石灰石—石膏湿法烟气脱硫技术的基本原理、子系统、主要控制环节、方案比较、主要脱硫设备的特点及选型、防腐等内容。
主题 Link 火电厂 - 湿法 - 烟气脱硫
分类号 LinkX701.3
个人著者 Link 武文江

馆藏地:索书号 华家池流通书库 : X701.3/CW1
馆藏地:索书号 紫金港农医流通书库 : X701.3/CW1
全部馆藏 所有单册

作者简介:
网络摘要: 石灰石—石膏湿法烟气脱硫工艺是目前世界上大型烟气脱硫的主要工艺,我国通过多年来对该技术的引进消化,已经进入推广阶段。自 2002 年从 300MW 机组国产化示范以来,在我国得到广泛的应用。

本书系统讲述了石灰石—石膏湿法烟气脱硫技术的工作原理、工艺流程、主要设备及特殊工艺等,并对石膏炒制及其它典型脱硫工艺进行了介绍。可作为火力发电厂及相关环保企业脱硫技术人员、管理人员及大专院校相关人员的参考书。
标签:

肖文德

系统号- 图书 000052966
ISBN Link7-5025-3166-1 : CNY26.00
作品语种 chi
题名 Link 二氧化硫脱除与回收 / 肖文德，吴志泉编著
出版发行 Link 北京 ：化学工业出版社 ：环境科学与工程出版中心, 2001
载体形态 282 页 ：图 ; 20cm
从编项 Link 环境工程实用技术丛书
摘要 本书主要论述有色金属冶炼厂废气和锅炉废气的 SO2 脱除与回收的原理、典型的工艺流程和相关的设备，并对主要技术的设计方法给予了论述。
从编 Link 环境工程实用技术丛书
主题 Link 烟气脱硫
分类号 LinkX701.3
个人著者 Link 肖文德
Link 吴志泉

馆藏地:索书号 华家池流通书库 : X701.3/CX1
馆藏地:索书号 紫金港基础流通书库 : X701.3/CX1
馆藏地:索书号 紫金港农医流通书库 : X701.3/CX1
全部馆藏 所有单册

作者简介:
网络摘要: 本书是“环境工程实用技术丛书”的一个分册,主要论述有色金属冶炼厂废气的二氧化硫脱除与回收原理、典型的工艺流程和相关的设备,并对主要技术方法给予了论述。主要内容是作者长期结合我国国情和国际前沿的感悟。

本书适合于能源、冶金、化工和环保等领域的大学生、研究生、研究人员、设计人员和工程技术人员,也适合于以上领域的政府管理官员、社会活动家和环保家和环保爱好者。
标签:

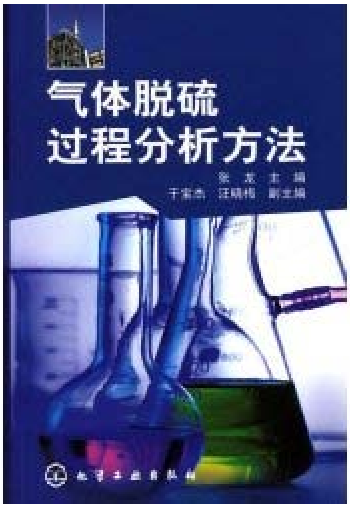
张磊

系统号- 图书 000746350
ISBN Link978-7-5083-8770-3 : CNY45.00
作品语种 chi
题名 Link 大型电站煤粉锅炉烟气脱硫技术 / 张磊, 刘树昌主编
出版发行 Link 北京 : 中国电力出版社, 2009
载体形态 305 页 : 图 ; 26cm
书目附注 有书目
摘要 本书内容包括石灰石-石膏湿法烟气脱硫机械设备与系统、脱硫岛设备与检修、脱硫装置自动控制及电气系统与设备、石灰石-石膏湿法脱硫装置的调试与性能试验、石灰石-石膏湿法脱硫装置的运行以及海水脱硫系统与运行。
主题 Link 火电厂 - 煤粉锅炉 - 烟气脱硫
分类号 LinkX773.013
LinkTM621.2
个人著者 Link 张磊
Link 刘树昌

馆藏地:索书号 华家池流通书库 : X773.013/CZ2
馆藏地:索书号 紫金港农医流通书库 : X773.013/CZ2
全部馆藏 所有单册

作者简介:
网络摘要:
标签:

张龙



系统号- 图书 000357862

ISBN Link7-5025-9535-X : CNY19.00

订单号 Link 华现 06-56-014

作品语种 chi

题名 Link 气体脱硫过程分析方法 / 张龙主编

出版发行 Link 北京 : 化学工业出版社, 2006

载体形态 201 页 : 图 ; 21cm

书目附注 有书目

摘要 本书系统地介绍了脱硫过程中气体成分的化学分析与仪器分析方法，脱硫液中各种成分及有关物理性质的分析及测定方法，常用脱硫催化剂溶液的成分分析方法，脱硫催化剂的硫容测定方法，还介绍了常用标准溶液的配置等内容。

主题 Link 气体 - 脱硫 - 过程 - 分析方法

分类号 LinkTQ028.2

LinkTQ031.9

个人著者 Link 张龙

馆藏地:索书号 玉泉理工阅览室 : TQ028.2/CZ1

馆藏地:索书号 玉泉流通书库 : TQ028.2/CZ1

馆藏地:索书号 玉泉样本书库 : TQ028.2/CZ1

全部馆藏 所有单册

作者简介:

网络摘要: 本书系统地介绍了脱硫过程中气体成分的化学分析与仪器分析方法,脱硫液中各种成分及有关物理性质的分析及测定方法,常用脱硫催化剂溶液的成分分析方法,脱硫催化剂的硫容测定方法,还介绍了常用标准溶液的配制等内容。全书结构合理,通俗易懂,基础实用,具有很强的可操作性。

本书可为从事气体脱硫净化过程研究和开发的科研人员提供科学、实用的参考资料;亦是电厂、化肥、焦化、煤气、甲醇、天然气、发酵、制药、沼气及水处理行业中从事脱硫工艺、分析的工程技术人员必备的专业工具书;还可作为相关部门进行“气体脱硫分析方法”的培训教材和相关院校分析化学、环境工程、工业分析及气体净化等专业师生的教学参考资料。

标签:

钟秦

系统号- 图书 000496346

ISBN Link978-7-122-00321-8 : CNY68.00
Link7-122-00321-3

作品语种 chi

题名 Link 燃煤烟气脱硫脱硝技术及工程实例 / 钟秦编著

版本说明 第 2 版

出版发行 Link 北京 : 化学工业出版社, 2007

载体形态 406 页 : 图 ; 26cm

书目附注 有书目

摘要 本书围绕着燃煤烟气脱硫脱硝这一主题，在简要阐述燃煤二氧化硫和氮氧化物的排放与控制技术的基础上，着重介绍了湿法、半干法和干法烟气脱硫技术、烟气脱硝技术及烟气同时脱硫脱硝技术。

主题 Link 煤烟污染 - 烟气脱硫 - 技术
Link 煤烟污染 - 烟气 - 脱硝 - 技术

分类号 LinkX701.3

个人著者 Link 钟秦

馆藏地:索书号 华家池流通书库 : X701.3/CZ1-2
馆藏地:索书号 紫金港农医流通书库 : X701.3/CZ1-2
全部馆藏 所有单册

作者简介:

网络摘要: 本书围绕着燃煤烟气脱硫脱硝这一主题，在简要阐述燃煤二氧化硫和氮氧化物的排放与控制技术的基础上,着重介绍了湿法、半干法和干法烟气脱硫技术、烟气脱硝技术及烟气同时脱硫脱硝技术。

全书分为七章。第一章介绍了燃煤二氧化硫和氮氧化物的排放及其控制技术;第二章至第四章分别系统地论述了湿法、半干法和干法烟气脱硫技术;第五章和第六章分别论述了烟气脱硝技术和烟气同时脱硫脱硝技术;第七章简要介绍了燃煤烟气脱硫脱硝技术经济分析。对应用较广的烟气脱硫脱硝技术在相关章节给出了应用实例。

本书可供从事大气污染物控制的管理、研究和工程技术人员参考,也可作为高等院校环境工程、热能工程和化学工程等专业的本科生、研究生和教师的参考书籍。

标签:

周根来

系统号- 图书 000732579

ISBN Link978-7-5083-8649-2 : CNY25.00

作品语种 chi

题名 Link 电站锅炉脱硫装置及其控制技术 / 周根来，孟祥新编著

出版发行 Link 北京 ： 中国电力出版社, 2009

载体形态 187 页 ： 图 ; 26cm

书目附注 有书目 (第 187 页)

摘要 本书讲述石灰石烟气脱硫装置常规仪表及控制系统的原理及技术基础上，着重讲述了石灰石烟气脱硫装置常规仪表的选型、安装，还介绍了烟气连续监测系统的组成、测量探头的安装、分析仪的测量原理及数据采集，控制系统的选型、设计、安装及调试等内容。

主题 Link 火电厂 - 燃煤锅炉 - 烟气脱硫 - 附属装置

Link 火电厂 - 燃煤锅炉 - 烟气脱硫 - 控制系统

分类号 LinkTM621.2

个人著者 Link 周根来

Link 孟祥新

馆藏地:索书号 玉泉理工阅览室 : TM621.2/CZ4

馆藏地:索书号 玉泉流通书库 : TM621.2/CZ4

馆藏地:索书号 玉泉样本书库 : TM621.2/CZ4

全部馆藏 所有单册

作者简介:

网络摘要: 全书分九章,除第一章湿法脱硫工艺外，其余八章分别介绍石灰石烟气湿法脱硫装置常规仪表、分析仪表的基本原理、选型、安装,烟气连续监测系统探头的安装、主要分析仪的基本原理,脱硫主要工艺设备控制说明、闭环控制及顺序控制说明,脱硫控制系统的选型、设计、硬件及软件出厂验收性能测试,脱硫控制系统现场上电、信号传动、现场热控设备调试、热控主保护功能调试、顺序控制等。

本书可供从事电站燃煤锅炉石灰石烟气湿法脱硫装置热工仪表维护管理的技术管理人员阅读,可作为烟气脱硫装置热工运行维护人员的培训教材,也可作为高等学校电厂热工专业的参考书。

标签:

周建安

系统号- 图书 000678125
ISBN Link978-7-5024-4757-1 : CNY20.00
作品语种 chi
题名 Link 炉外底喷粉脱硫工艺研究 / 周建安著
出版发行 Link 北京 : 冶金工业出版社, 2008
载体形态 154 页 : 图 ; 21cm
书目附注 有书目 (第 148-154 页)
摘要 本书从理论与实验的角度阐述了通过透气砖底喷粉脱硫工艺的可行性。全书共分为 5 章，主要内容有：硫对钢性能的影响；炉外脱硫；底喷粉脱硫系统；底喷粉透气砖内粉气流动与射流；底喷粉脱硫等。
主题 Link 炼钢 - 脱硫 - 工艺学
分类号 LinkTF704.3
个人著者 Link 周建安, 1965-

馆藏地:索书号 玉泉流通书库 : TF704.3/CZ1
馆藏地:索书号 玉泉样本书库 : TF704.3/CZ1
全部馆藏 所有单册

作者简介: 周建安,1965 年出生,中共党员，工学博士,教授级高级工程师,一级建造师。长期从事炼钢工艺技术设计及研究工作。主持、参加的工程设计和课题研究 30 余项,其中包括国内首创新型二冷系统等多项具有我

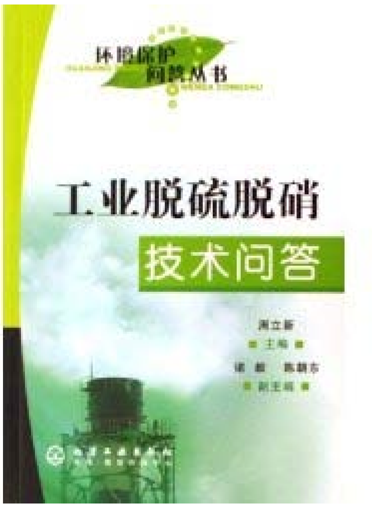
国自主知识产权的连铸核心新技术,获部级以上奖励 5 项,填补国内空白 4 项,获国家发明专利 3 项。先后在《钢铁研究学报》、《钢铁》、《炼钢》等期刊上发表论文、译文 20 余篇。主要社会兼职有《炼钢》等杂志编委、高校研究生导师等。

网络摘要: 本书在综合考虑当今钢铁冶炼过程中脱硫工艺的基础上,从理论与实验的角度阐述了通过透气砖底喷粉脱硫工艺的可行性。全书共分为 5 章:第 1 章介绍了硫对成品钢质量的影响以及钢铁冶炼过程各阶段脱硫效率分析;第 2 章介绍了当今钢铁联合企业炉外脱硫技术和炉外底喷粉脱硫的意义;第 3 章介绍了传统喷粉冶金设备的特点、狭缝型透气砖底喷粉系统的设计特别是底喷粉用透气砖的设计;第 4 章通过理论计算与实验验证揭示了气体和气粉两相流在狭缝型透气砖中的流动规律和射流特性;第 5 章综合讨论了底喷粉脱硫工艺的工业应用的可行性。

本书可供冶金专业的研究生、科研院所的科研人员以及工程技术人员阅读参考。

标签:

周立新



系统号- 图书 000426132

ISBN Link7-5025-9212-1 : CNY18.00

作品语种 chi

题名 Link 工业脱硫脱硝技术问答 / 周立新主编

出版发行 Link 北京 : 化学工业出版社, 2006

载体形态 262 页 : 图 ; 21cm

丛编项 Link 环境保护问答丛书

书目附注 有书目 (第 261-262 页)

摘要 本书从脱硫脱硝基本概念入手，对煤炭洗选和煤炭转化脱硫技术、工业型煤燃烧固硫技术、流化床燃烧脱硫技术、烟气脱硫技术、氮氧化物排放控制技术、烟气同时脱硝脱硫技术的原理、工艺特点以及在应用中的注意问题和国内外技术的发展状况一一做了解答。

丛编 Link 环境保护问答丛书

主题　　Link 脱硫 - 技术 - 解题
　　Link 脱硝 - 技术 - 解题
分类号　　LinkX701.3
个人著者　　Link 周立新

馆藏地:索书号　　华家池流通书库 : X701.3/CZ3
馆藏地:索书号　　紫金港农医流通书库 : X701.3/CZ3
全部馆藏　　所有单册

作者简介:
网络摘要:　　书中从脱硫脱硝基本概念入手,对煤炭洗选和煤炭转化脱硫技术、工业型煤燃烧固硫技术、流化床燃烧脱硫技术、烟气脱硫技术、氮氧化物排放控制技术、烟气同时脱硝脱硫技术的原理、工艺特点以及在应用中的注意问题和国内外技术的发展状况一一做了解答。问题的解答精练且通俗易懂。
　　本书可供从事烟气污染治理及控制的初、中级环境保护职业技术和管理人员参考使用。
标签:

周至祥

系统号- 图书　　000330710
ISBN　　Link7-5083-4125-2 (精装)　: CNY78.00
作品语种　　chi
题名　　Link 火电厂湿法烟气脱硫技术手册 / 周至祥, 段建中, 薛建明编著
出版发行　　Link 北京 : 中国电力出版社, 2006
载体形态　　699 页 : 图 ; 26cm
书目附注　　有书目 (第 696-699 页)
摘要　　本书阐述了湿法石灰/石灰石烟气脱硫技术以及有关的专业知识。介绍了 FGD 主要设备的类型、用途、主要性能参数和布置方式，阐述了 FGD 工艺的技术经济评估体系、评估指标和评估方法等。
主题　　Link 火电厂 - 湿法 - 烟气脱硫 - 技术手册
分类号　　LinkX773.013-62

个人著者 Link 周至祥
Link 段建中
Link 薛建明

作者简介:
网络摘要: 本书在广泛收集国内外烟气脱硫最新技术资料,结合作者十多年管理电厂烟气脱硫装置实际经验的基础上,较为全面、系统地阐述了湿法石灰/石灰石烟气脱硫技术以及与其有关的专业知识。

本书分为三篇,第一篇较详细、系统地阐述了烟气脱硫的原理和方法;脱硫系统重要设计参数、工艺变量和相互关系以及它们对系统性能的影响;系统主要设备的作用、特性和主要参数;脱硫腐蚀环境和材料选择;系统可靠性;化学监测以及脱硫工程施工、调试和性能考核等方面的内容。第二篇介绍了烟气脱硫主要设备的类型、用途、主要性能参数和布置方式;在目前工艺水平下主要设备在设计和选择时应考虑的问题以及适用的结构材料。第三篇详细讨论了烟气脱硫工艺选择原则;介绍了工艺的技术经济评估体系、评估指标和评估方法;工程标书的技术经济评估方法、列举了 7 个已投运的脱硫工程实例,以供选择烟气脱硫工艺时参考。此外,还在附录中汇集了国内目前已颁布的与烟气脱硫有关的主要标准、规程和规范,以便读者查阅。

本书涉及了烟气脱硫技术的各个方面,内容丰富,层次分明,综合性强,结合了工程实践经验,有助于从事烟气脱硫工作的工程技术人员在理论和实践上获得更多的信息,是国内第一本详细介绍湿法石灰/石灰石烟气脱硫技术的技术手册,具有较强的实用性和参考价值。

本书适用于从事火电厂烟气脱硫、其他工业废气治理、环境监测、工业管理、科研等部门的工程技术人员阅读,也可供高等院校师生参考。

标签:

周至祥

系统号- 图书 000330710
ISBN Link7-5083-4125-2 (精装) : CNY78.00
作品语种 chi
题名 Link 火电厂湿法烟气脱硫技术手册 / 周至祥, 段建中, 薛建明编著
出版发行 Link 北京 : 中国电力出版社, 2006
载体形态 699 页 : 图 ; 26cm
书目附注 有书目 (第 696-699 页)
摘要 本书阐述了湿法石灰/石灰石烟气脱硫技术以及有关的专业知识。介绍了 FGD 主要设备的类型、用途、主要性能参数和布置方式，阐述了 FGD 工艺的技术经济评估体系、评估指标和评估方法等。
主题 Link 火电厂 - 湿法 - 烟气脱硫 - 技术手册
分类号 LinkX773.013-62
个人著者 Link 周至祥
Link 段建中
Link 薛建明

馆藏地:索书号 紫金港农医工具书室 : X773.013-62/CZ1
馆藏地:索书号 紫金港农医流通书库 : X773.013-62/CZ1
全部馆藏 所有单册

作者简介:
网络摘要: 本书在广泛收集国内外烟气脱硫最新技术资料,结合作者十多年管理电厂烟气脱硫装置实际经验的基础上,较为全面、系统地阐述了湿法石灰/石灰石烟气脱硫技术以及与其有关的专业知识。

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本书涉及了烟气脱硫技术的各个方面,内容丰富,层次分明,综合性强,结合了工程实践经验,有助于从事烟气脱硫工作的工程技术人员在理论和实践上获得更多的信息,是国内第一本详细介绍湿法石灰/石灰石烟气脱硫技术的技术手册,具有较强的实用性和参考价值。

本书适用于从事火电厂烟气脱硫、其他工业废气治理、环境监测、工业管理、科研等部门的工程技术人员阅读,也可供高等院校师生参考。
标签:

11.1.5. SO2 Paper

非线性/复杂性科学在煤燃烧过程中 SO2 排放理论和数值模拟的应用

第一稿

2011-4-3

陈明华

12. 自古至今最杰出的科学家

12.1. 影响世界历史的 100 部名著

12.2. Scientists_CFD

12.3. Scientists_General_CN

12.4. Scientists_General_EN

12.5. SciOthers

12.6. SciMath

12.7. NanoThermScientists

12.8. Scientists_Radiation_CN

12.9. Scientists_Radiation_EN

12.10. Scientists_SSM

12.11. Scientists_Universe_CN

12.12. Scientists_Universe_EN

12.13. Scientists_Biotherm

12.14. Scientists_Thermodyn_Hist

12.15. Scientists_Thermodynamics

12.16. Biograpgy or Books

12.16.1. Einstein

爱因斯坦全集.第二卷.瑞士时期（1900－1909）.pdf
爱因斯坦全集.第三卷.瑞士时期（1909－1911）.pdf
爱因斯坦全集.第四卷.瑞士时期（1912－1914）.pdf
爱因斯坦全集.第五卷.瑞士时期（1902－1914）.pdf
爱因斯坦全集.第一卷.早年时期（1879－1902）.pdf

12.16.2. Euclid

Euclid Elementsxxx.pdf
EUCLIDS ELEMENTS OF GEOMETRY EngGreek.pdf
tomos-1.pdf
tomos-2.pdf
tomos-3.pdf

12.16.3. Euler

Elements of Algebra3rdEdxx.pdf
Foundations of Differential Calculusxxx.pdf

12.16.4. Hilbert

Hilbert The Foundations of Geometryxxx.pdf
Theoryalgebraicinvariantsxxx.pdf

12.16.5. Newton

Principia.pdf
自然哲学之数学原理 1.pdf

12.16.6. Schrödinger

schroedingerXXX.pdf

13. PREVIOUS RESEARCHES

Earlier I have also carried researches on a wide variety of topics such as

- nano and microfluidics
- CFD – Computational Fluid Dynamics
- (2008) Thermodynamics with special interests in mesoscopic thermodynamics (thermodynamics of small structures– such as porous media, cells, surface and interfaces, molecules, quantum, nucleation, and nano-structures)
- thermodynamics of cancer
- biothermodynamics with focus on human,
- Thermodynamics of Biosystems, Human Life, Health and Diseases particularly Cancers – its theory, prevention, diagnosis, monitoring, therapy and rehabilitation; thermodynamics applications in general;
- Thermodynamics of Biology, Life, Health and Diseases particularly Cancers – its theory, prevention, diagnosis, monitoring, therapy and rehabilitation; thermodynamics applications in general;
- Thermodynamics of Life, Biology and Health; thermodynamics applications in general;
- (2009-2008) Thermodynamics of the sun (in particular thermodynamics of corona heating and solar wind) and solar energy use (solar photovoltaics and solar heating)
- (2009-2008) Thermal Physics in Solar Photovoltaics: thermal physics in the process of research, development, manufacturing and operation of solar silicons, wafers, cells, modules and systems
- thermodynamics of the Sun (solar thermodynamics) with focus on solar corona heating and solar wind problems
- (2009-2008) Thermodynamics of the sun (in particular thermodynamics of corona heating and solar wind) and solar energy use (solar photovoltaics and solar heating)
- solar physics, incl standard solar model (SSM) and the neutrino problems
- (2008-2007) Solar physics with special interests in solar model, corona heating and solar wind, incl. basic theory and technologies and tools used for understanding the physical phenomenon of the Sun and the space and atmospheric thermal physics owing to the sun radiation.
- (2008-2007) Solar physics with special interests in solar model, corona heating and solar wind (2004)
- (2007) Solar radiation and its measurement technologies
- solar radiation and human health and solar therapy
- solar radiation and its measurement, incl ground based and orbiting satellites and other radiation measurement technologies and systems
- (2008-2007)Sun to Human Life: everything the Sun is related to human society, such as healthcare, science, technology, literature, religion, politics, wars, art, commerce and business, a very extensive topic
- (2008) Thermoeconomics, (exergoeconomic) and exergetic analysis
- (2009-2008) Thermal Physics in Solar Photovoltaics: thermal physics in the process of research, development, manufacturing and operation of solar silicons, wafers, cells, modules and systems
- photovoltaics and daylighting

- (2006-2003) Solar photovoltaics
- solar aircrafts and solar spacecrafts, solar airships, balloons, solar ion propulsion, light propulsion, solar sails etc
- (2007)Solar Aircrafts; Solar Airships: about solar airships, aerostats, balloons, blimps etc; Light Ion Propulsion; Light Sails; Space Photovoltaics.
- SO2 pollution control etc
- (1989-1986) Thermophysics with special topic of air pollution control in coal combustion
- (1989-1986) Thermophysics with special topic of air pollution control in coal combustion and thermal pipes
- Cryptography and Internet security applications
- (2009) Cryptography and Internet security applications

I've written a 300+ page "Thermodynamics Literature Review" in English (unpublished) and many other articles, but so far no publications were completed except some drafts.

14. FLUIDDYNAMICS

After more than 20 years of explorations I've decided to fix my research and business to fluid dynamics with:

- Primary focus on fluid dynamics of small systems, Non-Newtonian, and other weird systems and
- Secondary focus on computational theory

I plan to write
- one book and
- one article

which shall be remembered and cited by all the academia and by 20% of the world population.

I plan to discover something new in the fluid dynamics theory or rather fluidics (fluid science), not just to write hundreds of useless paper or books, only to be forgotten by all.

To contribute to the development of the fluid science particularly in the area of nanofluidics and biofluidics. Turbulent flow is also among my greatest interests.

14.1. WHY FLUID DYNAMICS?

The world is composed of three matters: solid, fluid and something between. Therefore if you understand liquid well, you understand a third of the world already.

On the other hand, fluid dynamics is one of the fundamental sciences of the mechanical engineers, to which I belong.

14.2. WHY FLUIDDYNAMICS RESEARCHES???

The reason to focus on fluiddynamics has been complex.

- it belongs to one of the fundamental science of the thermal physics chapter
- I have learned it very intensively over the past and
- my business over the last couple of years are related to this area.

14.3. Reading

CFD / PDF

000Methodes numeriques pour la dynamique des fluides 81
000Methods for Numerical Flow Simulation
000Modelisation analyse mathematique
000Numerische Methoden
000Analyse mathematique et numerique 35
000AnalyseMathematique
000Lattice-Boltzmann_Good
000Fundamentals of Compressible Fluid Mechanics 19
000INTERMEDIATE FLUID MECHANICS_Good 53
Computational Fluid Dynamics_Good page 11
Introduction to Computational Fluiddynamics_good
Analyse mathematique et numerique de la dynamique des fluides compressibles
Initiation a la simulation numerique en mecanique des fluides
Initiation a la Simulation Numerique en Mecanique des Fluides a l'Aide de CASTEM2000
Mécanique des Fluides Numérique
Methodes numeriques pour la dynamique des fluides
计算流体动力学分析-CFD 软件原理与应用
000 计算流体力学的理论、方法及应用
000 计算流体力学基础(苏铭德 清华大学)
000 计算流体力学讲义

General / PDF

000Fundamentals of Compressible Fluid Mechanics
000INTERMEDIATE FLUID MECHANICS_Good
Fluid dynamics / mechanics
Fluiddynamik
Strömungslehre
Dynamique des fluids
Mécanique des fluides
Механика жидкостей и газов
Динамика жидкостей
Ρευστοδυναμική
Μηχανική Ρευστών

Computational Fluid Dynamics with OpenFOAM_Good
Computational Fluid Dynamics_Good
Diffuse interface models in fuid mechanics_Good
Fluid Dynamics Physical ideas_good
Fluid Mechanics ELECTRO-WETTING_Good
fluid_mech_module_good
FluidLecture_Good
Fundamentals of Compressible Fluid_Good
Fundamentals of Compressible_Good
Geophysical Fluid Dynamics_Good
Hamitonian_Good
INTERMEDIATE FLUID MECHANICS_Good 18
Introduction to Computational Fluiddynamics_good
Lagrangian Fluid Dynamics3_Good
Lattice-Boltzmann_Good
Links between microscopic and acroscopicfluid mechanics_Good
Moving Mesh Methods for Computational Fluid Dynamics_Good
QUANTIFICATION OF UNCERTAINTY_Good
RELATIVISTIC FLUID_Good
Science and Reactor Fundamentals Fluid Mechanics_Good
The Finite Element Method_Good
THE FLUID MECHANICS OF NATURAL VENTILATION_Good
Unsolved Problems in Fluid Mechanics_Good
http://www.lib.kth.se/main/e-boocker.asp

NanoFluids

Books
Info
NanoFluidics
Nanoscience
NanoTransport

14.4. Literature

14.4.1. General

14.5. Problems

How to explain turbulent flow in molecular science?
用社么参数来判断湍流出现？怎样定量 Re 数与湍流的关系 （湍流度与 Re 数的关系）？

当黏度等于零时（无粘性流）Re 数无穷大，是否一定湍流？

How is eddy formed?

Unsolved Problems in Fluid Mechanics:
On the Historical Misconception of Fluid Velocity as Mass Motion, Rather than Volume Motion
Howard Brenner
Department of Chemical Engineering
Massachusetts Institute of Technology
Cambridge, MA 02139
hbrenner@mit.edu

14.6. Micro/nano fluiddynamics

流体力学	纳米/ /细胞/流体力学	0	2010-12-19 – 2010-12-23
6	纳米/小系统/生物/非牛顿流体力学/热物理/物理/科学	5	2010.8.1-2010-9-26, 2010-10-10 – 2010-12-19
	计算流体力学	1	2010-9-22 – 2010-10-10

Currently I am working for the nano science and technologies industries as the Senior Engineer, at NanoAge (China) Technologies (Hangzhou, China). My duties, among others, are to provide various researches, engineering, design and consulting services for the nanoscience and nanotechnology communities incl nanofluidics based on Computational Fluid Dynamic (CFD) - computational nanofluidics. These services help nano-manufacturing and processing by optimizing the fluid dynamics and thermodynamic parameters involved in the fabrication of nanochannels and nanotubes. Market intelligence services for international clients are also being provided as well as technological transfer.

Apart from nanofluidics, I've also collected experiences in other areas of the fluiddynamics such as the theoretical and experimental fluid mechanics. As a master of engineering in thermophysics, fluiddynamics was among one of the key courses. My studies of fluid dynamics were not limited to hydrodynamics but were extended to aerodynamics with the course of gas turbines and steam turbines. In my studies of international combustion engines, fluid dynamics was also the key theory to understand the mechanism of the combustion process. Fluiddynamics also has played key roles in other studies of the thermal engineering, such as steam boilers, compressors, pumps and valves, pipes and heat exchangers, etc. Later in my career as engineer at major multinationals and domestic design institute and powerplant, this part of science was intensively applied to fulfill my tasks.

14.6.1. MISSION - NANOFLUIDICS

Nanofluidics – its fundamental theory and applications to science and technology – incl transport, separation and molecular detection and capture.

My specific interest will be in developing theories to adequately describe the phenomenon of fluid flow at nanoscale where continuum theory may not be applicable. Molecular dynamics simulation, quantum mechanics and probability functional or other statistical methods will be explored. Computational Nanofluidics

– numerical solutions based on the above will also be my focus.

Special interests will be put on the transmembrane transport of cells, to identify possible properties of cell cycles with important factors on human disease and health.

My research will focuses on NanoThermodynamics.

My question remains what can thermodynamics do for the nanoscience and how new theories shall be developed to adapt to the new dimension.

I am also n writing the book titled “NanoThermodynamics – a Comprehensive Review”.

This book will summarize all thermodynamic topics related to the nano-technologies, mainly in three areas – nanoscale thermodynamics, thermodynamics of nano-materials and thermodynamics of nano-technologies. They can further be subdivided into many sections, for example (incmplete)

- Hill’s nanothermodynamics
- Tsallis thermodynamics
- Thermodynamics of Nano / Nanosize -systems
- Thermodynamics of Nano-Processes
- Thermodynamics of Nanomanufacturing / Nanofabrication
- Thermodynamics of Nano-engineering
- Thermodynamics of Nanomeasurements
- Thermodynamics of Nano scale characterization
- Thermodynamics of Nano-Phases
- Thermodynamics of Nanoelectronics
- Thermodynamics of Nanobiotechnology
- Thermodynamics of Nano Tools
- Thermodynamics of nanocanonical constraints
- Thermodynamics of nanoclays
- Thermodynamics of Nanodots
- Thermodynamics of Nanostructures
- Thermodynamics of Nano-materials
- Thermodynamics of Nano-Porous Materials
- Thermodynamics of Nanocrystals / Nanocrystalline materials
- Thermodynamics of nanocomposites
- Thermodynamics of Nanoparticles
- Thermodynamics of nanofibres
- Thermodynamics of Nanodroplets
- Thermodynamics of Nano-fluids
- Thermodynamics of Nano-Products
- Thermodynamics of Nano-components
- Thermodynamics of Nanodevices

Etc.

The book will describe each of these topic in full details: basic theory, research and application status. Key scientists, main problems, further research plans, problems.

I am planning to complete the writing of this book in two years.

14.6.2. WHY FLUID DYNAMICS OF NANO-SCIENCE & TECHNOLOGY ?

Nano-science and nano-technology have not only become a fashion and an investors' favorable area, but they also will play important roles in the future development of technologies and sciences. To understand the flow process in this domain will help the entire nano science and technologies. Nanofluidics involve the majority of nano-processes, hence is vital to the nano engineering, incl. those in the bioengineering.

14.6.3. AREAS OF INTERESTS

My special favor is flow in constrained space – porous media, small structures and micro- and nanofluidics and non-Newtonian flow.

My current researches and design are on CFD – Computational Fluid Dynamics.

My special interests lie in the studies of convergence, stability and efficiency of the various numerical methods involved in various types of fluid dynamics.

Earlier I have also carried researches on a wide variety of other topics such as

- thermodynamics of small systems – such as porous media, cells, surface and interfaces, molecules, quantum, nucleation, and nano-structures
- thermodynamics of cancer
- biothermodynamics with focus on human,
- thermodynamics of the Sun (solar thermodynamics) with focus on solar corona heating and solar wind problems
- thermoeconomics (exergoeconomic) and exergetic analysis
- solar physics, incl standard solar model (SSM) and the neutrino problems
- solar radiation and its measurement, solar radiation and human health and solar therapy
- photovoltaics and daylighting
- SO2 pollution control etc

All the above researches are being done on my own with no involvement of any research institutes.

14.6.4. AREAS OF INTERESTS

My special favor is flow in constrained space – porous media, small structures and micro- and nanofluidics and non-Newtonian flow.

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- thermodynamics of the Sun (solar thermodynamics) with focus on solar corona heating and solar wind problems
- thermoeconomics (exergoeconomic) and exergetic analysis
- solar physics, incl standard solar model (SSM) and the neutrino problems
- solar radiation and its measurement, solar radiation and human health and solar therapy
- photovoltaics and daylighting
- SO2 pollution control etc

All the above researches are being done on my own with no involvement of any research institutes.

14.6.5. WHY FLUIDDYNAMICS RESEARCHES???

The reason to focus on fluiddynamics has been complex.

- it belongs to one of the fundamental science of the thermal physics chapter
- I have learned it very intensively over the past and
- my business over the last couple of years are related to this area.

14.6.6. WHY FLUIDDYNAMICS RESEARCHES OUTSIDE CHINA???

- China's education and research segments are currently very corrupted, therefore
- it is impossible to undertake pure researches without the compromise with this system.
- In addition, China seems never to turn into a free country and
- the general social, political and economical situation is worsening daily so that
- there is a general trends towards decay of the Chinese society
- which does not allow for genuine researches and studies as
- to run my preferred business and

- even the survival chance is very rare if I don’t want to cooperate with the corrupted officials and the dictatorship regime.
- and possibly more reasons.

This decision to leave China by applying for

- a job,
- research, or
- immigration

has been delayed to present day when I am considered as pretty “old” by many. I thought I can always find a compromise between a moderate career and my strongest desire to stay together with my parents.

But now, this compromise can never be realized.

Therefore there is only one option to me: to suicide myself in China or to leave China for a new beginning.

That’s why I am now looking for opportunities at your organization at my age.

14.6.7. REASON TO WORK IN A UNIVERSITY

To discover something new in the science.

14.6.8. Resources

14.6.9. Reseachers

14.6.10. Comprehensive Intro

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14.6.11. Books

14.7. CFD

14.7.1. Fuiddynamics Skills

I've strong background in both theoretical and experimental fluid mechanics. As a master of engineering in thermophysics, fluiddynamics was among one of the key courses. My studies of fluid dynamics were not limited to hydrodynamics but were extended to aerodynamics with the course of gas turbines and steam turbines. In my studies of international combustion engines, fluid dynamics was also the key theory to understand the mechanism of the combustion process. Fluiddynamics also has played key roles in other studies of the thermal engineering, such as steam boilers, compressors, pumps and valves, pipes and heat exchangers, etc. Later in my career as engineer at major multinationals and domestic design institute and powerplant, this part of science was intensively applied to fulfill my tasks.

14.7.2. CFD related background

As early as in my graduate studies time I was already interested in and studied a little about the blood dynamics or hemodynamics in order to find out the causes of headache suffered by my mother. And still today, I am always interested in this subject, and wants to learn the mechanism of blood flow throughout the human body and its many factors and influences to health.

I have demonstrated computational skills over the past in my work and studies, incl. among other, also high performance computing and parallel numerical simulations. During the last years, I have also been involving in the computational modeling of various industrial and commercial systems, facilities and equipments, as well as complex multiphase flow in various processes and systems.

As an enthusiast of computational science (mathematics, physics etc) I have been following this branch of science ever since my graduation in 1983, in my work as well in my part-time studies as one of my key hobbies and interests. During these years of CFD career, I have developed and upgraded several existing CFD models specific to the industries and applications.

MY CFD-philia is not just centered around fluid mechanics, rather spreads over to other branches of the thermophysics – heat and mass transfer, and combustion.

14.7.3. RESEARCH & DESIGN INTERESTS

My current researches and design are on CFD – Computational Fluid Dynamics.

My special interests lie in the studies of

- convergence,
- stability and
- efficiency

of the various numerical methods involved in various types of fluid dynamics.

My special favor is the

- non-Newtonian flow and
- flow in constrained space –
    - porous media,
    - small structures and
    - micro- and nanofluidics.

14.7.4. CFD CAPACITY

14.7.4.1. Fluid Dynamics and related sciences

- Aerodynamics
- Combustion, turbulent combustion
- Compressible flow
- Fluidized Beds
- Incompressible flow
- Micro/nano -fluidics
- Multi-phase and multi-component flow
- Non-Newtonian flow, Rheology - Rheological modeling for non- Newtonian fluids
- Pneumatic conveyors, bulk granular material handling
- Porous media flow
- Turbulent fluid flow / mixing and modeling / evaluation

14.7.4.2. Numerical theory and techniques

- Boundary Element Methods (BEM)
- Discrete Element Method (DEM)
- Direct Numerical Simulations (DNS)
- Finite Difference Methods (FDM)
- Finite Element Methods (FEM)
- Finite Volume Methods (FVM)
- Moving Interface Methods (MIM) such as
  - Sharp Interface Method (SIM)
  - Level Set Method (LSM)
- Probability Density Function (PDF)
- Adaptive, unstructured mesh CFD

14.7.4.3. CFD theory and techniques

- Detached Eddy Simulations (DES)
- Lattice Boltzmann CFD
- Large Eddy Simulation (LES)
- Reynolds Averaged Navier Stokes (RANS)
  - U-RANS

- hybrid RANS/LES
- Reynolds Stress Model (RSM) model
  - Anisotropy-invariant Reynolds Stress Model of turbulence (AIRSM)
- Sliding mesh techniques
- Smoothed Particle Hydrodynamics (SPH)

14.7.4.4. CFD expertise

14.7.4.4.1. CFD consulting

My duties and responsibilities were/are:

- Specialist consultation
- Project consultation
- Process simulation and design
- Process, design, equipment optimization
- Thermodynamic cycle analysis
- Fluid flow and heat transfer analysis - 3-D fluid field analysis
- Software technical support

14.7.4.4.2. CFD development

Whereby I was involved in:

- Developing numerical algorithms and approaches
- Developing and implementing computational fluid dynamics codes
- Defining computational requirements
- Modeling and simulating various processes
- Documenting results
- Conducting data analysis and interpretation
- Performing post processing & visualization

14.7.4.4.3. CFD related processes and subjects

Flow Processes covered:

- Chemical reaction flows
- Fuel-air mixing processes
- Industrial processes
- Nucleate boiling
- Porous materials
- Sustainable energy systems
- Thermal flows
- Transport phenomena

14.7.4.4.4. CFD Related Systems and Equipments

- Boilers
- Burners
- Ducts and pipes
- Heat exchangers incl. condensers
- Pumps
- Steam/hydro turbines
- Thermal Energy Storage

14.7.4.4.5. CFD Relevant Industries and Areas of Applications

- Automobile
- Buildings
- Electronics
- Energy and Power
- Environment

14.7.4.5. CFD applications & tools

CFD applications (solver) such as

- Ansys: Ansys Workbench, Ansys CFX
- Fluent
- NUMECA
- OpenFoam
- Phoenix
- StarCD

CAD Software

- Pro/E
- solidworks

the most prevalent pre-processors

- Gambit
- ICEM-CFD

CFD post-processor

- EnSight

Computational Fluid Dynamics software page
CFD software page
计算流体力学软件 page

CFD 软件

CFD page
Computational Fluid Dynamics page
CFD Numerical flow simulation
Numerical simulation of the fluid dynamic

计算流体力学

Numerische Methoden
Analyse mathematique et numerique de la dynamique des fluides
simulation numerique en mecanique des fluides
Mécanique des Fluides Numérique
Methodes numeriques pour la dynamique des fluides

Hémodynamique
Lattice methods, including the lattice-gas method and its derivative, the lattice-Boltzmann method,
Lattice-Boltzmann

贴体坐标

保角变换

自适应网格

有限解析法
边界条件与解得存在唯一性
能力判别法
正则模态分析法
湍流模型没有统一成熟和普遍适用的模型
流体力学基本方程需要什么样的边界条件才能保证界的存在和唯一是一个未解决的问题
向量机
并行计算

通量校正传输
通量分裂
守恒律系单调上风格式 （MUSCL）
总变差减少法 (TVD)
有限元通量校正传输法
活动有限元法
自由拉格朗日法
无结构网络法
谱方法格络法
直接和半直接求解法
反扩散法
无参数无振荡耗散格式 （NND）
Lax 有限元-差分混合格式
非线性微分方程的差分格式的稳定性与收敛性至今没有完整的理论

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压缩机、制冷行业

计算流体力学 page
流场的数值模拟
流场的数值计算
流场的数值仿真
CFD page
Computational Fluid Dynamics page
CFD Numerical flow simulation
Numerical simulation of the fluid dynamic

Computational Fluid Dynamics software page
CFD software page
计算流体力学软件 page
CFD 软件

www.baisi.net http://www.baisi.org
www.baisi.net/archiver/fid-77-page-1.html
http://www.baisi.org/forum-77-3.html

http://www.boatdesign.net
http://www.boatdesign.net/Directory/Software/CFD-Flow_Simulation/

http://www.cad888.com
http://www.cad888.com/simple/index.php?f142_5.html

www.cfdchina.com
www.cfdchina.com/main/

www.cfluid.com
www.cfluid.com/bbs/forumdisplay.php?fid=53

http://www.cfluid.com.cn/

http://www.chnsj.com
http://www.chnsj.com/bbs/index.php?gid=40

伊塞中国（ESI China）科技有限公司
http://www.esi-ate.com/

www.flow3d.cn

http://www.hikeytech.com
http://www.hikeytech.com/p-detail.asp?id=56

http://www.jxcad.com.cn http://wwww.jxcad.cn/
http://www.jxcad.com.cn/forum_142.html

www.numeca-beijing.com

www.openfluid.cn
www.openfluid.cn/thread-1586-1-1.html

http://www.phoenics.cn/

http://www.pumpvip.com
http://www.pumpvip.com/forum-98-1.html

http://www.shanghaifeiyi.cn/

http://www.simould.com/

http://www.simwe.com
http://bbs.simwe.com/redirect.php?tid=782767&goto=lastpost

http://fans.solidworks.com.cn/bbs/archiver/tid-16959.html

http://www.topemx.com
http://www.topemx.com/bbs/thread.php?fid=25

www.xuelixue.cn

A list of open source CFD softwares that available through the internet is presented below. Possibly there are still a lot of other open source CFD packages that are not listed in here.

- ADFC
- Applied Computational Fluid Dynamics
- CFD2k
- Channelflow
- Code_Saturne
- COOLFluiD
- Diagonalized Upwind Navier Stokes
- Dolfyn
- Edge
- ELMER

EnSight CFD

- FDS
- Featflow
- Femwater
- http://www.freecfd.com/about/

FreeFEM

- Gerris Flow Solver
- IMTEK Mathematica Supplement (IMS)
- iNavier
- ISAAC
- Kicksey-Winsey
- MFIX
- NaSt2D-2.0
- NEK5000

- NSC2KE
- NUWTUN
- OpenFlower
- OpenFOAM
- OpenFVM
- PETSc-FEM
- PP3D
- SLFCFD
- SSIIM
- Tochnog
- Typhon solver
- PRIN-3D

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Abaqus
ACUITIV v3.3(美国 Fuel Tech 公司开发,用于 CFD(Computational Fluid Dynamics 计算流体动力学)的后处理和可视化软件
ADAMS
ADINA
AirPak 建筑流体模拟 CFD
ANSYS CFX http://www.ansys.com
ANSYS AutoReaGas3.1
AVL FIRE 2008.2.
Barracuda 工程软件包是专门模拟流体-颗粒流动及化学反应的商用软件包
Cart3D

Cfdesign
CFdesign 8.0 (CFD 分析仿真) 注册破解版
http://www.sn2sn.com/soft/1076.htm
CFD-FASTRAN
CFL3D
CFX
Coolit is an Advanced CFD Thermal Analysis Software for Electronics
Our flagship product, Coolit , has become the CFD software of choice for electronics cooling applications . Daat continues to deliver affordable products ...
www.daat.com

Abaqus
ADINA
Advanced CFD——流体力学模拟计算软件
Airpak

ALGOR
CFD4Aeroelasticity
CFD4Flight
CFD4Vortices
CFD4Rotor
CFD4Turbulence
http://www.cfd4aircraft.com/
CFD++——流体力学计算模拟软件介绍
CFD-ACE+
CFD Software From ACRi -- CFDStudio, ANSWER, PORFLOW, TIDAL and RADM
CFX
COSMOSFloWork
CONVERGE
COVENTOR
cradle CFD 软件
Design Space 7.1
DTFSE
DYNA/USA971
elsA software
EasyCFD_G
ESI CFDRC V2004 (计算流体力学)
Exceed，定位于帮助教授流体力学和运输现象的一个计算流体力学(CFD) 软件包
FACI
FASTRAN
FDS / NIST
FDS (Fire Dynamics Simulator)
FEATFLOW http://www.featflow.de open-source
FEMLAB / COMSOL http://www.comsol.com commercial
FIDAP 基于有限元方法的通用 CFD 求解器
Fine 系列 CFD 软件
Flexlm
FloEFD，FloEFD.Pro, FloEFD.V5
先进的通用流体软件-FloEFD
全球唯一完全嵌入机械 CAD 软件中、高度
工程化的通用流体传热 T：021-62157100
www.simu-cad.com

FloEMC v5.1 Flomerics
Flotran 7.1
Flotherm v9.1-ISO 1CD(电子电器设备空气流和热传导分析的专用CFD软件)
FLOVENT
FLOW-3D / FLOW-Science
FlowGrid
Flowmaster汽车流体系统仿真…
FLOWNEX – SYSTEMS CFD SOFTWARE FOR THE DESIGN, ANALYSIS AND. OPTIMIZATION OF FLUID

FLOW SYSTEMS. Flownex is an integrated systems CFD code used for the ...
www.flowsim.com.au

FLUENT CFD code
Fluent/Gambit
FLUENT / ANSYS-FLUENT
Fluent for CATIA v5 1.0.8
Fluent FloWizard 2.1.8 (计算流体力学软件)
FLUINT/FloCAD
FORMSYS MAXSURF 11 (船舶设计)
Free-Surface DEMO
Fun3D
The GASP CFD package http://www.aerosft.com/
gridgen
Hoam-OpenCFD 1.7 软件
高精度计算流体力学软件 Hoam-OpenCFD
ICEM-CFD Icem CFD v5.0 Working 1CD(一个独立的网格处理软件包,允许仿真分析
Icepak
I-Deas-ESC
KIVA-3v
LINFLOW 作为一款三维边界元流体动力学计算软件
Marc
Mathematica (Wolfram Research Inc.).
Mechanical 7.1
MFIX / NETL
Mgaero
MicroCFD
MixSim2.0 针对搅拌混合的专用
MoldFlow
Moldlex
MULTIFLO / SwRI
Multiphysics 3.2a / Comsol
Nastran + Heat Transfer Pro
《热流分析软件》(NIKA EFD Pro v8.2)
NSAERO

NUMECA
Numeca.Fine
OpenFOAM
Opera 3D Tempo
Overflow
Patran Thermal 2003
PAM- FLOW—PAM-FLOW|仿真软件
PAM-FLOW 是高级计算流体力学(CFD)软件产品

Phoenics
PipeNet v9.0 1CD（复杂管网流体分析软件）
PKPM
POLYFLOW 3.10.2 针对粘弹性流动的专用 CFD 求解器 Fluent Polyflow 3.10.4
POWER FLOW
Professional 7.1
PSE: Hybrid Multizonal gPROMS—CFD
PUMPLINX
pyrosim2006
RPCD 是散堆填料塔流体力学及传质计算软件的缩写
SC/Tetra
SENGA
simerics_计算流体力学
SPH-Tsunami / SwRI
STACH—3通风空调气流组织计算的CFD软件
STAR-CD or STAR-CCM+
Star-Design v4.14 Linux 64 (计算流体力学):
Storm/CFD2000
Tarsflow
TEACH / Gosman
TEAM
THINFOIL
umoni 计算流体力学平台软件 1.0
Upfront CFD
USAERO
VSAERO,

前处理
GAMBIT
HyperMesh

前后处理
ACUITIV v3.3(美国 Fuel Tech 公司开发,用于 CFD(Computational Fluid Dynamics 计算流体动力学)的后处理和可视化软件
GAMBIT
HyperMesh
TECPLOT

SIMPLE 算法(半隐式压力校正解法)

(High Resolution Scheme)高精致格式

(Flux Difference Splitting)通量差分分裂
(Flux Vector Splitting)矢通量分裂
(Total Variation Diminishing，TVD)总变差减小

Jameson 格式
(Resisual Smoothing)多层网格与残差光顺加速收敛技术

14.7.5. Reading

Analyse mathematique et numerique de la dynamique des fluides compressibles.pdf
Introduction to Computational Fluiddynamics_good.pdf
....

14.7.6. CFD Paper

15. NanoThermodynamics

My research will focuses on NanoThermodynamics.

My question remains what can thermodynamics do for the nanoscience and how new theories shall be developed to adapt to the new dimension.

I am also n writing the book titled "NanoThermodynamics – a Comprehensive Review".

This book will summarize all thermodynamic topics related to the nano-technologies, mainly in three areas – nanoscale thermodynamics, thermodynamics of nano-materials and thermodynamics of nano-technologies. They can further be subdivided into many sections, for example (incmplete)

- Hill's nanothermodynamics
- Tsallis thermodynamics
- Thermodynamics of Nano / Nanosize -systems
- Thermodynamics of Nano-Processes
- Thermodynamics of Nanomanufacturing / Nanofabrication
- Thermodynamics of Nano-engineering
- Thermodynamics of Nanomeasurements
- Thermodynamics of Nano scale characterization
- Thermodynamics of Nano-Phases
- Thermodynamics of Nanoelectronics
- Thermodynamics of Nanobiotechnology
- Thermodynamics of Nano Tools

- Thermodynamics of nanocanonical constraints
- Thermodynamics of nanoclays
- Thermodynamics of Nanodots
- Thermodynamics of Nanostructures
- Thermodynamics of Nano-materials
- Thermodynamics of Nano-Porous Materials
- Thermodynamics of Nanocrystals / Nanocrystalline materials
- Thermodynamics of nanocomposites
- Thermodynamics of Nanoparticles
- Thermodynamics of nanofibres
- Thermodynamics of Nanodroplets
- Thermodynamics of Nano-fluids
- Thermodynamics of Nano-Products
- Thermodynamics of Nano-components
- Thermodynamics of Nanodevices

Etc.

The book will describe each of these topic in full details: basic theory, research and application status. Key scientists, main problems, further research plans, problems.

I am planning to complete the writing of this book in two years.

I am writing this letter to talk about a Research on NanoThermodynamics at your group or for your considering my funding applications for my researches on NanoThermodynamics at your Fund.

My research will focuses on NanoThermodynamics.

My question remains what can thermodynamics do for the nanoscience and how new theories shall be developed to adapt to the new dimension.

I am also n writing the book titled “NanoThermodynamics – a Comprehensive Review”.

This book will summarize all thermodynamic topics related to the nano-technologies, mainly in three areas – nanoscale thermodynamics, thermodynamics of nano-materials and thermodynamics of nano-technologies. They can further be subdivided into many sections, for example (incmplete)

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- Thermodynamics of Nano-Products
- Thermodynamics of Nano-components
- Thermodynamics of Nanodevices

Etc.

The book will describe each of these topic in full details: basic theory, research and application status. Key scientists, main problems, further research plans, problems.

I am planning to complete the writing of this book in two years.

16. Mesoscopic thermodynamics (thermodynamics of small structures, 2008-2009)

16.1. My General Plan

1) Understand thermodynamic science in its entirety, incl. all its branches. For this purpose I have prepared a comprehensive list of thermodynamics literature available as a first guide to my studies. I have also collected thousands of papers and articles in different parts of Thermodynamics arranged in the same order as the literature index, so that all my future research can be carried out these bases.

2) Carry out special research on some selected topics of thermodynamics. My final decision is to carry out researches on **Thermodynamics of the Universe**, details see below.

3) Write the **Thermodynamics Review** books. This will only be realized at time of maturity – that is, when I feel ready.

16.2. Special Researches – Thermodynamics of Small Systems

This is the first priority of my plan and shall be executed in advance.

I won't try to reason about this final decision in great details. However, it is based mainly on my personal flavor as well as my firm belief that exploration of the miniature structure will eventually benefit the human kind too, and some of the scientific achievements can be readily applied to social and technological progress. When making this decision, no consideration of economic outcome, environment and energy impact as well as food shortage and health problems facing the human race were made.

The Thermodynamics of Small Systems (TOST) will be a complete science branch of the thermodynamics as a whole. It will establish theories, laws and rules governing the thermodynamic activities of the following:

✧ The surface and interface thermodynamics
✧ The thermodynamics of porous media
✧ The thermodynamics microscopic and microcanonical systems
✧ The thermodynamics mesoscopic systems
✧ Thermodynamics of cells and molecular clusters
✧ The thermodynamics nano-scale and nano-science
✧ The thermodynamics of molecules
✧ The thermodynamics of atoms, quantums and particles
✧ And other small structures

My TOST research will be carried out stepwise.

The first three years (2009-01-01-2011-12-31) will be concentrating on special areas of nano-scale thermodynamics and then the configuration of the complete nano-scale thermodynamics branch around 2011-01-01 to 2013-12-31. Afterwards, the research and studies will be extended to other areas at the nano and nuclear scenario. .

During the first one to two years (2009-01-01 to 2010-12-31), two areas of researches will be chosen, namely:

✧ Thermodynamics of nano-structure
✧ Thermodynamics of nano-science and technology

16.2.1. Thermodynamics of Nano-Structure (2009-01-01 to 2010-12-31)

This research will concentrate on the special thermodynamics theories and formalism at the nano-level, where statistics will play a major role.

The researches will be presented in a paper or a booklet with the following sections:

Part One Overview

Part Two Nano-Thermodynamics

- Thermodynamics of Nano-science & technology
- Thermodynamics of Nano-systems
- Thermodynamics of Nano-Processes
- Thermodynamics of Nanomanufacturing
- Thermodynamics of Nano-engineering
- Thermodynamics of Nano-measurements
- Thermodynamics of Nano-structures
  - Thermodynamics of Nanodots
- Thermodynamics of Nano-phases
- Thermodynamics of Nano-products
- Thermodynamics of Nano-components
- Thermodynamics of Nano-materials
- Thermodynamics of Nano-porous materials
  - THERMODYNAMICS OF NANOCRYSTALS
  - Thermodynamics of Nano-crystalline materials
  - Thermodynamics of Nano-composites
  - Thermodynamics of Nano-particles
  - Thermodynamics of Nano-fibres
  - Thermodynamics of Nano-droplets
  - Thermodynamics of Nano-canonical constraints
  - Thermodynamics of Nano-clays
- Thermodynamics of Nano-fluids

Part Three Conclusion and Proposals

16.2.2. Thermodynamics of Nano-Science and Technology (2010-01-01 to 2011-12-31)

Thermodynamics problems and theories for the nano-science and technology – R&D, manufacturing and operation will be exploited, in order to boost the development of nano-products and technology.

16.2.3. Thermodynamics of Small Systems (2012-01-01 to 2013-12-31)

After the researches on nano thermodynamics are completed, it is hoped to extend the studies to the entire branch of the thermodynamics of the small systems as above described.

17. Thermodynamics of cancers

What Thermodynamics has to do with Cancer?

Answering this is my lifetime mission

ALBERT EINSTEIN

A theory is the more impressive the greater the simplicity of its premises is, The more different kinds of things it relates, and more extended is its areas of applicability. Therefore, the deep impression, which classical thermodynamics made upon me. It is the only physical theory of universal content concerning which I am convinced that, within the framework of applicability of its concepts, it will never be overthrown.

OTTO WARBURG

The prime cause of Cancer is the replacement of the respiration of oxygen in normal body cells by a fermentation of sugar.

My research focuses on applying/developing thermodynamic theory to detect and diagnose cancers.

The first step of my researches is to find out thermodynamic properties, which will be unique to cancer cells and thus can be used to monitor cancer development.

My overall mission, however, is to further explore the possibilities of, to track the development of and to find out ways of applying thermodynamics to, the carcinogenesis mechanism and the prevention and detection of cancer

- ✓ by combining thermodynamics and oncology into one,

- ✓ by identifying
  - – thermodynamic, (entropy, enthalpy, Gibbs free energy, heat capacity, conductivity, opacity and others)
  - – cytological,
  - – biological or
  - – general physical

  properties or formulations that can be used to judge as criteria of cancerous sign evolution, exactly as the Gibbs energy is the criteria for judging whether a particular chemical reaction may proceed under certain conditions
- ✓ with non-classic thermodynamics (i.e.
  - ■ non-equilibrium,
  - ■ irreversible,
  - ■ definite-time,
  - ■ non-linear thermodynamics as well as,
  - ■ dissipative theory etc)
- ✓ at the specific domains (quantum, molecular, cellular and mesocopic levels)
- ✓ of a particular type of cancer e.g. lung cancer
- ✓ or a particular human organ/tissues
- ✓ under specified conditions (carcinogenetic instances such as smoking etc)

GENERAL IDEA

Non-equilibrium, Irreversible Thermodynamics of Cancer Cell Development
non-equilibrium, irreversible, definite-time , non-linear cellular /molecular / quantum thermodynamics
To find out the basic cause of cancer from the aspect of thermodynamics, thermal physics and other physical and natural sciences together with Medicine and biology.

Attention will be paid to apply the non-equilibrium, irreversible, definite-time and possibly non-linear cellular/molecular/quantum thermodynamics to cancer development, in order to identify thermodynamic theories, ways, properties and criteria in the cancer genesis and later development.
And part of my task is to prove (or reject) the carcinogenesis theory proposed by Dr Otto Warburg and others thermodynamically, mathematically and cytologically.

Normal Cell

chronic illness,
infections,
viruses,
bacteria,
radicals,
stress,
energy deficiency,
oxygen shortage,
pollution,
DNA mutation,

gene mutation and
others

Cancer Cell

GENERAL PURPOSE

To find out how a healthy cell of different parts (organs, tissues etc) is evolved into a cancerous cell under different conditions – chronic illness, infections, viruses, bacteria, radicals, stress, energy deficiency, oxygen shortage, pollution, DNA mutation, gene mutation and others from thermodynamic point of view.

To evaluate existing anti-cancer, cancer prevention, cancer diagnosis and cancer therapy technologies from thermodynamic point of view.

To identify thermodynamics-based new theory, technology, tools, devices, and ways to enable early detection and diagnosis of cancers.

General

My research will focus on thermodynamics of the

- ✧ Carcinogenesis theory
- ✧ prevention
- ✧ diagnosis
- ✧ monitoring
- ✧ treatment and
- ✧ rehabilitation

of cancers.

My research will focus on thermodynamics-> thermophysics -> and physics of the cancers in their phases of
Carcinogenesis (theory)
Cancer prevention
Cancer detection and diagnosis
Cancer treatment (therapy) and
Cancer rehabilitation

Non-equilibrium, Irregular Cellular Thermodynamics of Lung Cancers

Initially attention may be paid to apply the non-equilibrium, irregular cellular thermodynamics to lung cancers, which is among the most fatal cancers in the world, in order to identify thermodynamic and thermophysical theories, ways, technologies, techniques, methods and properties in the above stages of the cancer development and cure.

Integration of The Sporadic Thermodynamic Researches of the Worldwide Carcinogenic Academia

My greatest interest is to integrate the sporadic thermodynamic researches of the worldwide carcinogenic academia into a complete system and to understand the relationships between the cancer cell development and the thermodynamic phenomena in the normal cells. Of particular interests and importance is of course the irreversibility of the cell development and one of the most important task is to identify and quantify the critical point and criteria in determining the moment when the cell will be evolved into a malignant one.

Thermodynamic models will be developed to quantify the cancerous cell development process and relevant thermodynamic properties used for diagnosis of cancer cells with calorimetry and other techniques.

Book Titled "Thermodynamics Of Cancers"

I am intended to write the book titled "Thermodynamics of Cancers" over the next years.

SHORT TERM – 2010-2011

First task is:

to focus on the thermodynamics of the carcinogenetic theory, and on the application of non-static/non-classic thermodynamics (i.e. non-equilibrium, irreversible, definite-time and non-linear thermodynamics, dissipative theory etc) at the specific domains (quantum, molecular, cellular and mesocopic thermodynamics) to the carcinogenic cellular development.

to collect all relevant researches done on the thermodynamic aspects of the cancer theory and as a result of this intensive investigation and review

to write an article or a book titled "Review of Oncological Thermodynamics" or "Review of Thermodynamics of Cancers" or "What is Cancer? – a Thermodynamic Review" with a size of about 600 pages in English, hopefully to be published.

Research Approach:

Main research activities will be concentrated on reading of collected paper, materials and information and thinking, that is, the major part of this period of research is "indoor activities" – i.e. with minimum requirements of insitu observations or experiments.

My main work will be to think thermodynamics and oncology as a whole and to systematize and theorize what others have done or are doing upto now. That is, in my mind, more important than to do my own labwork, which is not my strong point.

And because of the nature of this research, which is more theoretical and philosophical than experimental, my research can "theoretically" be done anywhere. Therefore there shall be no difficulty to "embed" my research activities into your system as well, provided that enough funds and facilities are provided and my freedom of research can be guaranteed. On the other hand, my major facet of the research is the carcinogenesis theory from the thermodynamics point of view. I hope this approach falls in your domain of research. Prevention of second, diagnosis is of third importance and therapy of little priority.

The key of this step of research is reading and thinking.

Lab Works and Collaboration:

Occasionally clinic observations will be done to verify my thoughts;

International symposia and other academic activities will also be attended;

Constant exchange will also be made with the academic circles.

Cost & Personnel:

it involves minimum expenses except my own costs;

No labor tests are foreseen;
Most expenditures will be spent on how to gain access to the large amount of information, data and materials of other researchers, clinic people and facilities.

MEDIUM TERM – 2012-2020

Afterwards I am planning
to integrate the sporadic thermodynamic researches of the worldwide carcinogenic academia into a complete system

to understand the relationships between the cancer cell development and the thermodynamic phenomena in the normal cells and finally

to develop Thermodynamic models which shall identify and quantify the critical point and criteria in determining the moment when the cell will be evolved into a malignant one. Relevant thermodynamic properties used for diagnosis of cancer cells with calorimetry and other techniques will also be applied – such as Entropy, Gibbs energy, Heat capacity and others. Just like in chemical thermodynamics, a thermodynamic property or one integrating a number of others shall be identified to be used as a judgment criteria when the normal cell will be changed into a cancerous one.

Of particular interests and importance is of course the irreversibility of the cancerous cell development.
Book Titled “Thermodynamics of Cancers” will be written to summarize all my researches and studies

LONG TERM – 2021 AND BEYOND

The cancer thermodynamics will be further extended to:
Thermophysics
Fluid dynamics
Heat transfer
Mass transfer
Combustion (chemical reactions)
Radiation

Physics
mechanics
quantum physics
molecular physics
statistic physics
electromagnetics
optics
nano-technology
and others

Chemistry
Biology
and all relevant sciences

In one word, all existing sciences will be employed to study the cancer problems, thus the cancer research will be fully integrated into all sciences.

CURRENT RESEARCH STATUS WORLDWIDE

There are a dozens of universities, independent institutes and laboratories and companies in the world active in these fields. My first impression is that they are more or less concentrating on one particular area or other, but no systematic approach is attempted to develop a complete thermodynamic theory to apply to cancer theory, diagnosis and therapy.

But I still need more time to carefully study what they have done so far, and then I will be able to draw my conclusion.

Current Status

At the present I am only collecting information, arrange them in order, study these information and step by step I am hoping to figure out my own, systematic ideas in order to develop my particular system of theory. There are a dozens of universities in the world active in these fields but I still need more time to carefully study what they have done.

My Research Capacity and Background

Although I am relatively new in this area, particularly I am weak in bioscience, molecular and atomic biology, medicine and medical science, but I realize this will not be a one-man job. Important is, that this man shall have a good picture of the future of this science and I think I am this one.

Also I am a person without Ph.D in science and without books and articles written upto now, but I have written tens of thousands of English reports in various subjects over the last couple of years alone, therefore I think I am able to conduct scientific researches and write scientific reports in the shortest time. I am learning several times faster than most people – while others read in pages, I in books, that is, I complete reading a book in hours not days. What others need months I need days, etc. Therefore I may catch up with those people who are in this area for decades in a couple of years. In addition I am also proficient in several European languages – English, German, French, Russian, and some Latin, Greek and Hebrew.

17.1. CancerTherm Paper

18. Thermodynamics & Thermophysics of Life

Draft

18.1. General Plan

1) Carry out special research on some selected topics of thermodynamics. The final decision is to carry out researches on **Thermodynamics & Thermophysics of Life**, details see below.

2) Understand thermodynamic science in its entirety, incl. all its branches. For this purpose a comprehensive list of thermodynamics literature have been prepared available as a first guide to the studies. Thousands of papers and articles in different parts of Thermodynamics have also collected, arranged in the same order as the literature index, so that all future research can be carried out on these bases. And based on this, write the **Thermodynamics Review** books. This will only be realized at time of maturity – that is, when it's ready.

18.2. Thermodynamics and Human Kind

Think about the possibility of tackling general concerns and problems challenging the human kinds - poverty, inequality, pollution, health problems, energy and resource crisis and others - with thermodynamics

19. Solar and Cosmic Thermodynamics / Cosmic Thermodynamics or Thermodynamics of the Universe (2015-01-01 to)

This is the first priority of the plan and shall be executed in advance.

No reasoning about this final decision in great details will be given. However, it is based mainly on personal flavor as well as the firm belief that exploration of solar science will eventually benefit the human kind too, and some of the scientific achievements can be readily applied to social and technological progress. When making this decision, no consideration of economic outcome, environment and energy impact as well as food shortage and health problems facing the human race were made.

The solar thermodynamics researches will be split into two parts:

- ✧ Thermodynamics in Solar Technology and Industry and
- ✧ Solar Thermodynamics or Thermodynamics of the Sun

1) Understand thermodynamic science in its entirety, incl. all its branches. For this purpose a comprehensive list of thermodynamics literature have been prepared available as a first guide to the studies. Thousands of papers and articles in different parts of Thermodynamics have also collected, arranged in the same order as the literature index, so that all future research can be carried out on these bases.

2) Carry out special research on some selected topics of thermodynamics. The final decision is to carry out researches on **Solar Thermodynamics and Thermophysics**, and probably later to be extended to **Cosmic Thermodynamics and Thermophysics**, details see below.

3) Write the **Thermodynamics Review** books. This will only be realized at time of maturity – that is, when it's ready.

Based on the above (solar thermodynamics and thermophysics), thermodynamics researches shall be extended to the cosmos and planets, because over there, the classic theories are no more working, even the entire classic thermodynamics might be overturned. For example, there might predominate the entropy decrease law in the cosmos, while temperature is in most cases negative, because there are sound proves that there exists large amount of dark or negative energy as well as dark and negative matters in the universe, thus the classic thermodynamics will surely be unable to function. All these problems needs to be studied.

A systematic approach will be adopted in the development of the Thermodynamics of Universe (TOU). From planets to stars to galaxies to star clusters and to the entire universe, from our solar system to other planetary systems and celestial bodies. Thermodynamics of all types of celestial bodies will be established with unique features of their own. Questions such as how the celestial bodies and even the Universe were created, evolved and run shall be answered, along with various thermal physical and chemical properties

The Thermodynamics of Universe (TOU) will be a complete science branch of the thermodynamics as a whole. It will establish theories, laws and rules governing the thermodynamic activities of the following:

- ✧ The universe as a whole
- ✧ The galaxies
- ✧ The star clusters
- ✧ The stars – black holes, dwarfs, super nova, etc
- ✧ The planets
- ✧ And other celestial bodies

At the moment, only black hole thermodynamics is relatively intensively researched, while some aspects of the solar thermodynamics (as part of solar, celestial physics and astrophysics) are touched. But generally a complete and logic system is still absent.

19.1. General Plan

1) Understand thermodynamic science in its entirety, incl. all its branches. For this purpose a comprehensive list of thermodynamics literature have been prepared available as a first guide to the studies. Thousands of papers and articles in different parts of Thermodynamics have also collected, arranged in the same order as the literature index, so that all future research can be carried out on these bases.

2) Carry out special research on some selected topics of thermodynamics. The final decision is to carry out researches on **Solar Thermodynamics**, and later to be extended to **Cosmic Thermodynamics**, details see below.

3) Write the **Thermodynamics Review** books. This will only be realized at time of maturity – that is, when it's ready.

19.2. Special Researches – Solar & Cosmic Thermodynamics

This is the first priority of the plan and shall be executed in advance.

No reasoning about this final decision in great details will be given. However, it is based mainly on personal flavor as well as the firm belief that exploration of solar science will eventually benefit the human kind too, and some of the scientific achievements can be readily applied to social and technological progress. When making this decision, no consideration of economic outcome, environment and energy impact as well as food shortage and health problems facing the human race were made.

The solar thermodynamics researches will be split into two parts:

- ✧ Thermodynamics in Solar Technology and Industry and
- ✧ Solar Thermodynamics or Thermodynamics of the Sun

19.2.1. Thermodynamics in Solar Technology and Industry (2009-01-01 to 2011-12-31)

For three years efforts will be concentrating on the investigation and studies of thermodynamics theory involved in all aspects of the solar energy technology and applications, incl.

- ✧ Solar radiation,
- ✧ Solar materials
- ✧ Solar thermal technology
- ✧ Solar phovotoltaic technology
- ✧ Other solar technologies
- ✧ Research and development
- ✧ Manufacturing
- ✧ Operation and maintenance

Purpose of the research is to find out how to optimize the thermodynamic process during the above processes, periods and stages, and to establish a complete system.

19.2.2. Solar Thermodynamics (2012-01-01 to 2013-12-31)

After the above research and studies are completed, then the second phase of solar related thermodynamics will be initiated, starting from the Thermodynamics of solar corona heating and Thermodynamics of solar wind.

19.2.2.1. Thermodynamics of solar corona heating (2009-01-01 to 2010-12-31)

The mechanism of solar corona heating is still unsolved. Where does the energy come to heat up the solar corona from about 10000 Kelvin at the base upto several millions K at its outer boundary – several sun diameter? Some argue it's due to magnetic force, while other contribute it to seismological movement etc. The aim is to establish physical model to calculate the heating process with different assumptions and try to figure out which is correct. If none is correct, find a assumption. This is of course a challenging task, involving multidisciplinary sciences and lots of solar physics.

The researches will be presented in a paper or a booklet with the following sections:

Part One Solar Corona Physics
✧ Geometry
✧ Physics – temperature, density, pressure, velocity, magnetism, radiation and others
✧ Chemistry

Part Two Review of Solar Corona Heating Models
✧ Theories, mechanism and assumptions
✧ Data and charts
✧ Cons and pros

Part Three Solar Corona Heating Thermodynamics
Application of thermodynamic laws to solar corona heating – the thermal equilibrium, non-equilibrium and non-linear approaches

Part Four Conclusion and Proposals

19.2.2.2. Thermodynamics of solar wind (2010-01-01 to 2011-12-31)

Solar wind extends from solar atmosphere to the heliosphere and it is interacting with earth's magnetospehere as well. Thermodynamics will be established to explore some of the key issues of the creation, movement and properties of the solar plasma.

Since 1960's, solar models are well developed, which can fairly correctly explain various sun phenomenon and physical parameters such as temperature, pressure, density, metal abundance, and over the last couple of years, observation, detection, measurement and studies of neutrinos have also proven the solar models.

Nevertheless, neither the solar models nor the solar physics do not touch the solar thermodynamics. The solar modelists concern more about the few basic equations of state, while the solar physicists care about the sun activities only, and now even the generation and activities of the solar magnetic fields and the solar corona heating mechanism are not yet rightly described.

Therefore it is necessary to observe and study the thermal physical phenomenon of the solar internal and surface from the thermodynamics aspects, incl. its thermodynamic state, thermodynamic functions and relations, and to explain the solar magnetic fields and solar corona heating with thermodynamic theory.

19.2.3. Cosmic Thermodynamics or Thermodynamics of the Universe (2014-01-01 to)

Based on the above, thermodynamics researches shall be extended to the cosmos and planets, because over there, the classic theories are no more working, even the entire classic thermodynamics might be overturned. For example, there might predominate the entropy decrease law in the cosmos, while temperature is in most cases negative, because there are sound proves that there exists large amount of dark or negative energy as well as dark and negative matters in the universe, thus the classic thermodynamics will surely be unable to function. All these problems needs to be studied.

A systematic approach will be adopted in the development of the Thermodynamics of Universe (TOU). From planets to stars to galaxies to star clusters and to the entire universe, from our solar system to other planetary systems and celestial bodies. Thermodynamics of all types of celestial bodies will be established with unique features of their own. Questions such as how the celestial bodies and even the Universe were created, evolved and run shall be answered, along with various thermal physical and chemical properties

The Thermodynamics of Universe (TOU) will be a complete science branch of the thermodynamics as a whole. It will establish theories, laws and rules governing the thermodynamic activities of the following:

- ✧ The universe as a whole
- ✧ The galaxies
- ✧ The star clusters
- ✧ The stars – black holes, dwarfs, super nova, etc
- ✧ The planets
- ✧ And other celestial bodies

At the moment, only black hole thermodynamics is relatively intensively researched, while some aspects of the solar thermodynamics (as part of solar, celestial physics and astrophysics) are touched. But generally a complete and logic system is still absent.

20. Solar Thermodynamics & Thermophysics

This is the first priority of the plan and shall be executed in advance.

No reasoning about this final decision in great details will be given. However, it is based mainly on personal flavor as well as the firm belief that exploration of solar science will eventually benefit the human kind too, and some of the scientific achievements can be readily applied to social and technological progress. When making this decision, no consideration of economic outcome, environment and energy impact as well as food shortage and health problems facing the human race were made.

The solar thermodynamics & thermophysics researches will be split into two parts:

- ✧ Thermodynamics and Thermophysics of the Sun
- ✧ Thermodynamics and Thermophysics in Solar Radiation, Solar Technology, Industry and Applications

20.1. General Plan

1) Understand thermodynamic science in its entirety, incl. all its branches. For this purpose a comprehensive list of thermodynamics literature have been prepared available as a first guide to the studies. Thousands of papers and articles in different parts of Thermodynamics have also collected, arranged in the same order as the literature index, so that all future research can be carried out on these bases.

2) Carry out special research on some selected topics of thermodynamics. The final decision is to carry out researches on **Solar Thermodynamics**, details see below.

3) Write the **Thermodynamics Review** books. This will only be realized at time of maturity – that is, when it's ready.

4) Think about the possibility of tackling general concerns and problems challenging the human kinds – poverty, inequality, pollution, health problems, energy and resource crisis and others – with thermodynamics

20.2. Special Researches – Solar Thermodynamics

This is the first priority of the plan and shall be executed in advance.

No reasoning about this final decision in great details will be given. However, it is based mainly on personal flavor as well as the firm belief that exploration of solar science will eventually benefit the human kind too, and some of the scientific achievements can be readily applied to social and technological progress. When making this decision, no consideration of economic outcome, environment and energy impact as well as food shortage and health problems facing the human race were made.

The solar thermodynamics researches will be split into two parts:

- ✧ Thermodynamics in Solar Radiation, Solar Technology, Industry and Applications
- ✧ Thermodynamics of the Sun

20.3. Thermodynamics in Solar Radiation, Solar Technology, Industry and Applications

Efforts will be concentrating on the investigation and studies of thermodynamics theory involved in all aspects of the solar energy technology and applications, incl.

- ✧ Solar radiation,
- ✧ Solar materials
- ✧ Solar thermal technology
- ✧ Solar phovotoltaic technology
- ✧ Other solar technologies
- ✧ Research and development
- ✧ Manufacturing
- ✧ Operation and maintenance
- ✧ Solar energy use and applications

Purpose of the research is to find out how to optimize the thermodynamic process, and thus to maximize the energy use and minimize the adverse impact on the human being and the environment during the above processes, periods and stages, and to establish a complete system based on the established theories of thermodynamics.

I will start with the thermodynamics of solar power systems simultaneously with the research on solar corona heating thermodynamics.

Research scope will be probably the following

- ➢ Thermodynamics in the solar PV plant planning
- ➢ Thermodynamics in the solar PV plant designing
- ➢ Thermodynamics in the solar PV plant procurement
- ➢ Thermodynamics in the solar PV plant engineering
- ➢ Thermodynamics in the solar PV plant construction
- ➢ Thermodynamics in the solar PV plant commissioning
- ➢ Thermodynamics in the solar PV plant operation

- Thermodynamics in the solar PV plant maintenance and repair
- Thermodynamics in the solar PV plant expansion
- Thermodynamics in the solar PV plant decommissioning

20.4. Thermodynamics of the Sun

Thermodynamics of the Sun will begin with the Thermodynamics of solar corona heating and then followed by Thermodynamics of solar wind.

The aim of this purpose is to explain some of the unresolved problems so far such as solar corona heating and solar wind, with the aid of thermodynamics or possibly modify the classical thermodynamics theory to comply with what are happening on the Sun.

Thermodynamics of solar corona heating

The mechanism of solar corona heating is still unsolved. Where does the energy come to heat up the solar corona from about 10000 Kelvin at the base upto several millions K at its outer boundary – several sun diameter? Some argue it’s due to magnetic force, while other contribute it to seismological movement etc. The aim is to establish physical model to calculate the heating process with different assumptions and try to figure out which is correct. If none is correct, find a assumption. This is of course a challenging task, involving multidisciplinary sciences and lots of solar physics.

The researches will be presented in a paper or a booklet with the following sections:

Part One Solar Corona Physics

- Geometry
- Physics – temperature, density, pressure, velocity, magnetism, radiation and others
- Chemistry

Part Two Review of Solar Corona Heating Models

- Theories, mechanism and assumptions
- Data and charts
- Cons and pros

Part Three Solar Corona Heating Thermodynamics

Application of thermodynamic laws to solar corona heating – the thermal equilibrium, non-equilibrium and non-linear approaches, MHD flow and others

Part Four Conclusion and Proposals

20.5. Thermodynamics of solar wind

Solar wind extends from solar atmosphere to the heliosphere and it is interacting with earth's magnetospehere as well. Thermodynamics will be established to explore some of the key issues of the creation, movement and properties of the solar plasma.

20.6. Thermodynamics of the Sun or Solar Thermodynamics

Since 1960's, solar models are well developed, which can fairly correctly explain various sun phenomenon and physical parameters such as temperature, pressure, density, metal abundance, and over the last couple of years, observation, detection, measurement and studies of neutrinos have also proven the solar models.

Nevertheless, neither the solar models nor the solar physics do not touch the solar thermodynamics. The solar modelists concern more about the few basic equations of state, while the solar physicists care about the sun activities only, and now even the generation and activities of the solar magnetic fields and the solar corona heating mechanism are not yet rightly described.

Therefore it is necessary to observe and study the thermal physical phenomenon of the solar internal and surface from the thermodynamics aspects, incl. its thermodynamic state, thermodynamic functions and relations, and to explain the solar magnetic fields and solar corona heating with thermodynamic theory.

The aim of this studies, as a logic continuation of the previous studies of thermodynamics of the solar corona heating problems and solar wind mechanism, is to establish a comprehensive theory of the solar thermodynamics in order to explain the major phenomena of sun activities, particularly the energy balance and radiation mechanism.

20.7. Thermodynamics & Thermophysiscs of the Sun or Solar Thermodynamics & Thermophysiscs (2015-01-01 to 2011-12-31)

Since 1960's, solar models are well developed, which can fairly correctly explain various sun phenomenon and physical parameters such as temperature, pressure, density, metal abundance, and over the last couple of years, observation, detection, measurement and studies of neutrinos have also proven the solar models.

Nevertheless, neither the solar models nor the solar physics do not touch the solar thermodynamics & thermophysiscs. The solar modelists concern more about the few basic equations of state, while the solar physicists care about the sun activities only, and now even the generation and activities of the solar magnetic fields and the solar corona heating mechanism are not yet rightly described.

Therefore it is necessary to observe and study the thermal physical phenomenon of the solar internal and surface from the thermodynamics & thermophysiscs aspects, incl. its thermodynamic state, thermodynamic functions and relations, and to explain the solar magnetic fields and solar corona heating with thermodynamic theory.

The aim of this studies, as a logic continuation of the previous studies of thermodynamics and thermophysics of the solar corona heating problems and solar wind mechanism, is to establish a comprehensive theory of the solar thermodynamics and thermophysics, in order to explain the major phenomena of sun activities, particularly the energy balance and radiation mechanism.

20.7.1. Thermodynamics and Thermophysics of solar corona heating (2009-01-01 to 2010-12-31)

The mechanism of solar corona heating is still unsolved. Where does the energy come to heat up the solar corona from about 10000 Kelvin at the base upto several millions K at its outer boundary – several sun diameter? Some argue it's due to magnetic force, while other contribute it to seismological movement etc. The aim is to establish physical model to calculate the heating process with different assumptions and try to figure out which is correct. If none is correct, find a assumption. This is of course a challenging task, involving multidisciplinary sciences and lots of solar physics.

The researches will be presented in a paper or a booklet with the following sections:

Part One Solar Corona Physics

- ✧ Geometry
- ✧ Physics – temperature, density, pressure, velocity, magnetism, radiation and others
- ✧ Chemistry

Part Two Review of Solar Corona Heating Models

- ✧ Theories, mechanism and assumptions
- ✧ Data and charts
- ✧ Cons and pros

Part Three Solar Corona Heating Thermodynamics & Thermophysiscs
Application of thermodynamic and thermophysical laws to solar corona heating – the thermal equilibrium, non-equilibrium and non-linear approaches, MHD flow and others

20.7.2. Thermodynamics & Thermophysiscs of solar wind (2013-01-01 to 2014-12-31)

Solar wind extends from solar atmosphere to the heliosphere and it is interacting with earth's magnetospehere as well. Thermodynamics & Thermophysiscs will be established to explore some of the key issues of the creation, movement and properties of the solar plasma.

21. Thermodynamics of the Sun or Solar Thermodynamics

Since 1960's, solar models are well developed, which can fairly correctly explain various sun phenomenon and physical parameters such as temperature, pressure, density, metal abundance, and over the last couple of years, observation, detection, measurement and studies of neutrinos have also proven the solar models.

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The aim of this studies, as a logic continuation of the previous studies of thermodynamics of the solar corona heating problems and solar wind mechanism, is to establish a comprehensive theory of the solar thermodynamics in order to explain the major phenomena of sun activities, particularly the energy balance and radiation mechanism.

21.1. Solar Thermodynamics / Thermodynamics of the Sun (2012-01-01 to 2013-12-31)

After the above research and studies are completed, then the second phase of solar related thermodynamics

will be initiated, starting from the Thermodynamics of solar corona heating and Thermodynamics of solar wind.

Thermodynamics of the Sun will begin with the Thermodynamics of solar corona heating and then followed by Thermodynamics of solar wind.
The aim of this purpose is to explain some of the unresolved problems so far such as solar corona heating and solar wind, with the aid of thermodynamics or possibly modify the classical thermodynamics theory to comply with what are happening on the Sun.

This is the first priority of the plan and shall be executed in advance.

No reasoning about this final decision in great details will be given. However, it is based mainly on special flavors as well as the firm belief that exploration of solar science will eventually benefit the human kind too, and some of the scientific achievements can be readily applied to social and technological progress. When making this decision, no consideration of economic outcome, environment and energy impact as well as food shortage and health problems facing the human race were made.

The solar thermodynamics researches will be split into two parts:

- Thermodynamics in Solar Radiation, Solar Technology, Industry and Applications
- Thermodynamics of the Sun

Thermodynamics of the Sun will begin with the Thermodynamics of solar corona heating and then followed by Thermodynamics of solar wind. The aim of this purpose is to explain some of the unresolved problems so far such as solar corona heating and solar wind, with the aid of thermodynamics or possibly modify the classical thermodynamics theory to comply with what are happening on the Sun.

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The researches will be presented in a paper or a booklet with the following sections:
Part One Solar Corona Physics

- Geometry
- Physics - temperature, density, pressure, velocity, magnetism, radiation and others
- Chemistry

Part Two Review of Solar Corona Heating Models

- Theories, mechanism and assumptions
- Data and charts

- Cons and pros

Part Three Solar Corona Heating Thermodynamics
Application of thermodynamic laws to solar corona heating - the thermal equilibrium, non-equilibrium and non-linear approaches, MHD flow and others
Part Four Conclusion and Proposals

Thermodynamics of solar wind
Solar wind extends from solar atmosphere to the heliosphere and it is interacting with earth's magnetospehere as well. Thermodynamics will be established to explore some of the key issues of the creation, movement and properties of the solar plasma.

Thermodynamics of the Sun or Solar Thermodynamics
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21.2. Thermodynamics of solar corona heating (2009-01-01 to 2010-12-31)

The mechanism of solar corona heating is still unsolved. Where does the energy come to heat up the solar corona from about 10000 Kelvin at the base upto several millions K at its outer boundary – several sun diameter? Some argue it’s due to magnetic force, while other contribute it to seismological movement etc. The aim is to establish physical model to calculate the heating process with different assumptions and try to figure out which is correct. If none is correct, find a assumption. This is of course a challenging task, involving multidisciplinary sciences and lots of solar physics.

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Part Two Review of Solar Corona Heating Models
- ✧ Theories, mechanism and assumptions
- ✧ Data and charts
- ✧ Cons and pros

Part Three Solar Corona Heating Thermodynamics
Application of thermodynamic laws to solar corona heating – the thermal equilibrium, non-equilibrium and non-linear approaches

Part Four Conclusion and Proposals

21.3. Thermodynamics of solar wind (2010-01-01 to 2011-12-31)

Solar wind extends from solar atmosphere to the heliosphere and it is interacting with earth's magnetospehere as well. Thermodynamics will be established to explore some of the key issues of the creation, movement and properties of the solar plasma.

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Therefore it is necessary to observe and study the thermal physical phenomenon of the solar internal and surface from the thermodynamics aspects, incl. its thermodynamic state, thermodynamic functions and relations, and to explain the solar magnetic fields and solar corona heating with thermodynamic theory.

22. Thermodynamics and Thermophysics in Solar Radiation, Solar Technology, Industry and Applications (2015-01-01 to)

Efforts will be concentrating on the investigation and studies of thermodynamics theory involved in all aspects of the solar energy technology and applications, incl.

- ✧ Solar radiation,
- ✧ Solar materials
- ✧ Solar thermal technology
- ✧ Solar phovotoltaic technology
- ✧ Other solar technologies
- ✧ Research and development
- ✧ Manufacturing
- ✧ Operation and maintenance
- ✧ Solar energy use and applications

Purpose of the research is to find out how to optimize the thermodynamic process during the above processes, periods and stages, and to establish a complete system based on the established theories of thermodynamics and thermophysics.

23. Thermodynamics in Solar Radiation, Solar Technology, Industry and Applications

Efforts will be concentrating on the investigation and studies of thermodynamics theory involved in all aspects of the solar energy technology and applications, incl.

- Solar radiation,
- Solar materials
- Solar thermal technology
- Solar phovotoltaic technology
- Other solar technologies

- Research and development
- Manufacturing
- Operation and maintenance
- Solar energy use and applications

Purpose of the research is to find out how to optimize the thermodynamic process, and thus to maximize the energy use and minimize the adverse impact on the human being and the environment during the above processes, periods and stages, and to establish a complete system based on the established theories of thermodynamics.

The research will be started with the thermodynamics of solar PV plant simultaneously with the research on solar corona heating thermodynamics. Research scope will be probably the following

- Thermodynamics in the solar PV plant planning
- Thermodynamics in the solar PV plant siting
- Thermodynamics in the solar PV plant designing
- Thermodynamics in the solar PV plant procurement
- Thermodynamics in the solar PV plant engineering
- Thermodynamics in the solar PV plant construction
- Thermodynamics in the solar PV plant commissioning
- Thermodynamics in the solar PV plant operation
- Thermodynamics in the solar PV plant maintenance and repair
- Thermodynamics in the solar PV plant expansion
- Thermodynamics in the solar PV plant decommissioning

24. Thermodynamics in the solar radiation process and measurement (2008-2009)

Fundamental researches and studies of solar radiation

Solar Radiation Measurement, Solar Physics (Solar Thermophysics and Solar Thermodynamics Researches and Studies and Related Services such as:

- ➢ Fundamental researches and studies of solar radiation, with particular emphasis on solar physics and thermal physics and thermodynamics in the solar radiation process and measurement;
- ➢ Customized researches;
- ➢ Tailored solar measurement services of solar radiation in China;

25. Thermodynamics of Solar Energy Systems (2008 -)

- ✧ Thermodynamics of the sun and related to solar radiation and solar energy use on earth; thermodynamics applications in general;
- ✧ Cryptography and its applications in Internet

25.1. Thermodynamics in Solar Technology and Industry (2009-01-01 to 2011-12-31)

For three years efforts will be concentrating on the investigation and studies of thermodynamics theory involved in all aspects of the solar energy technology and applications, incl.

- ✧ Solar radiation,
- ✧ Solar materials
- ✧ Solar thermal technology
- ✧ Solar phovotoltaic technology
- ✧ Other solar technologies
- ✧ Research and development
- ✧ Manufacturing
- ✧ Operation and maintenance

Purpose of the research is to find out how to optimize the thermodynamic process during the above processes, periods and stages, and to establish a complete system.

Efforts will be concentrating on the investigation and studies of thermodynamics theory involved in all aspects of the solar energy technology and applications, incl.

- ✧ Solar radiation,
- ✧ Solar materials
- ✧ Solar thermal technology
- ✧ Solar phovotoltaic technology
- ✧ Other solar technologies
- ✧ Research and development
- ✧ Manufacturing
- ✧ Operation and maintenance
- ✧ Solar energy use and applications

Purpose of the research is to find out how to optimize the thermodynamic process, and thus to maximize the energy use and minimize the adverse impact on the human being and the environment during the above processes, periods and stages, and to establish a complete system based on the established theories of thermodynamics.

I will start with the thermodynamics of solar power systems simultaneously with the research on solar corona heating thermodynamics.

Research scope will be probably the following

- Thermodynamics in the solar PV plant planning
- Thermodynamics in the solar PV plant designing
- Thermodynamics in the solar PV plant procurement
- Thermodynamics in the solar PV plant engineering
- Thermodynamics in the solar PV plant construction
- Thermodynamics in the solar PV plant commissioning
- Thermodynamics in the solar PV plant operation
- Thermodynamics in the solar PV plant maintenance and repair
- Thermodynamics in the solar PV plant expansion
- Thermodynamics in the solar PV plant decommissioning

26. Thermodynamics Review (2009-01-01 to)

Over the past years, thermodynamics has been progressing in both the scope of depth and width.

In the scope of width, thermodynamics has already come out of the equilibrium arena and has entered and penetrated into the non-equilibrium, irreversible states and into the related and non-relevant disciplines such as pharmaceuticals, biotics, ecosystems, energy, social sciences, economics, and management theory etc.:

- expansion into the cosmos that is the universe system, where gravitational and negative energy as well as dark matters may play vital roles
- extension to the microscopic areas – cellular, molecular, nanoscales, atomic, subatomic areas and their thermodynamic treatment
- penetration and merging with other areas of sciences - natural sciences, arts, incl economics, politics,

culture, religion, biology, geology, astronomy, etc

- marching towards the non-classic areas incl
    - non-equilibrium
    - irreversible processes

A preliminary survey shows the thermodynamics has already developed to more than a hundred subbranches. Of course not all of them have become independent disciplines. However special titles and books are already written and published in some branches (refer to ThermoLiterature.doc attached). This list also shows that many of the topics are still not yet covered by the authors.

Therefore it is necessary to understand the current status of the thermodynamics system. Is it necessary to have so many subbranches? Or it is better to maintain a limited number of independent disciplines while the majority appears like the application of the thermodynamic principles to those areas.

Nevertheless, it is necessary to summarize what is achieved in the thermodynamics - its knowledge, theory and experiences, and to present the summarization in form of an encyclopaedia, which shall collect all the thermodynamics as detailed above.

This review will also study the correctness of the categorization of the current thermodynamics system, if necessary make some correction. And its main objective is to provide keynote introductions to the individual branches, its recent status of researches and progress, the main obstacles and problems unsolved, the research and development trends and forecasts, and the key scientists in brief.

This review might not be scheduled for the near term task, it will be rather a continuous effort to follow up the general development of thermodynamics and it will be presented to the audience only when it is mature to hand it out to the thermodynamic communities either as printout or e-media.

The review will possibly contain the following information:

- Brief of scope, content, major theories, findings and contributions
- Major progress, latest development
- Development and research trends
- Major problems to be solved
- Major researchers and institutions
- Literatures
- Papers
- Websites

27. Thermodynamics – General (2008-2009)

Why have I chosen Thermodynamics as my research subject?

It is a purely random choice, because whatever I will select as my research subject, I will devote the same energy and with the same determination towards a success or a failure, i.e. whether or not there will be good results or not, does not much depend on the areas I am planning to work on. The only key issue is my determination.

However, choosing Thermodynamics might shorten the time for the preparation for entry into the academic communities, as this is the area where I have known relatively well since my graduate study, when I have pursued a master's degree in Thermophsics, which also included Thermodynamics – the others included heat transfer, fluid flow, combustion and radiation. Thus I can save upto 2 years for further indepth studies, compared to a selection of an untapped area such as biomedicine or nano-manufacturing.

Another consideration is the concern about possible failure that eventually no university, no institute, in one word, no one would admit you into their academic circle so that I have to carry my research "solo". In this case, I have no laboratories to work at for some experiments or observations, I would have little chance to read the books and papers because of the inaccessibility to these resources. Therefore only theoretical studies and strategic thinking can help me overcome the shortcomings aforementioned. At lease during the first years when my researches could not be witnessed by others.

Earlier, I have spent several years to study solar radiation and radiation measurement. This is also a large subject and has been researched intensively. Like thermodynamics, it involves a lot of measurement technologies and therefore at the current stage, I am unable to carry out any practical researches without the delicate instruments. People are launching satellites worth many hundreds millions of dollars to observe the Sun radiation and to measure its rays and other solar events. I can't sit quietly at home in order to get all the measurements done.

Over the last 14 years (1994-2008), I have been following the solar industry, have been involving in the consulting services, and have studied much of the solar technologies such as solar photovoltaics, apart from solar radiation and its measurement.

And ever since 1983, when I have completed my graduate studies, I have been working in the energy and electricity power industries, and solar is one of the energy and electricity sources.

The last factor in choosing Thermodynamics is the belief that it is a science with universal applicability and long lasting effectiveness as Albert Einstein once put it:

A theory is the more impressive the greater the simplicity of its premises is, the more different kinds of things it relates, and more extended is its areas of applicability. Therefore, the deep impression, which classical *thermodynamics made upon me. It is the only physical theory of universal content concerning which I am convinced that, within the framework of applicability of its concepts, it will never be overthrown.*

My thermodynamic activities include not only researches but also services to the industries.

Planned to study all thermodynamic branches with focus of combustion thermodynamics, solar thermodynamics. Also intended to design a thermodynamics platform and a thermodynamics journal called ThermodynamicsToday.

- 热力学及各分支学科
- **撰写以下著作：**
  - 燃烧热力学 （2008-2010）
  - 太阳热力学 （2008-2010）
  - 热力学大全 （2008-2030）
  - 热力学进展杂志 （2009-）
  - 热力学网络平台 （2009-）

Researches on the thermodynamics of the Sun (from its nuclear fusion core, through the radiation zone, the convection zone, the photosphere, the chromosphere, the transition zone upto the solar corona) have been lasting for quite a while, with initian focus on the solar corona heating problem. Investigating into thermodynamics theories and practices in all solar applications - from upstream solar radiation, to downstream solar power systems) has also been undertaking since long. An overview of the modern thermodynamics is also enrolled into the research interests...

a) Understand thermodynamic science in its entirety, incl. all its branches. For this purpose a comprehensive list of thermodynamics literature have been prepared available as a first guide to the studies. Thousands of papers and articles in different parts of Thermodynamics have also collected, arranged in the same order as the literature index, so that all future research can be carried out on these bases.

b) Carry out special research on some selected topics of thermodynamics. The final decision is to carry out researches on Solar Thermodynamics, details see below.

c) Write the Thermodynamics Review books. This will only be realized at time of maturity, that is, when it's ready.

d) Think about the possibility of tackling general concerns and problems challenging the human kinds - poverty, inequality, pollution, health problems, energy and resource crisis and others with thermodynamics

27.1. How am I Prepared?

Frankly speaking, I am not yet 100% prepared for an indepth research of the thermodynamics.

One of the major obstacles for entering the academic circles is my lack of records in scientific researches. That is not because of my inability to conduct researches, rather the absence of chance to work in the academic world. Since graduation, my career has been shifting between various industries and functionalities, ironically I was never employed by a research institution except the Guangdong Electric Power Design Institute, which is not a research organization in its true meaning. As such, I don't have any paper to show possible employers, not talking about publications on major international magazines, such as Science, EI, Nature etc. However, I have written **tens of thousands of pages** delivered to my clients in the solar and general power industries and several other industries. I don't doubt about my ability to write first class articles. Of course, scientific papers and business reports are fairly different – both in their formats and contents. I know how to turn my style to the right path.

And although I have completed my master degree about 20 years ago and while at University, I have studied wide spectra of sciences not just my own major. However, when trying to write a paper on certain topics of thermodynamics, I find myself in severe shortage of basic knowledge of mathematics, physics and other sciences. Therefore I need to enhance my capacity in these areas and this study will continue for all my career period. Mathematics is of particular importance in scientific research, therefore this will be one of my key areas of studies.

Nevertheless, the basic foundation of knowledge building is completed. And recently I have also carried out a preliminary research of the overall status of the Thermodynamics science, resulting in a comprehensive list of literatures arranged in the order of their corresponding branches. It is easy to find out that one cannot tackle all these branches as his/her research areas. Careful considerations shall be given to final decision as to which area will be my target research subject.

27.2. Recommandations

Cai Fu
GVK
岑院士

27.3. 总体计划

1）全面了解热力学学科，包括各分支学科的情况，同时，希望能在热力学理论上有所领悟和创新,目的是要彻底了解整个的热力学知识的大厦和其上的每一片砖瓦,全面了解有哪些学科，互相之间的关系，以此为基础，建立一个完备的热力学学科体系
2) 准备花三-五年左右的时间写完《燃烧热力学》,《太阳与宇宙热力学》和《热力学综述》三部书。

27.4. 《太阳热力学》（2008-2010）

太阳是我们地球上唯一的能源来源，利用太阳能是解决我们许多能源问题的主要途径之一（当然不是唯一途径）。过去的年月里，花了许多精力了解太阳能的各种技术，包括光伏。在最近的二年里，注意力更转移到太阳辐射理论，技术，特别是其测量技术和太阳物理。专门研究了太阳模型。 自 1960 年代以来，太阳模型基本成熟，能解释绝大多数太阳现象和参数，包括它的温度，压力，密度，元素丰度等，而且最近几年，中微子的观察和研究也证明太阳模型的正确性。太阳模型，太阳等离子体的力学和热力学，甚至于太阳风的等离子体物理和力学及热力学，等已经深入得到研究，各种研究成果散步于各种研究机构和个人，但没有完整的系统的总结成太阳热力学，没有专门涉及《太阳热力学》这以学科。 太阳模型的研究着关心的是几个基本方程，太阳物理学家关心的是各种表面物理现象，而且如今连太阳磁场的产生和活动机理以及日冕加热机制都没有搞清楚。

因此，有必要专门从热力学的观点考察太阳内部和外部的各种热物理现象，包括其热力学状态，热力学函数关系，利用热力学来解释太阳磁场，日冕加热等现象。

另外，太阳热力学的研究将扩展到宇宙和天体热力学，因为在那里，经典热力学理论将不再起作用，甚至于全部的经典热力学都有可能被推翻而重建。例如，宇宙中有可能是熵减定律起主导，温度在绝大多数情形下是负值，因为宇宙中如果存在大量的暗能量或负能量，以及暗物质与负物质，经典热力学肯定无法起作用。 这些问题都需要探讨。

27.5. 《燃烧热力学》（2008-2010）

燃烧是一个与人类生活和工作关系密切的现象和过程，每天我们需要面对它，因此，其重要性怎么说也不过分。然而，目前，还没有发现专门的讲述燃烧过程热力学的专著，无论国内还是国外都是如此。 所找到的唯一内容是在燃烧学教科书里面篇幅很短的介绍，而且介绍的内容似乎并非真正的燃烧热力学，而是地地道道的化学热力学。总而言之，这门课程被忽视了。

为此， 准备写一部《燃烧热力学》的专著，将热力学的全部理论，包括经典热力学，平衡态热力学，非平衡态热力学，可逆与不可逆热力学，以及最近几十年来发展的各种热力学理论，应用到各种燃烧现象和过程中，包括各种燃料种类，各种燃烧方式（扩散，预混，暴震等），各种燃烧情景（正常的，非正常的例如火灾，森林燃烧）等等。 最后将燃烧热力学成为一门成熟的独立的科目。

准备在您，张老师的指导下写此书，由您和张老师分别为第一和第二作者。

27.6. 《热力学回顾》（2008-2010）

最近几十年来，热力学向广度和深度进军。

热力学已经脱破传统的平衡态领域，向非平衡态，不可逆，有限时间，向各种相关和不相关的学科渗透，例如医药，生物，能源，甚至于社会学，生态学，经济学，管理学等：

- ✧ 向宇观领域，也就是宇宙体系的扩展，那里引力和负能量以及暗物质可能起着至关重要的作用；
- ✧ 向微观领域的拓展 – 在分子，原子，亚原子领域的热力学处理
- ✧ 向其他科学领域的渗透 – 自然科学和社会科学，包括经济领域，政治领域，文化，宗教等传统上热力学不涉及的领域
- ✧ 在非经典热力学的拓展，包括
  - ■ 非平衡系统
  - ■ 不可逆过程

据初步了解，热力学的分支学科已经超过 100 个。当然，并非都成为独立的子学科。 但有些领域已经有专著出现（参考 ThermoLitarature.doc）。

由此可见，热力学在各个领域的扩展程度是如何的深，广。

因此，有必要梳理一下热力学学科体系的现状。是否有必要建立如此众多的分支学科，将如此多的应用以 XXX 热力学的形式独立成体，还是保持有限数量的独立学科，而将其他部分都看做是热力学在 XXX 领域的应用。

不管如何，有必要将迄今为止，在热力学领域取得的知识，理论，和经验来个大总结，并将结果以热力学全集或大全的形式，将热力学的全部学科，理论，知识和经验编辑汇总。

这部《回顾》将详细考察目前热力学的分支学科的分类是否正确，并且就每一个分支学科提供主要的内容介绍，目前进展以及研究热点的简短说明。

编辑这样的文集，需要动用大量的人力物力财力，也需要巨大的精力去完成，是一个浩大的工程。

目前国内外都没有如此详细的回顾和总结性文集。 目前找到的唯一比较接近的著作是：
王季陶著《现代热力学及热力学学科全貌》，复旦大学出版社 2005 年 9 月以及 J. Serrin.的 New perspectives in thermodynamics, Springer-Verlag, c1986. 这二部著作提供许多有意的信息和启示，但尚不完全。其他还有如干类似的书籍，但我还没有机会阅读。

27.7. Special Researches

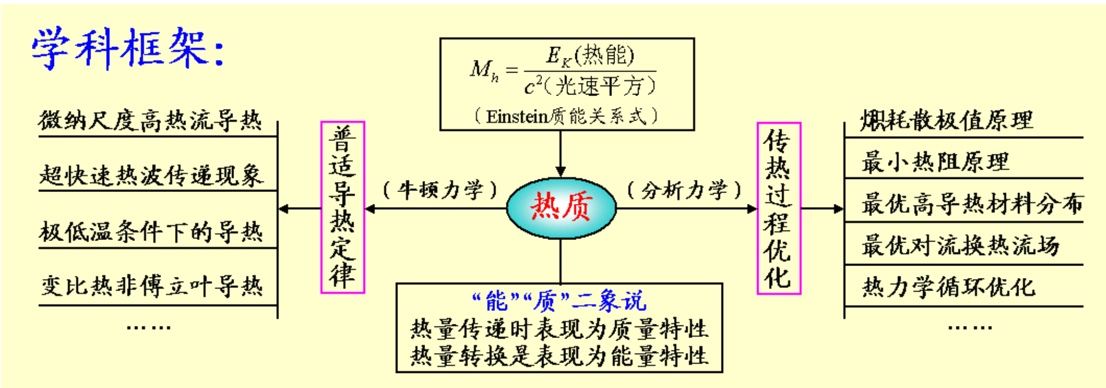
Areas of researches have to be identified yet. As the first step, I would suggest to carry our researches of thermodynamics phenomenon related to the solar corona heating mechanism, the solar magnetic fields and its formation. The negative temperature and negative energy thermodynamics, thermodynamics of small systems incl. nanoscale thermodynamics, thermodynamics of porous media and other compact systems related to the aerospace and chip industry. Details have to be identified and researched yet.

27.8. 热力学体系

热力学体系的全面整理，分类的清理和分析，学科相互间的关系等

27.9. 微观体系热力学

27.10. 新概念热学



新概念热学是清华大学航天航空学院过增元教授的学术团队正在从事的研究领域。新概念热学提出了热的动质二象性说，即热具有能量和质量的双重属性，在热学中引入热质、热质势、热质能等热学新概念，以建立热量传递的普适定律和优化热量传递过程的普遍原理。通过建立热量传递的动力学控制方程，探讨傅立叶导热定律的物理本质，建立亦适用于极端条件（纳米、超快速、极低温传热等）的普适传热规律；基于变分原理建立传热过程的最小作用量原理，即热质能耗散极值原理，应用于传递过程和热功转换过程的优化，以提高能量利用效率。清华大学已为本科生开设“新概念热学” 课程，北京大学、华中科技大学、上海交通大学也将开设相关课程。

新概念热学与现有热学既非相互分割，亦不是相互矛盾的。前者是后者的拓宽和发展， 因此更需要对现有热学的内涵有进一步的认识和分析。

※　迎接高新科技的挑战

*微纳系统的散热
*激光加工的热过程预测
*热系统能量利用效率的提高

※　探索热量的本质和热量传递与转换的普适规律
*热的“运动”“物质”二象说
*普适导热定律
*传热学与热力学的内在联系

《新概念热学》目录

最近发表的相关论文

物理学报:声子气的状态方程和声子气运动的守恒方程

自然科学进展:火积——描述物体传递热量能力的物理量

Int J Heat Mass Transfer: Entransy—A_physical_quantity_describing_heat_transfer_ability

J_Appl_Phys: Equation_of_motion_of_a_phonon_gas_and_non-Fourier heat conduction

A0703_物理学报-声子气的状态方程和声子气运动的守恒方程.pdf

A0706_J_Appl_Phys-Equation_of_motion_of_a_phonon_gas_and_non-Fo.pdf

Entransy—A_physical_quantity_describing_heat_transfer_ability.pdf

27.11. 宏观体系热力学

27.12. 太阳热力学

27.13. 日冕加热的热力学问题

27.14. 燃烧热力学

27.15. 其他

27.16. 热力学与能源问题

27.17. 热力学与环境问题包括气候变暖

27.18. 热力学与贫困问题

27.19. 热力学与平等及发展问题

27.20. 热力学与艾滋病

27.21. 熵与人的寿命

27.22. 熵与人的健康

27.23. 熵与癌症

热力循环研究
热力学理论研究
流体机械气动热力学
推进系统气动热力学
叶轮机械气动热力学
统计热力学
热机气动热力学研究方向
溶液热力学
小系统非平衡稳定态热力学研究
复杂流体热力学性质的统计力学研究
分子热力学研究
受限空间内计算机分子模拟和热力学研究
水合物形成热力学
冶金热力学
土壤肥力的生物热力学理论的研究
中枢热力学疲劳
计算热力学
非平衡热力学
有限时间热力学
吸附热力学
界面热力学
生化过程中的热力学基础
热力学理论联姻中医药研究
低维量子自旋系统热力学研究
半导体热电堆发电循环的热力学研究

电解液热力学爆炸技术
聚合物热力学溶解采矿
溶液过量热力学性质的研究
软化学的热力学
无机化合物热力学和相平衡
材料热力学
纳米材料的基础热力学及其可控合成原理
热力学分析与火用经济学理论及其应用
材料制备过程中的热力学研究
天然气溶解热力学研究
熔体热力学性质的计算
萃取过程的热力学
生物质制造可持续生物燃料过程的热力学研究
多层薄膜材料的热力学
摩擦体系热力学
非平衡热力学
船舶动力机械热力学及热力系统研究
二元液态合金的热力学 研究
生物活性及热力学性质研究
纳米热力学理论
流体热力学
内流气动热力学
生物非平衡态热力学
室内空气微污染物环境热力学行为研究
复杂流体相行为及分子间相互作用热力学
洁净介质中化学反应热力学
材料化学热力学
能源利用中的气动热力学
生物热力学：生物传热、软组织生物热力学. 热感觉：热觉与热疼痛
复杂流体的分子热力学研究
超高温陶瓷的热力学性能
应用热力学
Skin Biothermomechanics and Thermal Pain
纳米热力学理论包括纳米尺度下材料生长的热力学与动力学理论和纳米材料体系表面与界面的热力学理论.
有限时间火用 经济 及生态学最优性能研究
广义热力学优化理论
有限时间热力学理论扩展到传统的机械、电、磁、流体力学、化学系统、经济过程和动植物的生命过程
有限时间热力学及热力学优化和现代热机理论及其在能源利用、动力与制冷空调装置中的应用

宇宙大爆炸
精神疾病
气候变化
ＲＮＡ研究

单分子 生物学家
恒星剧增与伽马射线
老鼠干细胞能发育出精子和卵细胞
研制出“左手材料”
Ｙ染色体
癌症治疗

极端天体环境下的光学喷流系统
纳米结构表面材料超疏水与超亲水之间的可逆转变
利用 STM 对 Si 衬底上的 Pb 岛进行操纵
光合作用膜蛋白研究
翼龙胚胎化石
五粒子纠缠和终端开放的量子态隐形传输
早期生命研究
离子的激光冷却与囚禁
物质第五态——酯膜结构

27.24. dark entropy

27.25. negentropy

27.26. thermodynamics of biology

27.27. Thermodynamics of Black Holes

27.28. Shannon’s Information Theory

27.29. 研究与应用范围

热力学研究
热力学分析

热力学分析与节能
热力学效率
热力学平衡分析
不可逆热力学分析
热力学分析与比较
热力学分析及设计研究
热力学分析及用能改进建议
热力学不完善性分析
热力过程数学模型的研究
热力学效应的数值模拟
热力学优化与计算
热力学优化方法
热力学数据库的优化与完善
相变热力学研究
能量价值分析

热力学函数研究
热力学性质
热物理性质
热力学模型
热力学参数
热力学特性
热力学性能的评价
热力学性质的稳定性分析
热力特性及热经济性分析
热力学性质的理论计算
热力学计算及分析
热力学模型及数字仿真
热力学数学模型
热力学数据焓、熵、 火用的计算
流体热物性和能量系统优化
气、固相成分跟踪热力学计算
平衡组成计算
相图优化计算
活度及活度因子
活度测定
活度的热力学一致性检验
多组分平衡系统热力学组成

热耦合精馏的热力学效率

有限时间热力学分析
有限时间热力学和热经济分析

有限时间火用经济性能优化

计算气动热力学
气动热力学研究
气动热力学数值模拟

热动力学研究法--热弛豫法
热动力学研究法--自函数回归法
热动力学对比参量法
一级反应精确热动力学
热-动力学耦合有限元分析
溶剂萃取热动力学研究
磁性薄膜热动力学性质的研究
热动力学性质的分子动力学研究

化学热力学平衡分析

脱硫能力计算热力学

结构热 非线性动力学耦合有限元分析

熵理分析

热工学分析及能耗效益对比
材料热力学性质的解析方法
非平衡态热力学分析
非平衡热力学分析模型方程的建立
非平衡态不可逆过程的热力学
非线性热力学分析
分子热力学模型研究
Internet 热力学计算平台

线性热力学对大气系统的应用
大气系统的线性唯象关系和热力学性质
排列熵应用于气候复杂性度量

热分析（DSC）测量及转变热力学

网络热力学的建模方法

皮肤组织的热力学行为

生态热力学评价
熵与生态环境研究

低熵经济战略
信息熵与土地利用结构演化研究
热力学的财富增量公式及中国经济反思
来自热力学的财富增量公式及中国经济反思
广义熵在现代农业研究中的应用
基于热力学嫡的交通流模型

27.30. 具体研究项目

用不可逆热力学分析伴随内部结构 变化的粘弹性体非线性蠕变行为
不可逆热力学的等熵产面及其在化学中的应用 A curved surface of equal entropy generation for irreversible thermodynamics a nd its applications in chemistry
不可逆热力学研究木材干燥规律 On Laws in Wood Drying by Irreversible Thermodynamics
液态锡焊料常见元素氧化的热力学分析
热弹性马氏体相变连续介质热力学研究
一种可用于计算贮氢材料热力学性质的解析方法

自然工质低温复叠式制冷循环的热力学分析与比较
CO2 低温制冷循环热力学分析
四种双温蒸汽压缩制冷循环的热力学比较
吸热式热力循环发动机的热力学特性
氦制冷系统热力学分析及设计研究
低温气体冷凝过程的热力学分析
吸附式制冷系统吸附床内非平衡态热力学分析 Non-equilibrium thermodynamic analysis of heat and mass transfer of adsorption refrigeration system
带经济器的涡旋压缩机制冷循环热力学分析
铝合金熔炼热工学分析及能耗效益对比
应用热力学讨论氢卤酸的强度
应用热力学函数研究不同钙基固硫试剂的固硫特性
热力学理论在中医药研究中的应用与发展
稀土元素在钢中的热力学参数及应用
基于 Internet 的热力学计算平台

液体混合物的热力学及输运性质研究
非平衡态热力学理论在河流动力学领域中的应用
冶金过程与非平衡态热力学 Metallurgical processes and non-equilibrium thermodynamics

非平衡态热力学理论与钢铁冶金过程 Non-equilibrium thermodynamic theory and ferrous metallurgical process

非平衡态热力学与激光 The Nonequilibrium Thermodyqamics and Laser
神经网络的非平衡态热力学研究 Study on the Non-equilibrium Thermodynamic Theory of Neural Networks
精馏节能过程非平衡热力学分析模型方程的建立
生物体中非平衡态不可逆过程的热力学
绿洲系统维持机制的非线性热力学分析
共聚高分子系统的分子热力学模型研究

户式燃气空调的热力学分析
蒸气喷射式制冷的热力学原理
热泵干燥系统的热力学分析及干燥过程传热传质研究
活塞式压缩机变工况热力学分析
柴油机工作过程热力学研究
空调新风系统的热力学分析与研究
考虑污垢时换热器热力学性能的评价
压缩/喷射混合制冷循环的热力学分析探讨
用状态方程计算油气体系的热力学参数
二氧化碳热力学性质的理论计算
选择性催化还原(SCR)烟气脱硝的热力学计算及分析

飞机液压系统的热力学模型及数字仿真
摩托车减震器阻尼特性热力学模型的建立与流场模拟分析
部分煤气化炉的热力学数学模型

压缩/喷射混合制冷循环的热力学分析探讨
反斯托克斯荧光制冷的热力学分析
燃气涡轮发动机气动热力学理论及其应用

民营企业文化系统的熵理分析

冶金熔体的化学性质与热力学性质
应用热力学方法研究钛合金锻造热力参数
硅系合金氧化精炼过程的热力学研究
液固界面平衡结构的热力学分析
含硼水溶液热力学性质研究进展
计算热力学在钢中非金属夹杂物研究中的应用
电弧炉粉尘直接还原炉渣氧化和脱硫能力计算热力学

21 世纪生产力发展方针的热力学思考

热力学超临界流体换热计算与分析
地质流体的热力学模型研究进展与现状
地质流体热力学性质的蒙特卡罗模拟
超临界流体化学热力学

超临界流体萃取热力学及其工艺特点和应用
磁化流体的分子热力学模型及磁化燃油燃烧性能的研究
流体热力学的格子 Boltzmann 方法的理论分析
瓦斯水合物分解热力学研究

摩擦体系的热力学理论、实验验证及其在表面改性中的应用
摩擦体系结构分析和定量建模的熵探索
摩擦体系的非平衡热力学研究（Ⅰ）：系统组成及结构分析
变比热气体和变比热有离解气体热力学过程的计算
以有限元方法为主体的计算气动热力学
节能低噪声轴流风机气动热力学和气动声学研究
涡轮叶栅气动热力学研究
湿压缩燃气轮机气动热力学研究
涡轴发动机全状态实时气动热力学数值模拟
涡轴发动机起动过程的一种气动热力学实时模型
复合轮齿压缩机原理及热力学特性分析
叶轮机械气动热力学及其现代设计和优化方法

时间参量法(VI)--连续一级反应的热动力学研究
热动力学特征对比参量法及其应用研究
较快一级化学反应的热动力学研究法--热弛豫法
慢对峙反应的热动力学对比参量法
热动力学的滴定量热法研究Ⅱ.考虑热滞后的一级反应精确热动力学
平行反应的热动力学研究法
连续一级反应的热动力学研究法--自函数回归法
特征参量法Ⅰ.简单级数反应的热动力学研究法
平行反应的热动力学研究法(Ⅱ)——平行一级和二级反应
热动力学对比参量法 ——简单级数反应
自函数回归法连续一级反应的热动力学研究
生物代谢过程的热动力学研究
经典“Wenzel”和“Cassie”润湿模型有效性的热动力学分析
莫霍面的性质及热.动力学特征（王玉玺）
酶促反应热动力学研究
大型空间结构热-动力学耦合有限元分析
晶界与纳米粒子热动力学性质的分子动力学研究
萃取剂性质及溶剂萃取热动力学研究
量子 Heisenberg 磁性薄膜热动力学性质的研究
智能剥离工艺的热动力学模型?
生物质焦油及其馏分的热动力学研究

生物熵在医学研究中的应用
全球粮食危机与熵定律
“熵”在中医方证研究中的运用

基于信息熵的永州市土地利用结构演化研究
重庆一小时经济圈与城乡统筹：历史合力下的低熵经济战略

来自热力学的财富增量公式及中国经济反思
从冷水到共产主义——热力学定律与马克思主义政治经济学 2008-07-29

以“热力学第二定律”解释三国时代之国之兴亡与天下大势 2008-7-25
熵与生态环境 entropy

河蚌壳的微结构及热力学分析
生物体中非平衡态不可逆过程的热力学
皮肤组织的热力学行为表征：Ⅰ．拉压行为
人体熵流的数学模型

利用统计热力学中的微扰理论推算实际气体 p、v、T 的新方法
计算液态混合物内能和内压的统计热力学理论

网络热力学--热力学发展的一个新逻辑阶段
网络热力学的建模方法

线性热力学对大气系统的应用(I)大气系统的线性唯象关系和热力学性质
线性热力学对大气系统的应用(Ⅱ)大气系统中线性唯象关系的例证

基于热力学表达的板蓝根药效物质筛选和品质评价的初步研究
卡马西平的热分析（DSC）测量及转变热力学

氮化钛/氮化铝多层膜体系的热力学研究
铁磁晶体热力学性质的稳定性分析

金刚烷的结构、溶解性及热力学性质
硅系合金氧化精炼过程的热力学研究
《特殊钢》——钢平衡相转变的热力学计算和分析
钛铁矿还原过程的热力学计算及相关实验研究
硅热法冶炼金属钙的热力学及工艺
高能球磨制备铁铝固溶体及其热力学分析
稀土卤化物与碱金属卤化物相图的热力学优化与计算
氧化铝生产热力学数据库的优化与完善
卢 柯 纳米晶体材料的微观结构及相变热力学研究
激光熔凝的微观机理及热力学初步分析

磨料磨具工艺的热力学分析与应用探讨

金及贵金属团簇的结构和热力学性质研究
内燃机理论循环有限时间热力学理论的发展

太阳能热泵的有限时间热力学分析
内燃机混合加热(Dual)循环有限时间热力学分析
内燃机循环的有限时间热力学分析
临界点二级相变的有限时间热力学逼近
传热传质过程和设备的有限时间热力学优化
太阳能热水系统有限时间热力学和热经济分析
广义不可逆卡诺制冷机的有限时间火用经济性能优化

逆流换热器热力学优化方法比较
用微扰理论计算磁场对低浓度磁性胶粒体系热力学性质的影响 APPLYING PERTURBATION THEORY TO CALCULATING EFFECTS ON THERMODYNAMICS OF MAGNETIC COLLOIDAL PARTICLES SYSTEM
强子物质热力学性质和非微扰 CJT 计算方法研究
轧辊疲劳破坏的热力学分析 2007-12-25
云南天文台 1m 红外望远镜的主镜热力学分析
半导体热电堆发电循环的热力学研究
燃气轮机热电联产系统的热力学分析及用能改进建议
改造常规汽轮机电站联合循环系统的热力学分析
燃气-蒸汽联合循环发电装置的热力特性及燃气轮机热经济性分析
燃煤气的注蒸汽燃气轮机循环的热力学分析
闭式注蒸汽燃气轮机循环热效率的估算方法
适用于燃煤气的 STIG 循环中湿燃气的状态方程

燃气轮机循环有限时间热力学分析:理论和应用

两级热电热泵的有限时间热力学分析
具有压降不可逆性的回热式燃气轮机循环热力学优化
开式燃气轮机中冷循环热力学优化
MOCVD TMG—AsH3—和 TMG—AsH3—He 体系的热力学平衡分析

西门子法生产多晶硅的热力学
Thermodynamic consistency of sub-bandgap absorbing solar cellproposals
Introduction into applied renewable thermodynamics for direct solarenergy conversion systems
Finite-time thermodynamic analysis of a solar driven heat engine
An irreversible thermodynamic model for solar absorption refrigerator
Solar cell thermodynamics including multiple impact ionization and concentration of radiation
Thermodynamic analysis of solar thermochemical energy absorption
A Finite-Time Thermodynamic Framework for Optimizing Solar-Thermal Power Plants
Thermodynamic analysis of solar photovoltaic cell systems
A finite-time thermodynamic framework for optimizing solar-thermal power plants
Thermodynamic limitations to solar energy conversion
Thermodynamics and reciprocity of solar energy conversion
Thermodynamics of the conversion of solar radiation
硅提纯的热力学基础
CdS/CdTe 太阳电池制备过程的热力学分析

太阳烟囱发电系统及其固有的热力学不完善性分析
太阳烟囱发电系统及其固有的热力学不完善性分析
太阳能热风发电系统集热器热物理模型及分析
太阳能热气流电站系统的热力学分析
太阳能热泵系统(SAHP)的热力学分析
新型太阳能热泵多功能复合机原理与热力学分析
太阳能-热泵热源地板辐射供暖系统房间热力过程数学模型的研究
混合制冷剂在直接膨胀式太阳能热泵集热器中的热力学分析
Thermal and technical analyses of solar chimneys
光子核聚变过程的熵变问题与热力学第二定律
强脉冲 X 射线辐射热力学效应的数值模拟

辐射热力学中光量子的熵和光子气的熵
借助集团展开的超辐射热力学
RADIATION THERMODYNAMICS: SOLAR POWER POTENTIAL

希尔反应的热力学探讨
生态系统的能量流动
黄河干流水资源生态热力学评价
准二级压缩热泵系统的热力学分析——赵会霞 马国远
热耦合精馏的适应性及其热力学效率
地冷耦合除湿型空调系统的热力学分析
发动机系统热力学模拟的现状
直接接触式蓄冷循环的热力学研究
换热器系统的热力学性能评价
微燃机分布式能源系统的热力学分析
空调系统热力学分析与节能
能量（能源）系统的热力学

含碳能源直接制氢的热力学分析与实验研究
能量传递系统强化的热力学判据
水源热泵系统的热力学分析
生态系统的能量冗余与热力学第二定律
两级 TFE—TUR 复合地热发电系统热力学分析及能量...
生态系统中的能量流动
能量价值分析原理在电厂降低制粉电耗中的应用
用热力学方法测量大型锅炉给水泵效率
微型冷热电联产系统热力学分析
改造常规汽轮机电站联合循环系统的热力学分析

太阳能收益与热力学定律
基于热力学定律的太阳能利用探究
太阳能热泵的有限时间热力学分析

太阳能热水系统有限时间热力学和热经济分析

太阳能热泵系统的热力学分析

太阳能高倍聚光能量利用系统热力学分析及传输过程设计优化
道路交通系统类热力学熵及其应用
计算高速列车车内压力的热力学模型
化学热力学教学中生命科学的渗透
氢化钚与空气反应的热力学平衡计算
共聚高分子系统的分子热力学模型研究

NH_4Bph_4 在(CH_3OH-H_2O)混合溶剂中热力学性质的测定
化学热力学与生命科学
软质聚氨酯泡沫塑料生产配方的化学热力学研究
化学热力学在化学气相输运中的应用
化学所分子间相互作用化学热力学研究组创新文化建设成绩突出[2003 年 3 月 26 日
多联产系统中合成气一步法制取二甲醚的热力学分析
尿素生产系统热力学研究及流程模拟开发
铁磁晶体热力学性质的稳定性分析

生物质无氧气化制氢系统的热力学计算

流体化工热力学数据焓、熵、 火用的计算
摩擦体系结构分析和定量建模的熵探索
关于液体沸腾汽化过程的热力学分析
广义熵在现代农业研究中的应用
温度场熵在矩形散热翅片中的应用
阿司匹林的热解机理及热动力学研究
生物体多尺度热学响应问题的研究与应用
跨临界二氧化碳蒸汽压缩 / 喷射循环的热力学分析
煤燃烧过程中有害痕量元素形态分布的化学热力学平衡分析
非平衡态热力学在现代植物生命科学研究中的作用
用人工神经网络方法研究高聚物的热力学性质
链状分子流体混合物热力学性质的预测模型
地质流体热力学性质的蒙特卡罗模拟
七水硫酸锌脱水机理热力学初探
高温堆甲烷蒸汽重整制氢系统性能热力学分析
表面活性剂在瓦斯水合物生成过程中的热力学作用
CO_2 热力学性质的量子化学计算
变分累积展开对不同格点结构的磁性薄膜的热动力学性质的研究
非简谐振动对晶体 Mo 热力学性质的影响
含钛矿物加碳氯化反应的热力学分析
热力学遗传算法计算效率的改进
基于热力学嫡的交通流模型
大型柔性空间结构热 非线性动力学耦合有限元分析
排列熵应用于气候复杂性度量
传热传质过程和设备的有限时间热力学优化

L abV IEW 在热力学函数测定中的应用
来自热力学的财富增量公式及中国经济反思
PanEngine 热力学计算开发平台
冶金熔体热力学数据库的开发
PTT 纤维染色的动力学和热力学
吸附式制冷循环热力学及性能
辉钼矿浮选体系中的界面热力学
Thermodynamics of Energy Production from Biomass
信息热力学
钼合金耐火材料液相烧结性能热力学研究
NBI 低温冷凝泵液氦杜瓦的热力分析与工程设计
CO 加氢合成低碳醇的热力学计算与分析
基于信息熵和经营耗散理论下的品牌自传播计量框架*
聚合物溶液热力学模型的评述
精馏节能过程非平衡热力学分析
The thermodynamics of the hydrogen economy
非线性色谱的非平衡热力学分离理论
Second Law Analysis of an Air-Cooled Solar Collector
Analysis of Solar Thermochemical Water-Splitting Cycles for Hydrogen Production
Thermodynamics of heat engines
THERMODYNAMIC DESIGN OF A SOLAR REFRIGERATOR TO PRESERVE SEA PRODUCTS
Thermodynamic concepts in quantum solar energy conversion
Investigation of the Thermodynamic Component of Penman’s Method for Estimating Evaporation
A Simple Thermodynamic Analysis of Photosynthesis
Thermodynamic analysis of absorption refrigeration system based on entropy generation
Thermoeconomic optimization of the SOL-14 plant
Simple Thermodynamics of Transportation
化工熱力學在超臨界技術上之研究
杯芳冠醚与碱金属离子配合热力学分析
液态钠 2 氢系统化学热力学平衡分析
流体动力润滑油膜破裂的热力学失稳机理
纳米多晶体的热力学函数及其在相变热力学中的应用
高温超导体的热力学性质的研究
中药药性的生物热力学表达及其应用
氧化钒制取碳化钒的热力学分析
盐湖卤水体系的热力学模型及其应用
外推法计算高温气体恒压摩尔热容
多种不可逆性对热变换器热经济性能的影响
压缩热泵系统的热力学分析

污水厂污泥低温热化学转化过程机理
汽包锅炉热化学试验

27.31. 精炼的项目

用不可逆热力学分析伴随内部结构 变化的粘弹性体非线性蠕变行为
不可逆热力学的等熵产面及其在化学中的应用 A curved surface of equal entropy generation for irreversible thermodynamics a nd its applications in chemistry
不可逆热力学研究木材干燥规律 On Laws in Wood Drying by Irreversible Thermodynamics

热力学超临界流体换热计算与分析
地质流体的热力学模型研究进展与现状
地质流体热力学性质的蒙特卡罗模拟
超临界流体化学热力学
超临界流体萃取热力学及其工艺特点和应用
磁化流体的分子热力学模型及磁化燃油燃烧性能的研究
流体热力学的格子 Boltzmann 方法的理论分析

变比热气体和变比热有离解气体热力学过程的计算
以有限元方法为主体的计算气动热力学
节能低噪声轴流风机气动热力学和气动声学研究
涡轮叶栅气动热力学研究
湿压缩燃气轮机气动热力学研究
涡轴发动机全状态实时气动热力学数值模拟
涡轴发动机起动过程的一种气动热力学实时模型
叶轮机械气动热力学及其现代设计和优化方法

太阳能高倍聚光能量利用系统热力学分析及传输过程设计优化
太阳能收益与热力学定律
基于热力学定律的太阳能利用探究
太阳能热泵系统的热力学分析
太阳能热水系统有限时间热力学和热经济分析
太阳能热气流电站系统的热力学分析
太阳能热泵系统(SAHP)的热力学分析

新型太阳能热泵多功能复合机原理与热力学分析
太阳能-热泵热源地板辐射供暖系统房间热力过程数学模型的研究
混合制冷剂在直接膨胀式太阳能热泵集热器中的热力学分析
硅提纯的热力学基础
西门子法生产多晶硅的热力学
CdS/CdTe 太阳电池制备过程的热力学分析
太阳烟囱发电系统及其固有的热力学不完善性分析
太阳能热风发电系统集热器热物理模型及分析

煤燃烧过程中有害痕量元素形态分布的化学热力学平衡分析
含碳能源直接制氢的热力学分析与实验研究
能量传递系统强化的热力学判据
水源热泵系统的热力学分析
用热力学方法测量大型锅炉给水泵效率
微型冷热电联产系统热力学分析
改造常规汽轮机电站联合循环系统的热力学分析
两级热电热泵的有限时间热力学分析
具有压降不可逆性的回热式燃气轮机循环热力学优化
开式燃气轮机中冷循环热力学优化
燃气轮机循环有限时间热力学分析:理论和应用
燃气涡轮发动机气动热力学理论及其应用

地质流体热力学性质的蒙特卡罗模拟

传热传质过程和设备的有限时间热力学优化

热交换器多种不可逆性热经济性能分析
逆流换热器热力学优化方法比较

燃气轮机热电联产系统的热力学分析及用能改进建议
改造常规汽轮机电站联合循环系统的热力学分析
燃气-蒸汽联合循环发电装置的热力特性及燃气轮机热经济性分析
燃煤气的注蒸汽燃气轮机循环的热力学分析

内燃机混合加热(Dual)循环有限时间热力学分析
内燃机循环的有限时间热力学分析
内燃机理论循环有限时间热力学理论的发展

传热传质过程和设备的有限时间热力学优化

广义不可逆卡诺制冷机的有限时间火用经济性能优化

精馏节能过程非平衡热力学分析
聚合物溶液热力学模型的评述
跨临界二氧化碳蒸汽压缩 / 喷射循环的热力学分析

压缩热泵系统的热力学分析
吸附式制冷循环热力学及性能
准二级压缩热泵系统的热力学分析

地冷耦合除湿型空调系统的热力学分析
发动机系统热力学模拟的现状

直接接触式蓄冷循环的热力学研究
换热器系统的热力学性能评价
微燃机分布式能源系统的热力学分析
空调系统热力学分析与节能
压缩/喷射混合制冷循环的热力学分析探讨
反斯托克斯荧光制冷的热力学分析
户式燃气空调的热力学分析
蒸气喷射式制冷的热力学原理
热泵干燥系统的热力学分析及干燥过程传热传质研究
活塞式压缩机变工况热力学分析
柴油机工作过程热力学研究
空调新风系统的热力学分析与研究
考虑污垢时换热器热力学性能的评价
压缩/喷射混合制冷循环的热力学分析探讨
选择性催化还原(SCR)烟气脱硝的热力学计算及分析
带经济器的涡旋压缩机制冷循环热力学分析
自然工质低温复叠式制冷循环的热力学分析与比较
CO2 低温制冷循环热力学分析
四种双温蒸汽压缩制冷循环的热力学比较
吸热式热力循环发动机的热力学特性
氦制冷系统热力学分析及设计研究
低温气体冷凝过程的热力学分析
吸附式制冷系统吸附床内非平衡态热力学分析 Non-equilibrium thermodynamic analysis of heat and mass transfer of adsorption refrigeration system

磨料磨具工艺的热力学分析与应用探讨

热化学
污水厂污泥低温热化学转化过程机理

基于热力学嫡的交通流模型
道路交通系统类热力学熵及其应用

信息熵和耗散理论

基于信息熵和经营耗散理论下的品牌自传播计量框架*
来自热力学的财富增量公式及中国经济反思
广义熵在现代农业研究中的应用
基于信息熵的永州市土地利用结构演化研究
21 世纪生产力发展方针的热力学思考
民营企业文化系统的熵理分析

27.32. Calls to Scientists

Thermodynamics Research Program

Dear Sir or Madam:

My name is Chen Minghua, 46, male Chinese, a postgraduate of thermophysics from Tongji University, Shanghai, China in June 1989. I write you this email in order to seek an opportunity to conduct my research and writing program of solar thermodynamics at your institution.

I have a diversified career path in various industries and roles – refer to my resume (**Resume.doc**) attached. And now I have decided to reenter the academic world after many years in the industry and business (see **Background.doc** for my reasoning) and I am now already to execute my thermodynamic research plan – see the plan document (**Researches.doc**). My aim is to establish a comprehensive Solar Thermodynamics, starting from the thermodynamics of the solar corona heating and thermodynamics of solar PV plant in the near terms (2009-2011). The goal of this research and study is to explore possibility to explain relevant thermodynamics phenomenon involved in the entire solar process – from the sun events down to the solar energy use on the earth. Details see the attached document, or other backing information I will compile in the future.

In addition, I am also interested in the overall development of the thermodynamics science, for that purpose, I have compiled a literature index (in its primitive form) of that science – see **ThermoLiterature.doc**. Based on this I will further detail the scope and indepth of the studies of thermodynamics, in order to compile a comprehensive review of the thermodynamics science in the medium term.

My secondary research subject is cryptography, out of my need to combat the government censoring and filtering of Internet.

My another interest is my long-time hobby for foreign languages, apart from English – almost my working language, German, and French (reading capacity), I am also competent to some degree in Russian, and some knowledge in Latin, Greek and Hebrew. I will continue to improve these languages and in the near future, will add Spanish, Arabic and Japanese to my language menu. And then stop.

I still stay in China mainly because I want to take care of my parents at their old ages but now the situation of China and particularly my own situation is so bad that I can't do so any longer. It's becoming an unlivable country now, with the authoritative regime controlling the people and media stricter and stricter. The only option is to quit that damned place. More information about the reasons why I want to leave China refer to **Reason.doc** provided at the link.

Now, I would like also to remind you that although I am at my mid-40, I am still young – look young, think young, study, work and live like a young student 20 years ago. I have not changed my life style ever since I left the universities, unlike other mid-aged.

I hope my research program will invoke your interests.

Sincerely yours

Chen Minghua
Hangzhou
China
Tel: 0571-8169-1576
Websites: http://groups.google.com/group/helioslab (main entry),
Others: http://www.helioslab.org/, http://helioslab.org/, http://helioslab.byethost22.com, http://helioslab.gofreeserve.com/

January 27, 2013
Attachments:
The attachments are to be found at the following link https://sites.google.com/site/helioslab/yesterday, which includes the following documents:
1) Background information – **Background.doc**,
2) Thermodynamics research plan draft - **Researches.doc**,
3) Thermodynamics literature - **ThermoLiterature.doc**,
4) Resume, **Resume.doc**

5) Reason for leaving China, **Reason.doc**
6) Past Competence - **Past_Private.doc**
7) Past Researches and Studies - **Past_Studies.doc**
8) Past Business - **Past_Business.doc**

为热力学研究与著述工作寻求帮助与合适岗位（陈明华，杭州）

尊敬的 XXX 好！

请允许我打扰您，写此信为热力学研究与著述工作寻求帮助与合适的岗位。

我叫陈明华，是 1989 年同济大学工程热物理硕士研究生，研究方向是煤燃烧的SO2 污染控制。 从 89 年毕业后，我一直在工业界， 在一些西方 （主要是德国）公司工作， 在国内， 主要是广东， 北京和上海。 那些公司包括德国西门子Siemens，德国巴高克Deutsche Babcock， 法国阿尔斯通Alstom，德国莱茵技术TUV Rheinland 等，也有国内单位，包括广东电力设计院，大亚湾核电站，长城工业公司等。

2000 年起，我一直在 IT，太阳能，电力技术，公务和私人航空及其他行业提供独立咨询，客户是国际电力，太阳能，航空等的一些著名企业机构。

现在，经过多年的摸索和尝试，我决定将我的业务以及研究方向都转回到我的老本行-热物理。我决定选择其中的热力学作为今后的研究和业务方向,包括对热力学学科体系的全面总结和回顾，撰写几部专著，包括太阳热力学，以及燃烧热力学，可能还有更多，就某些专题进行研究。有关计划的细节见附件– 热力学计划 ThermoPlan.doc。

目前，我初步将热力学的分支学科了解的结果汇集成文。除了工程热力学，化学与化工热力学，材料热力学，气动热力学，热力学与统计物理，统计热力学，非平衡态热力学，不可逆热力学和其他少数以外，极大多数还没有专著（也包括相应类别的热力学）。但总的来讲，热力学已经渗透到各个学科和行业，而不再局限在工程和技术领域。热力学向不可逆非平衡，向宏观和微观领域，向社会和经济领域，向人类一切活动范围扩展，从抽象，又向具体扩展。 有关热力学分支学科及相应的出版物的情况见文件ThermoLiterature.doc.

为了实现我的计划，我需要依托一个实力雄厚的单位与研究机构，而不能独自进行。 所以我考虑在贵处工作的可能性。 我的学术生涯等于零，因为我毕业后一直在工业界，没有在学术界。但并不表明我缺少研究与学术能力，恰恰相反，我更合适做学问，而不是政治，商业或其他。 而且我也只对学问感兴趣。我的撰写能力是毫无疑问的：过去五年，我写了超过 12000 （一万）页的英文报告，其中约一半提交给我的客户，是我独立撰写的。随信附上了几个报告样本。

我想，能在您的指导下去实施上述研究与著述计划，将给我带来莫大帮助。当然，无论是何种工作都可以-实验室技术人员，一般的帮手等，主要是能利用贵处条件查阅资料，也许还要进行少量的实验等。我对头衔，地位没有兴趣，金钱差不多就行。我是一个传统意义上的知识分子（如果配得上的话）。为让您了解我过去的情况，特寄上简历Resume_EN.doc 供参考。

我提供的文件多半是英文的，因为我过去差不多都在跨国公司工作，我期望的工作单位一般也都是是西方大公司，平时一般阅读和撰写的多半是英文资料和报告。

如能得到回复，将不胜感激！

谢谢您的帮助。

顺颂

大安！

陈明华　草上
电子邮件： thermodynamicstoday@gmail.com
电话：　（需预约）0571-8169-1576

2008-12-04
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5) 中国太阳能报告 CPSolar0504.pdf
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动热力学，热力学与统计物理，统计热力学，非平衡态热力学，不可逆热力学和其他少数以外，极大多数还没有专著（也包括相应类别的热力学）。但总的来讲，热力学已经渗透到各个学科和行业，而不再局限在工程和技术领域。热力学向不可逆非平衡，向宏观和微观领域，向社会和经济领域，向人类一切活动范围扩展，从抽象，又向具体扩展。 有关热力学分支学科及相应的出版物的情况见文件ThermoLiterature.doc.

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6) 世界太阳能技术报告 SolarTech_0806.pdf

28. Thermal physics (1986-1989)

Thermophysics with special topic of air pollution control in coal combustion when doing my graduate studies.

29. Solar physics (2007-2008)

Solar physics with special interests in solar model, corona heating and solar wind

30. Solar Radiation (2007-2008)

Solar radiation and its measurement technologies

My current focus is study of solar radiation, particularly the theory and mechanism of absorption, reflection and transmission of sun radiation through the earth atmosphere and the terrestrial measurement of solar radiation. Other areas of studies include sun radiation and human health, particularly the relationship of sun exposure to skin cancer and its prevention.

The focus is study of solar radiation, particularly the theory and mechanism of absorption, reflection and transmission of sun radiation through the earth atmosphere and the terrestrial measurement of solar radiation. Other areas of studies include solar terrestrial radiation measurement technology, solar physics (with key researches of solar thermophysics and solar thermodynamics).

My goal is to explore and create the above two new fields of solar sciences - solar thermophysics and solar thermodynamics. Currently there are no dedicated publications. Following topics may be covered in my studies and writing:

Part I: Sun Radiation It is a report and book about the sun radiation with the following chapters: Basic theory, Sunlight direct use and storage, Software, databases, and online business, R&D, Scientists, Products, Organizations, Academic events, Publications, Special focus will be put on space solar photovoltaic theory and technology.

Part II: Solar Physics: Research about the solar physics, incl. basic theory and technologies and tools used for understanding the physical phenomenon of the Sun and the space and atmospheric thermal physics owing to the sun radiation.

Part III: Atmospheric Thermal Physics: thermal physics related to the atmosphere for the understanding of sun radiation

Part IV: Thermal Physics in Solar Photovoltaics: thermal physics in the process of research, development, manufacturing and operation of solar silicons, wafers, cells, modules and systems.

Part V: Sun to Human Life: everything the Sun is related to human society, such as healthcare, science, technology, literature, religion, politics, wars, art, commerce and business, a very extensive topic

For this purpose I have been collecting information pertaining to all areas of the solar sciences and to the Sun. I have a rough timetable for the plan.

Fundamental researches and studies of solar radiation, with particular emphasis on solar physics and thermal physics and thermodynamics in the solar radiation process and measurement;
Customized researches;

Sun Radiation is a report and book about the sun radiation with the following chapters: Basic theory, Sunlight direct use and storage, Software, databases, and online business, R&D, Scientists, Products, Organizations, Academic events, Publications, Special focus will be put on space solar photovoltaic theory and technology. Fundamental theory and practical technologies are described, with an integration of solar radiation mechanism on solid, liquid and gaseous objects.

31. Solar Aviation and Aerospace (2006)

I used to have a plan to write the Solar Aviation and Aerospace (**SAA**) book series that are comprised of the following parts:

Part I: Solar Aircrafts: about solar aircrafts using solar photovoltaic electricity as power to drive the propellers through electric motors in fixed and winged airplanes.

Part II: Solar Airships: about solar airships, aerostats, balloons, blimps etc using solar photovoltaic electricity as power to drive the propellers through electric motors without fixed wings mostly for geostationary purposes.

Part III: Light Ion Propulsion: spacecrafts propelled by ion gases generated by electricity from solar or stellar light photovoltaics.

Part IV: Light Sails: space sailing crafts using the following sources of power: 1) solar or stellar light wind 2) solar or stellar light photonic pressure 3) solar or stellar light magnetic pressure and 4) concentrated beams using solar or stellar light power and others.

Part V: Space Photovoltaics: theory and practices of space photovoltaics and technologies and products.

Other authoring includes:
Space solar cells
Space/cosmic solar power

The plan is temporarily suspended due to financial uncertainty.

32. Solar photovoltaics (2001-2006)

Intensive studies were made during this period for the solar PV theory and technology.

33. German Literature Studies (2007)

There was time when I wanted to devote to German language and literature studies and researches, but I gave the plan up after failure to find a research institute to support my plan, such as Goethe Institute.

34. Other Languages

Studies of Greek, Latin and Hebrew were initiated but somehow stopped. I once have a plan to learn 100 languages thus to become one of those in the world with most language proficiency.