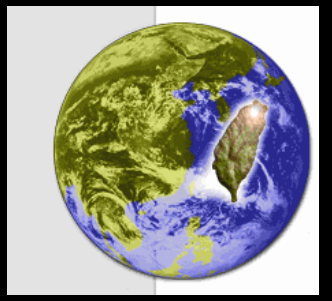
15:10 ~ 16:50	**Oral Session III | VIP ROOM, F5 (Nov. 1., Sunday) 口头报告III | 五层首见厅** **Chair: Prof. Tai-Shan Fang,** **Department of Chemistry, National Taiwan Normal University, Taiwan** **口头报告III（主持：唐敏博士)**
1.	**Tai-Shan Fang, Department of Chemistry, National Taiwan Normal University, Taiwan** **Taiwan's Cultivation on the Creativity via Accuracy Science Education and on the Innovation through Precise Culture Reflection** **题目：台湾通过精准科学教育的创造力培育与经由反思艺术文化的创新养成之探讨**
2.	Elisabeth Hotze, Teacher, school administration, lectureship at university Duisburg- Essen, Germany Title: Training student-coachers and coaching scholars – synergies by cooperation of high schools and universities 题目：培养学生指导员和培养学者—高中和大学的合作
3.	Elisabeth Hotze, Teacher, school administration, lectureship at university Duisburg- Essen, Germany Title: Underachievement – options and limits of counteraction within a regular school system 题目：未能发挥学习潜能 — 常规学校体系中的机会和限制
4.	Dechang Li, School of Energy and Power Engineering, Xi'an Jiaotong University, China Title: the innovation mechanism and talent quality in the view of potential science – The dynamics mechanism of innovation education 题目：势科学视域中的创新机制与人才素质——创新教育的动力学机制
5.	Shaoan Xie, Wuhan University of Science and Engineering, China Title: Research on Teaching Design to train innovative thinking ability for Students 题目：培养学生创新思维的3I教学设计研究

科技發展與人文反思的創新教育相對論

-台灣通過精準科學教育的*創造力*培育與
經由反思藝術文化的*創新*養成之探討-



(Taiwan's Cultivation on the Creativity via Accuracy Science Education and on the Innovation through Precise Culture Reflection)

(Nov. 1., Sunday, 15:10 ~15:25 , Oral Session III | VIP ROOM, F5)

Tai-Shan Fang, Ph.D.

Professor, Department of Chemistry
Principal Investigator of Taiwan's Participation of IChOs
National Taiwan Normal University

摘要

在冷戰結束20世紀90年代國際間廣泛的討論創造力和創新的需求。台灣已妥善同時與國際社會共同努力，改革科學和技術教育，力求改進國家的創造力和創新教育，在國際間崢嶸頭角。本論文從自然能源（0, 守恒）和熵（1, 自發）的角度評論這些努力，描繪了台灣在因應全球創新快速變化的背景下，通過精準科學教育的創造力培育與經由反思藝術文化的創新養成，正在台灣發生。本文試圖強調並澄清在台灣特有的高教育素質的人力資產，問題和面臨的創造和機遇創新的改革。需要特別注意納入:台灣豐沛的人力資源、當地的技術和其工具、民主與自由的民國成立以來西學中用混合的文化貢獻、自然世界的邏輯觀念和技術，在職業、終身教育和傳統文化的實力也是需要加以簡要探討。 文中還簡要地討論了一些問題，可能需要文化與社會反思，如在學校的考試和社會競爭。

Abstract

The end of cold war in 1990s has been characterized by widespread discussions about the need for the creativity and the innovation. Concurrent with international efforts to reform science and technology education, Taiwan has properly embarked on its own efforts to change the nature of creativity and innovation education. This paper comments on these efforts from the precise and accuracy perspectives of nature of the energy (zero change, conservation) and entropy (one lively exist, motivation). It portrays science and technology education reform in Taiwan in the context of global changes that are occurring throughout much of the world and in the context of institutional changes occurring within Taiwan. The article attempts to elucidate unique assets, problems, and opportunities facing creativity and innovation reform in Taiwan. The need to incorporate special attention to Taiwan's rich man-power resources, local technologies and technology tools, Chinese-Western mixed culture contributions to technology and to perceptions of the natural world, strength in vocational along with life-long career education, and cultural traditions' reflection is briefly examined. The paper also briefly discusses some concerns that may need to be evaluated such as the role of examination and competition in schools and the society.

Epitome (Introduction)

- Chinese(Eastern) Culture is an Art
  中華(東方)文化是 “昇華到藝術”？
  Western Culture is a State of Art
  (西方)文化是 “由科學到藝術”！

- The Academy of Energy （0, 守恒） and Entropy （1, 自發）能源和熵的學術

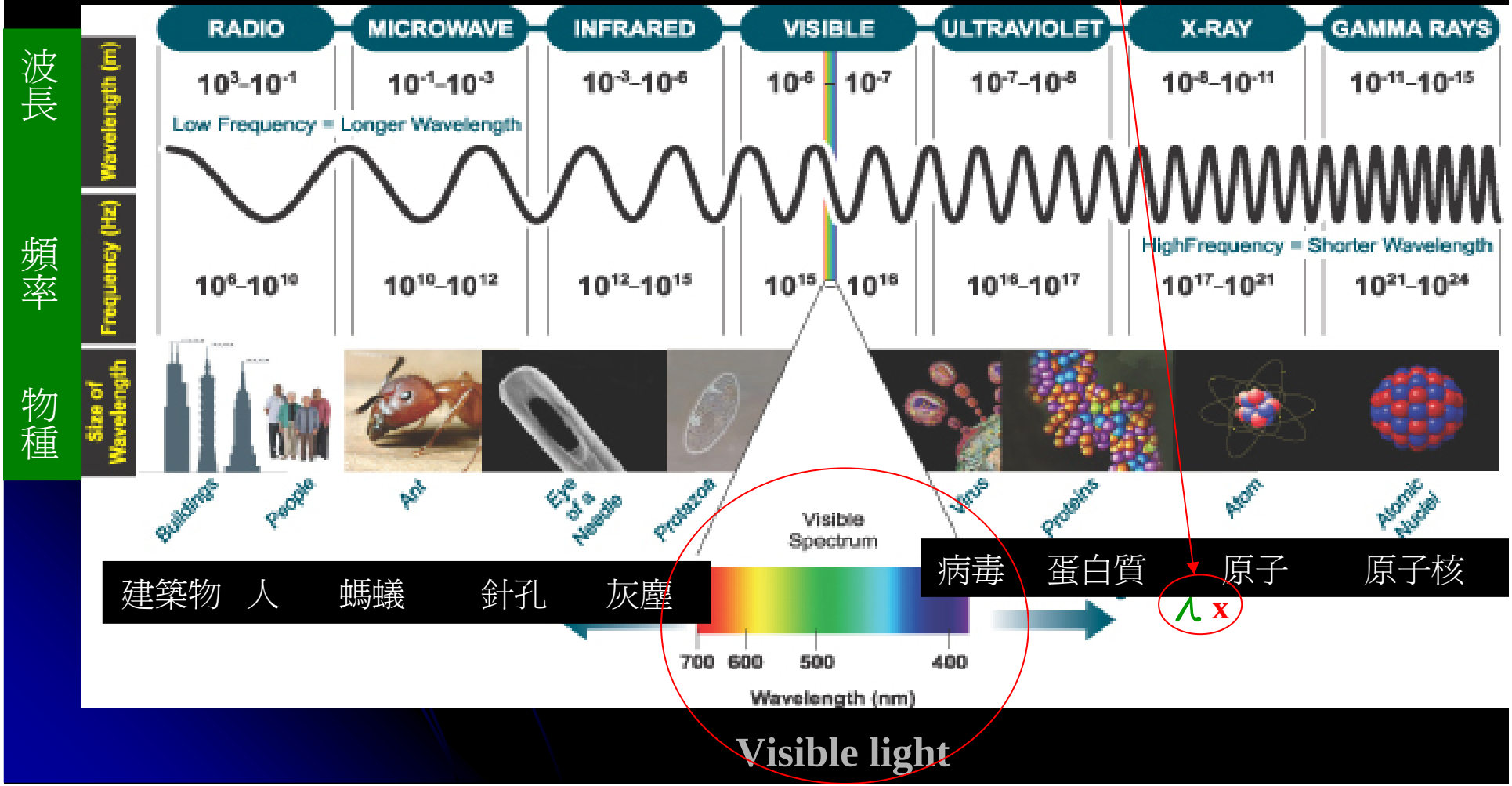
Interconversion of Energy and Entropy

由0到1 的相對論

複雜系統簡單化:n相位焦踞單1相位（mass phase ⟶ x相位）

能量Zero【 $E = kT = mC^2 = h\nu = hCx/\lambda x$ (nm)≒ S 】空間One

$k = 13.8 \times 10^{-24}$ j/K　$h = 6.626 \times 10^{-34}$ j.s. ; s/K = 2.0827 x (10 ^{10})



Visible light

How big the “Entropies”?

[Powers of 10]

25	14	3	-8
24	13	2	-9
23	12	1	-10
22	11	0	-11
21	10	-1	-12
20	9	-2	-13
19	8	-3	-14
18	7	-4	-15
17	6	-5	-16
16	5	-6	-17
15	4	-7	-18

http://powersof10.com/

International Symposium

Nano-Science of Advanced Metal Complexes

March 22-24, 2003
Okazaki Conference Center
Institute for Molecular Science

		SI system
10^{68}	無量大数	
10^{64}	不可思議	
10^{60}	那由他	
10^{56}	阿僧祇	
10^{52}	恒河沙	
10^{48}	極	
10^{44}	載	
10^{40}	正	
10^{36}	澗	
10^{32}	溝	
10^{28}	穣	
10^{24}	杼	
10^{20}	垓	
10^{18}		exa(E)
10^{16}	京	
10^{15}		peta(P)
10^{12}	兆	tera(T)
10^{9}		giga(G)
10^{8}	億	
10^{6}		mega(M)
10^{4}	万	
10^{3}	千	kilo(k)
10^{2}	百	hecto (h)
10^{1}	十	deka(da)
10^{0}	壷	

Entropies

		SI system
10^{-1}	分	deci(d)
10^{-2}	厘	centi(c)
10^{-3}	毛	milli(m)
10^{-4}	糸	
10^{-5}	忽	
10^{-6}	微	micro(u)
10^{-7}	繊	
10^{-8}	沙	
10^{-9}	塵	nano(n)
10^{-10}	埃	
10^{-11}	渺	
10^{-12}	漠	pico(p)
10^{-13}	模糊	
10^{-14}	逡巡	
10^{-15}	須臾	femto(f)
10^{-16}	瞬息	
10^{-17}	弾指	
10^{-18}	刹那	atto(a)
10^{-19}	六徳	
10^{-20}	虚空	
10^{-21}	清浄	
⋮		
0	零	

Energy

新地平線號升空 10年才能抵達冥王星(Pluto)探測

(Plutonium-238 Shortage Could Stall Space Exploration)

- 美國航空暨太空總署2006年1月19日終於在卡納維爾角把探測冥王星的太空船「新地平線號」（New Horizons）19日下午從佛羅里達州卡納維爾角成功發射。推動「新地平線號」探測太空船的「擎天神五號」（Atlas V-551）火箭

- 「新地平線號」以時速5萬8000公里運行，需要10年才能抵達冥王星，**預估是在2015年7月到2017年7月間，再花大約4小時25分鐘經無線電傳輸資料回地球**。這艘探測船在升空42分鐘後與火箭分離。它在升空九小時後經過月球，而當年「阿波羅號」太空人卻花了三天。

New Horizons lifts off Thursday(Jan.19,2006) afternoon atop an Atlas V rocket bound for Pluto.

New Horizons will reach a speed of about 47,000 mph (75,600 kph), more than 10 times faster than a speeding bullet. According to The Physics Factbook, a bullet from a large-caliber rifle travels at about 1,500 meters or 5,000 (1,500 meters) feet per second -- about 3,400 mph (5,400 kph).

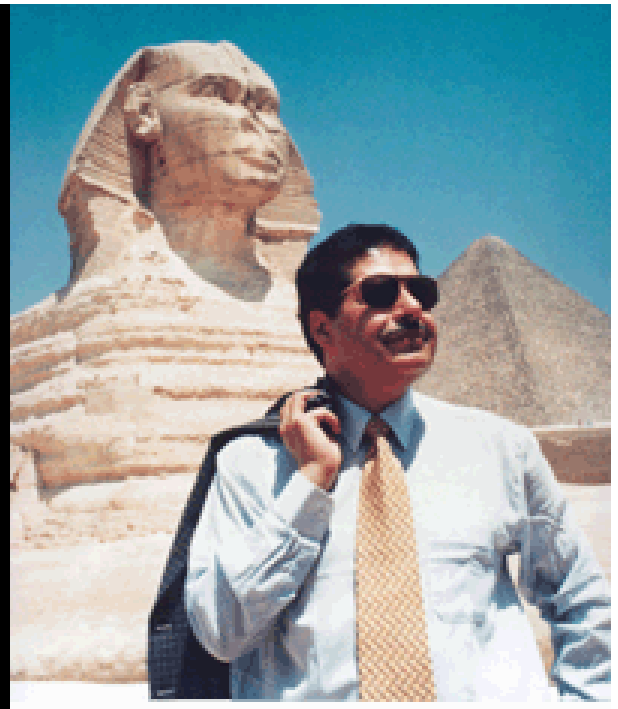
The Nobel Prize in Chemistry 1999

Ahmed H. Zewail, Egypt and USA,
California Institute of Technology
Pasadena, CA, USA

因研究極速"飛秒"(10^{-15} S)獲1999年諾貝爾獎

" for his studies of the transition states of chemical reactions using femtosecond spectroscopy"

The "shutter speed" of such a camera must be extremely high since molecules are very small (about 10^{-9}m) and move extremely rapidly (1 000 m/s).

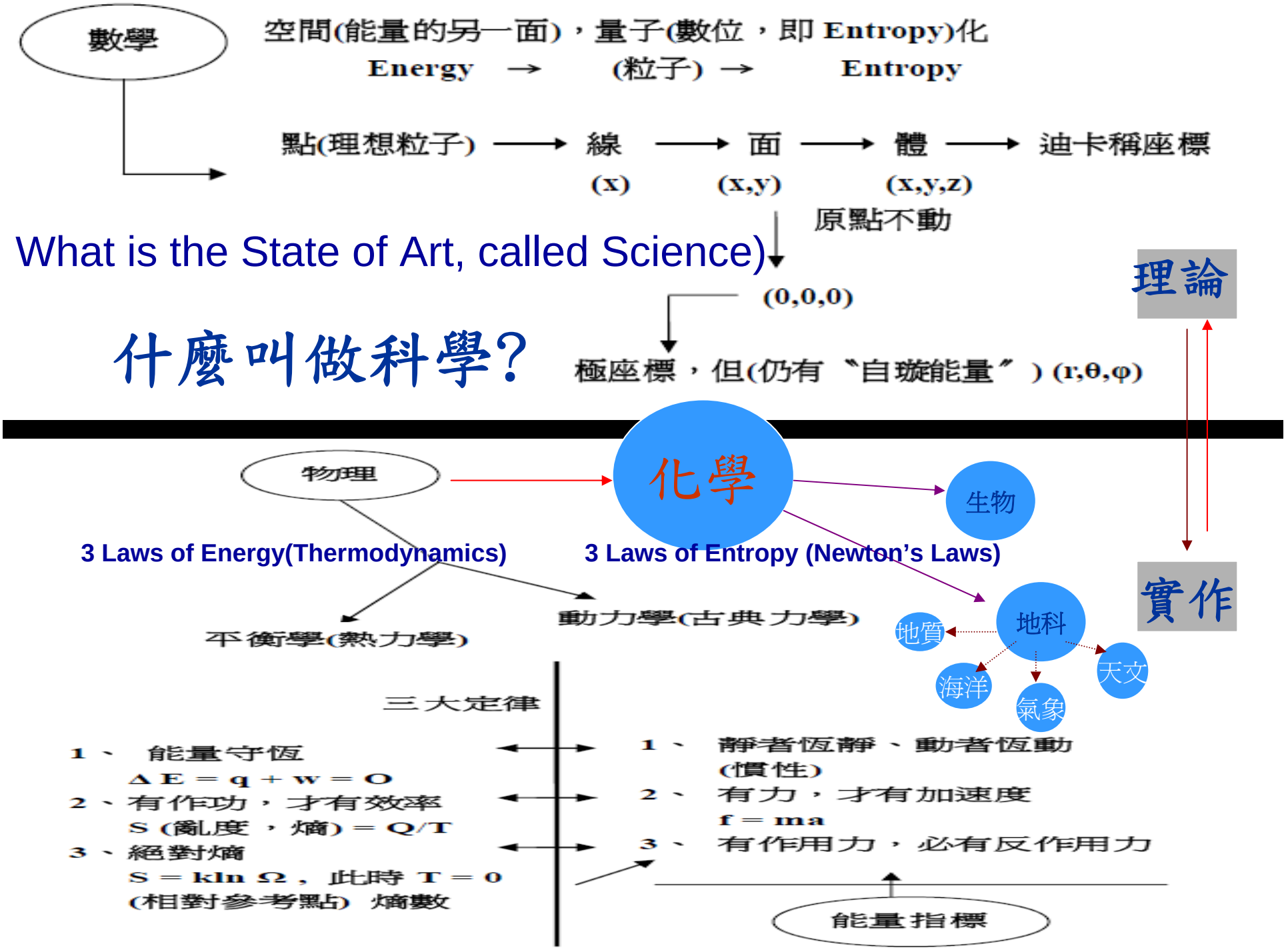


Zewail – King of Femtoland

Ahmed H. Zewail was born near Alexandria in Egypt. He has now been working for many years at Caltech, Pasadena, USA, where he directs a large Laser Femtochemistry laboratory, called Femtoland. He is also Director of the Laboratory for Molecular Sciences (LMS).

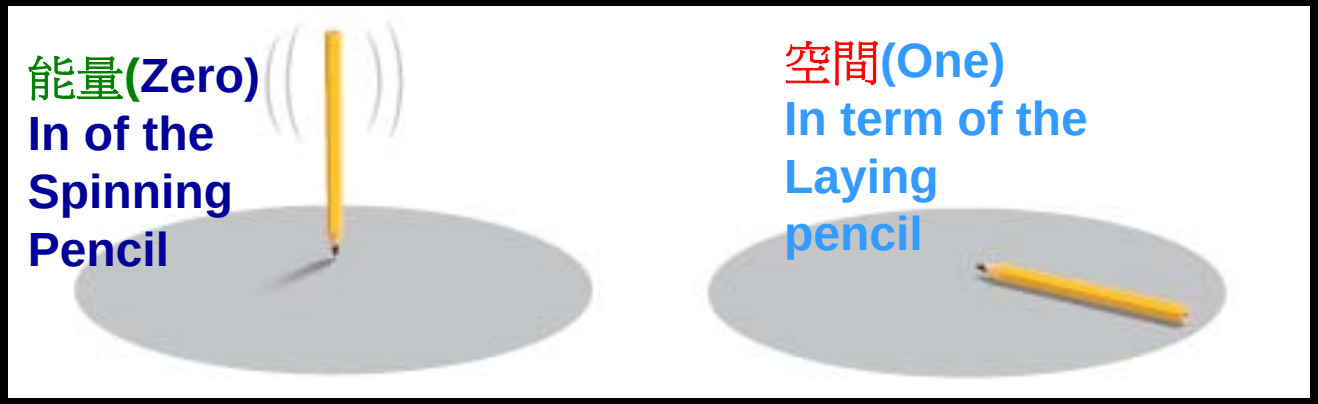
1 ms	1 millisecond	$= 0.001\ s = 10^{-3}\ s$
1 µs	1 microsecond	$= 0.000\ 001 s = 10^{-6}\ s$
1 ns	1 nanosecond	$= 0.000\ 000\ 001\ s = 10^{-9}\ s$
1 ps	1 picosecond	$= 0.000\ 000\ 000\ 001\ s = 10^{-12}\ s$
1 fs	1 femtosecond	$= 0.000\ 000\ 000\ 000\ 001\ s = 10^{-15}\ s$

In one second light travels from the earth to the moon, while in one femtosecond it travels a fraction of a human hair's-breadth.


數學
空間(能量的另一面)，量子(數位，即 Entropy)化
Energy → (粒子) → Entropy
點(理想粒子) → 線 → 面 → 體 → 迪卡稱座標
(x) (x,y) (x,y,z)
原點不動
(0,0,0)
What is the State of Art, called Science)
什麼叫做科學?
極座標，但(仍有〝自璇能量〞) (r,θ,φ)
理論
實作
物理
化學
生物
3 Laws of Energy(Thermodynamics)
3 Laws of Entropy (Newton's Laws)
平衡學(熱力學)
動力學(古典力學)
地科
地質
海洋
氣象
天文
三大定律
1、 能量守恆
ΔE = q + w = O
2、有作功，才有效率
S (亂度，熵) = Q/T
3、絕對熵
S = kln Ω，此時 T = 0
(相對參考點) 熵數
1、 靜者恆靜、動者恆動
(慣性)
2、 有力，才有加速度
f = ma
3、 有作用力，必有反作用力
能量指標

零= 0
(Energy)

壹= 1
(Etropy)



Spontaneous broken symmetry. *The world of this pencil is completely symmetrical. All directions are exactly equal. But this symmetry is lost when the pencil falls over. Now only one direction holds. The symmetry that existed before is hidden behind the fallen pencil.*

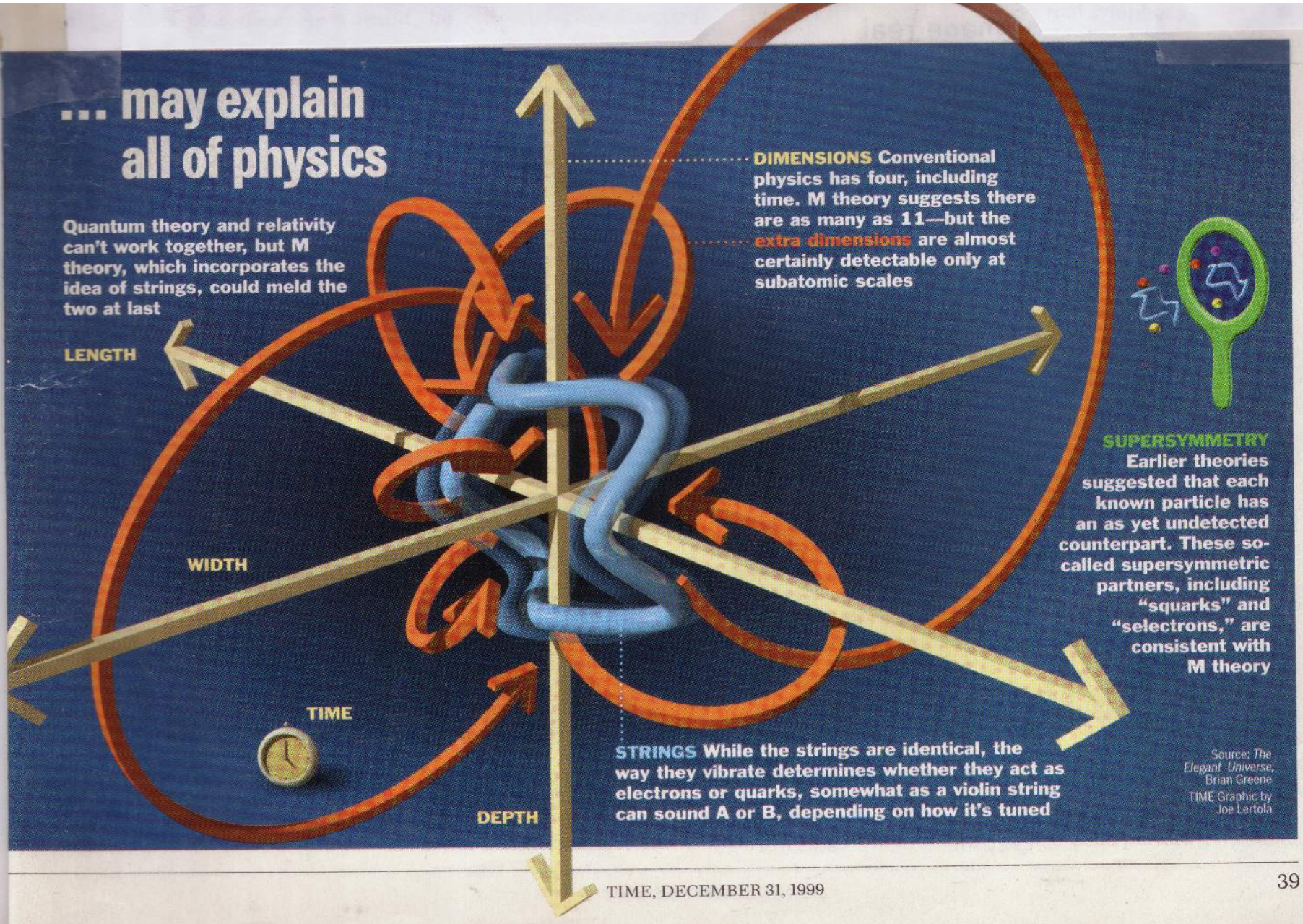
生活中的自發破缺對稱

以筆尖立於桌面的鉛筆，若呈現完美對稱，其來自所有方向的能量應都相等。但鉛筆終究會倒下，此時對稱就被破壞。換句話說，鉛筆倒下後達到較穩定的狀態。

Nature and Science Technology Society

... may explain all of physics

Quantum theory and relativity can't work together, but M theory, which incorporates the idea of strings, could meld the two at last



DIMENSIONS Conventional physics has four, including time. M theory suggests there are as many as 11—but the extra dimensions are almost certainly detectable only at subatomic scales

SUPERSYMMETRY Earlier theories suggested that each known particle has an as yet undetected counterpart. These so-called supersymmetric partners, including "squarks" and "selectrons," are consistent with M theory

STRINGS While the strings are identical, the way they vibrate determines whether they act as electrons or quarks, somewhat as a violin string can sound A or B, depending on how it's tuned

Source: *The Elegant Universe*, Brian Greene

TIME Graphic by Joe Lertola

經由數理的創造力教育：自然與人文社會的對話

The Creative Education through Math and Science Education

加成性(Extensive and Linear Dimension)

甲 A〔 +/ - 〕B 乙;

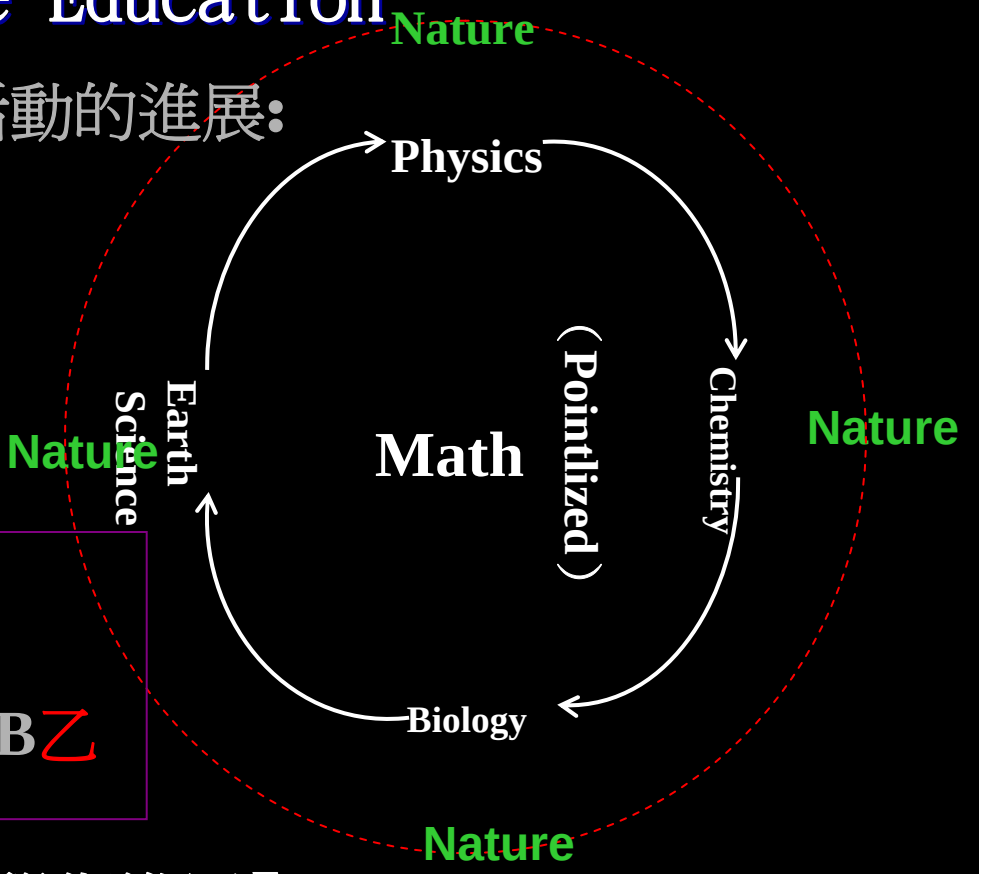
相對性 (Relativity and Non-Linear Dimension)

甲A 〔x / ÷〕B乙

邏輯(Log) 〔甲A(x / ÷)B乙〕=

邏輯(Log)甲A〔 +/ - 〕邏輯(Log)B乙

人類科學活動的進展:



【基礎教育與學術進展】

三度空間(實體,火商)→第四度空間(時間,焓)→第五度空間哲學,(博士,Ph.D.)

→*第六感(文藝創作數學)資優* (→宗教,昇華)

英國(劍橋800年)→美國(哈佛400年)→日本(東京150年)→台灣(台大80年)

*賀!!*台大擠進世界百大！生醫大躍進

Map of the *Dialogue Between Nature and Creativity*

Nature Dynamics (particulated):

(humans)	(thermos)	(electrons)	(photons)
Human-dynamics	Thermodynamics	Electro-dynamic	Photo-dynamics
$Q = 10^n$ (Brains?)	10^{30}(Boltzmans)	10^2(Fermions)	10^{∞}(Bosons)

Human Dynamics (social science):

GATT WTO (WTA) APEC Environmental Changes and Pollutions
Internet and Impact : Knowledge , Creative , Vision and Economics

Reversibility of Nature and Human (Dynamics Equilibrium):

Money Units (Money Market, Stocks) Electronis (e-business,material and biological science)

Social science (Economics) Nature Science

Integrated Science (Science, Engineering and Technology to the Art)

ΔG (Freedom) = ΔH (Enthusiastic)- T (localized constant) ΔS(Democratic) = 0

賀! 最新公布的英國金融時報2009年全球高階商管碩士班(EMBA) ，台灣大學排名40、中山大學排名48 !!

Efficiency of work = (work done)/ (locolized constant)

certainty = *k* (constant)* Ln (occasions)

台教育部：五年(2006-)
五百億繼續推動(2011-)

Weigh Up the Debate on the Current 10 Scientific Issues toward creative solution

1. **science and spirituality**
2. **water resources**
3. **nuclear energy**
4. **stem cell research**
5. **GM foods**
6. **mental health**
7. **greenhouse gas emissions**
8. **toxic waste remediation**
9. **gene patenting**
10. **emerging diseases**

Performance in Space實(際)驗測量的【精】與【準】

Precision and Accuracy
Errors in Scientific Measurements

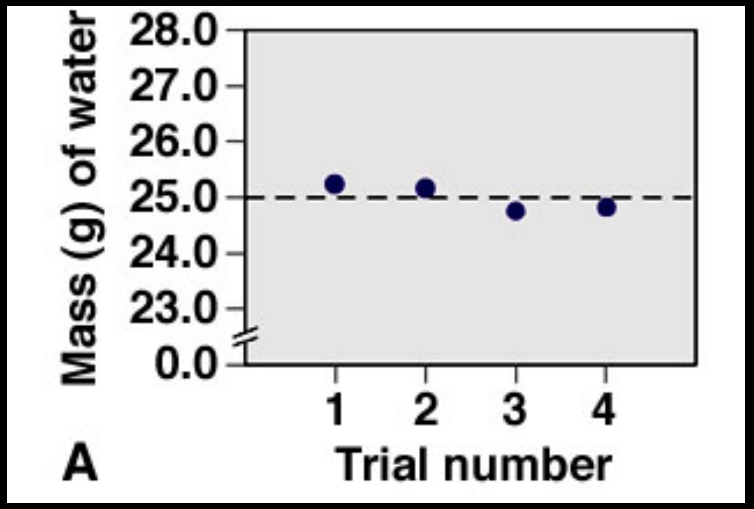
Precision - 精
Refers to *reproducibility* or how close the measurements are to each other.

Accuracy - 準
Refers to how close a measurement is to the real value.

Systematic error – 系統誤差
Values that are either all higher or all lower than the actual value.

Random Error – 隨機誤差
In the absence of systematic error, some values that are higher and some that are lower than the actual value.

Precision and accuracy in the laboratory and/or field study.

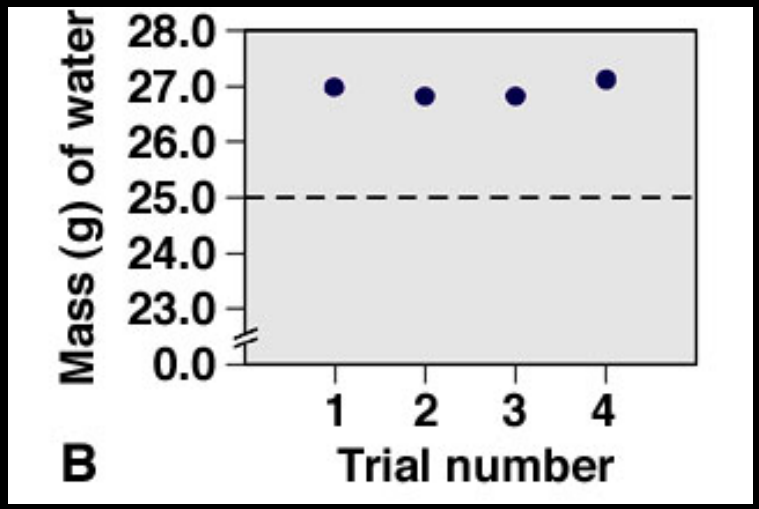


precise and accurate

【精】且【準】

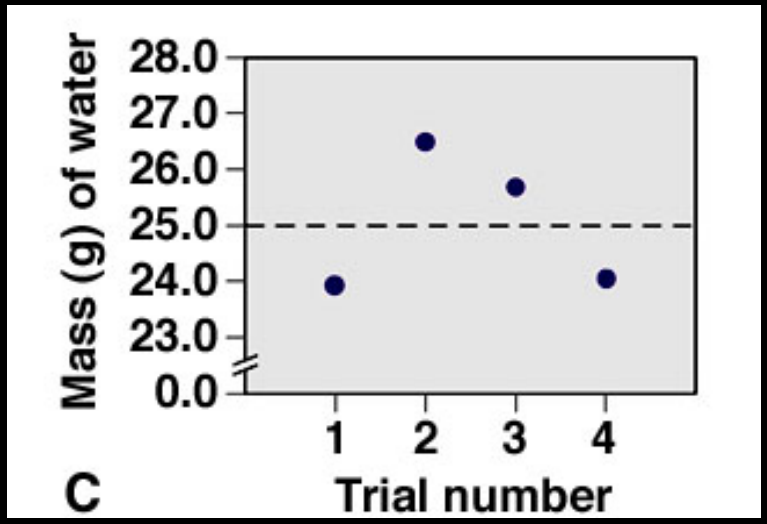
precise but not accurate

【精】但不【準】



Precision and accuracy in the laboratory.

continued

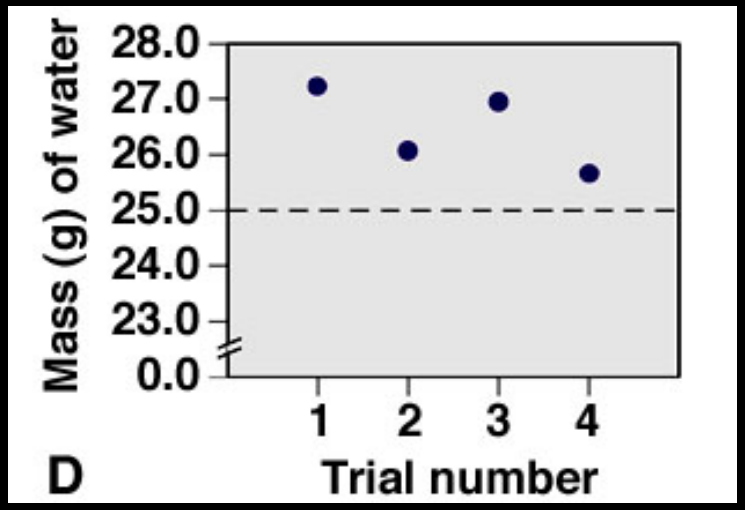


random error

隨機誤差

systematic error

系統誤差



Progress of the Human-Dynamics

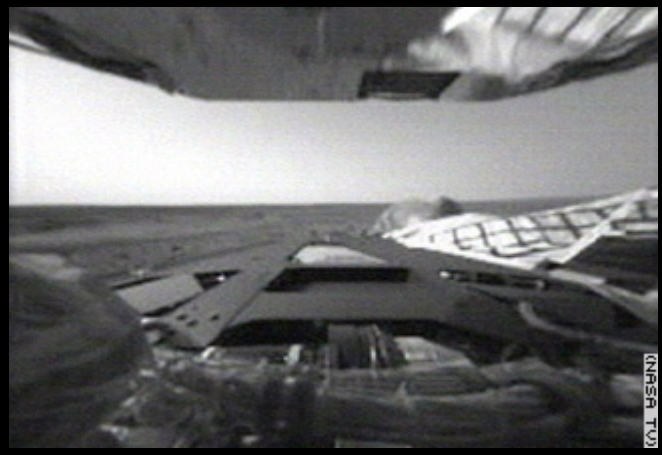
Macroscopic

NASA The robotic explorer Spirit rover wakes up on Mars

23:35 Jan.3,2004 (East Coast Time USA) < 30% probability

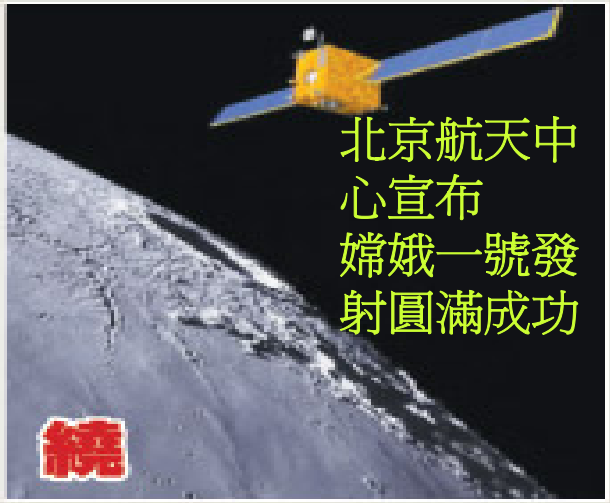
(NASA and ESA Unveil Joint Mars Exploration Plan)

- This image taken by the hazard avoidance camera on the Mars Exploration Rover Spirit shows the rover's rear lander petal and, in the background, the Martian horizon. Spirit took the picture immediately after successfully landing on Mars.

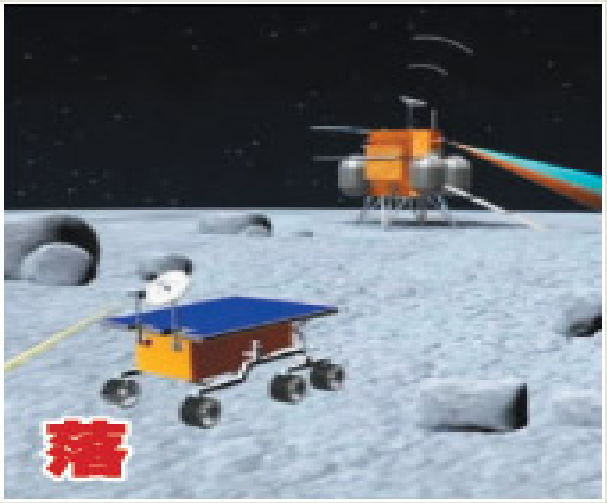


- The $400 million rover Spirit, designed to conduct unprecedented geologic and photographic surveys on the Martian surface, transmitted a simple hello to Earth within minutes after landing, which took place just after 11:30 p.m. ET.

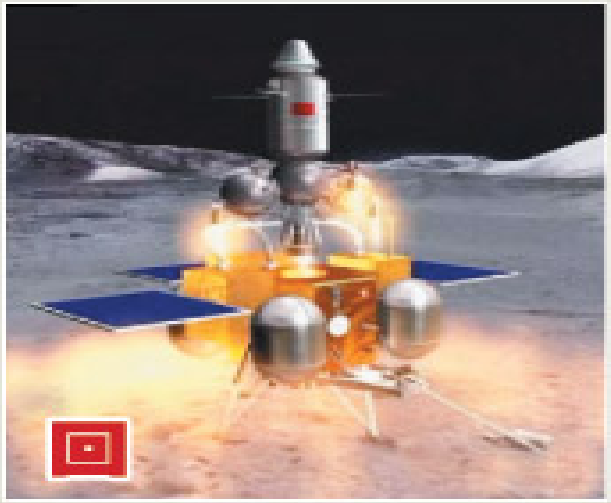
探月工程三階段



一期 研發和發射月球探測衛星，實施繞月探測



二期 進行首次月球軟著陸和自動巡視勘測



三期 進行首次月球樣品自動採樣返回

資料來源／新華社

China astronauts return to Earth triumphant
中國神舟七號載人太空飛行任務圓滿成功

新華社報導，中國北京航天飛行控制中心今晚宣布，「嫦娥一號」衛星準確入軌，這次發射圓滿成功。「嫦娥一號」爲中國首枚探月衛星，於24日晚上六時零五分零四秒在西昌衛星發射中心由長征三號甲火箭發射升空，展開對月球一年的科學探測任務。 中國是繼美國、俄羅斯及日本之後，第四個對月球展開全面探索的國家。

台灣2010將自力發射衛星

Taiwan is looking forward to launching its own domestically developed satellites using locally made launch vehicles by 2010, the head of the National Science Council (NSC) said yesterday. Fielding questions at the legislature, NSC Chairman Chen Chien-jen (陳建仁) confirmed that the council had been striving to make progress in the research and development of satellite launch vehicles in the hope that Taiwan would be able to venture into space with its own satellites in less than three years.

2009年10月9日19時31分美國『*轟炸』月球*

Us “Bombarded” Moon Surface

NASA: Small amounts of water in lunar soil

An artist's rendering shows the LCROSS

(CNN) -- There wasn't a cloud in the sky early Friday when Dave Samuels trained his telescopes at the moon, hoping to catch a glimpse of a NASA rocket striking the lunar landscape.

經過近4個月的飛行，美國半人馬座火箭、月球坑觀測和傳感衛星9日相繼撞擊月球南極地區，以在月表之下尋找水冰存在的線索，但美國航天局預計的閃光現象並未如期出現。半人馬座火箭首先以每小時約9000公里的速度撞擊月球南極的凱布斯坑。半人馬座火箭是將月球坑觀測和傳感衛星送入太空的運載火箭的第二級。4分多鐘之後，月球坑觀測和傳感衛星也『如約』撞擊月球。

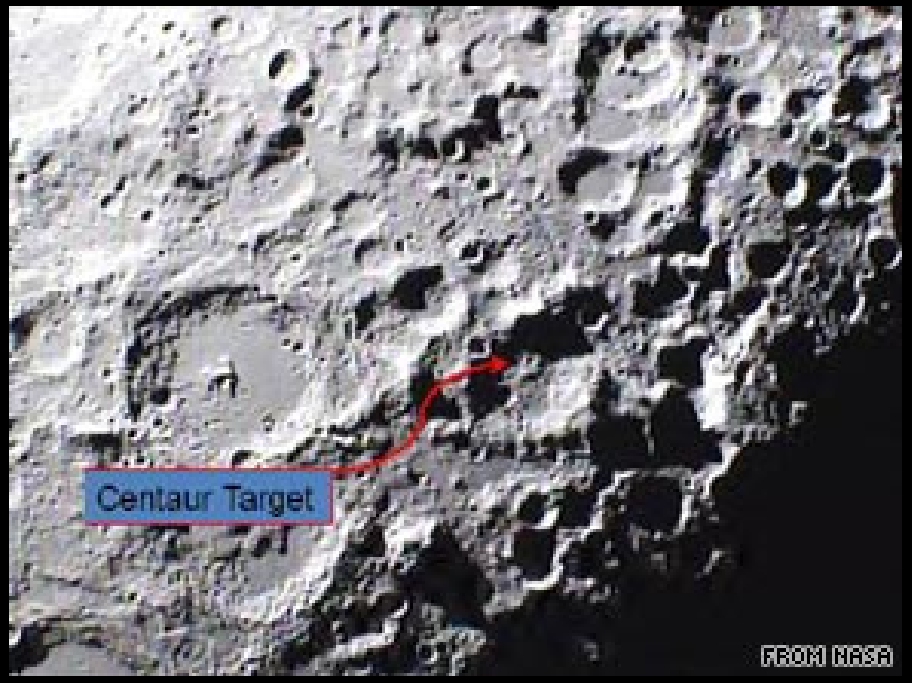
A NASA rendering of the LCROSS spacecraft entering a debris plume on its way to the moon.

The story (October 9, 2009 -- Updated 1502 GMT (2302 HKT)

NASA said Friday's rocket and satellite strike on the moon was a success, kicking up enough dust for scientists to determine whether or not there is water on the moon.

"We have the data we need to actually address the questions we set out to address," said Anthony Colaprete, principal investigator for the Lunar Crater Observation and Sensing Satellite, or LCROSS, mission.

It will be awhile before all the data from the satellite can be analyzed to determine if there is water on the moon, according to LCROSS project manager Dan Andrews.

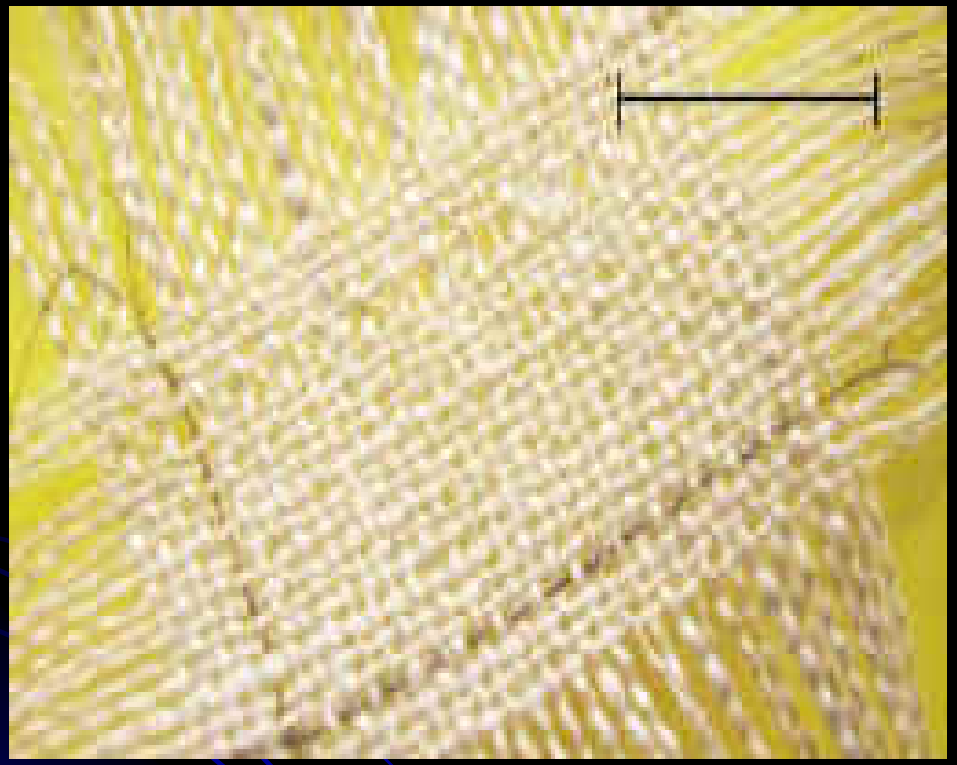


The moon, shown shortly before NASA's rockets hit on Friday morning.

Progress of the Human-Dynamics

Microscopic

Taiwan Brand Nano-fiber Technology



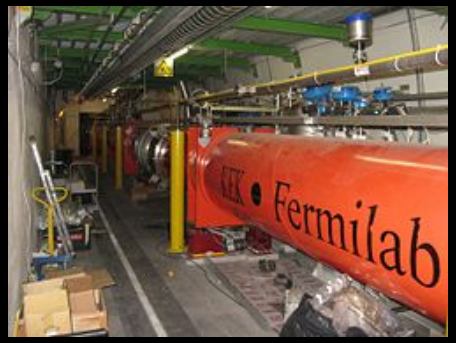
兩個奈米管纖維超級電容器編織成互相垂直方向的紡織品。（比例尺：1cm）

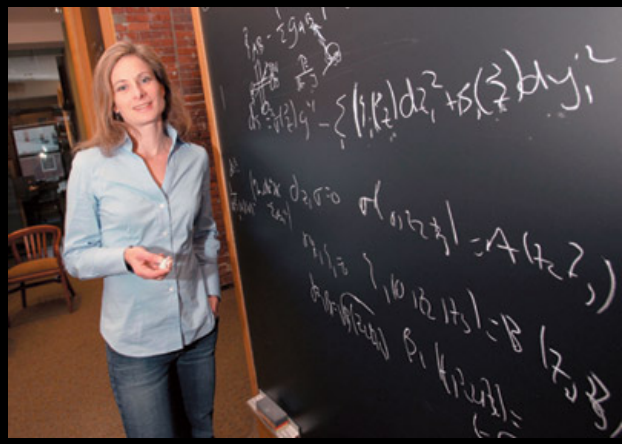
兩個奈米管合成纖維分別浸泡在電解質水性聚乙烯醇/磷酸（aqueous polyvinyl alcohol/phosphoric acid）（19％phosphoric acid、4％ polyvinylalcohol）中進行上膠，纏繞在一起後用電解質再上膠。纖維超級電容器（直徑100公釐）提供電容量(5 F g-1)和能量貯存密度(0.6 W h kg-1 at 1 V)，與大型商業超級電容器相當，經過1200次電荷釋放循環後仍維持原來表現。螺旋狀纏繞的奈米管纖維在電容器的末端是分離的，所以可以進行電力連結。

電(-)、洞(+) 與大強子(質子(+) 、質子(+)對撞機)的相對論故事---

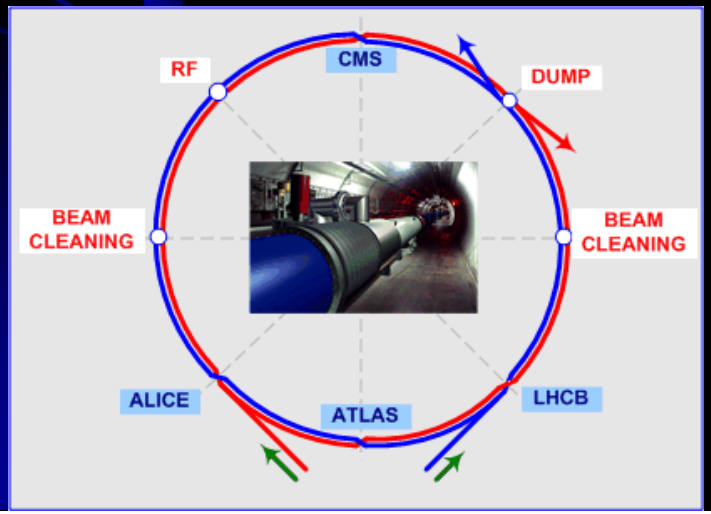
哈佛大學美女教授麗莎藍道:神秘！　神佛鬼魅就在第五空間？！

The Large Hadron Collider should tell us more about the underlying nature of matter and how elementary particles acquire mass.





Lisa Randall (born June 18, 1962) is an American theoretical physicist and was the first tenured woman in the Princeton University physics department and the first tenured female theoretical physicist at MIT and Harvard University. Her research concerns elementary particles and fundamental forces, and has involved the study of a wide variety of models, the most recent involving extra dimensions of space.



座落在日內瓦郊區的「大強子對撞機」（Large Hadron Collider，簡稱LHC），是科學家花了十四年，耗資八十億美元建造的。這部巨型粒子加速器訂2008年五月完工啓用，科學家希望利用它進行質子對撞實驗，製造出宇宙「大霹靂」（Big Bang）那一瞬間的狀況，從而解開宇宙誕生的奧秘，2008年9月10日啓動而這項實驗在啓動9天後宣告失敗，強子對撞器也即將在2009年10月重新啓動。

List of Nobel laureates by top sixteen countries

+ 2009: 11 USA, 1Germany, 1 Isarel 1 China (physics)

前 16 名 / 68 國家, 1901~ 2008 諾貝爾獎得獎人數統計表

(美) United States of America	305(醫 91	物 81	化 58	文 12	和 21	經 42	) (1)
(英)United Kingdom	114(醫 32	物 21	化 27	文 12	和 13	經 8	) (2)
(德) Germany	101(醫 23	物 31	化 30	文 9	和 6	經 2	) (3)
(法) France	56(醫 12	物 11	化 8	文 14	和 9	經 2)	(4)
(典)Sweden	28(醫 7	物 4	化 4	文 6	和 5	經 2	) (5)
(士)Switzerland	25(醫 9	物 5	化 6	文 2	和 3	經 0)	(6)
(俄) Russia	22(醫 2	物 10	化 2	文 5	和 2	經 1	) (7)
(意) Italy	20(醫 6	物 5	化 1	文 6	和 1	經 1)	(8)
(奧) Austria	19(醫 7	物 3	化 4	文 1	和 3	經 1	) (9)
(荷) The Netherlands	18(醫 3	物 9	化 3	文 0	和 1	經 2	) (10)
(加)Canada	17(醫 3	物 2	化 6	文 1	和 2	經 3	) (11)
(日) Japan	16(醫 1	物 7	化 5	文 2	和 1	經 0	) (12)
(丹)Denmark	13(醫 5	物 3	化 1	文 3	和 1	經 0	) (13)
(比) Belgium	11(醫 4	物 0	化 1	文 1	和 5	經 0	) (14)
(挪) Norway	11(醫 0	物 1	化 2	文 3	和 2	經 3	) (15)
(匈) Hungary	10(醫 2	物 3	化 3	文 1	和 0	經 1)	(16)
(台)(Taiwan)	3(醫 0	物 2	化 1	文 0	和 0	經 0)	( )
(韓)South Korea	1(醫 0	物 0	化 0	文 0	和 1	經 0)	( )
(中) China	5(醫 1	物 2	化 1	文 1	和 0	經 0)	( )

Creativity Progress in Taiwan

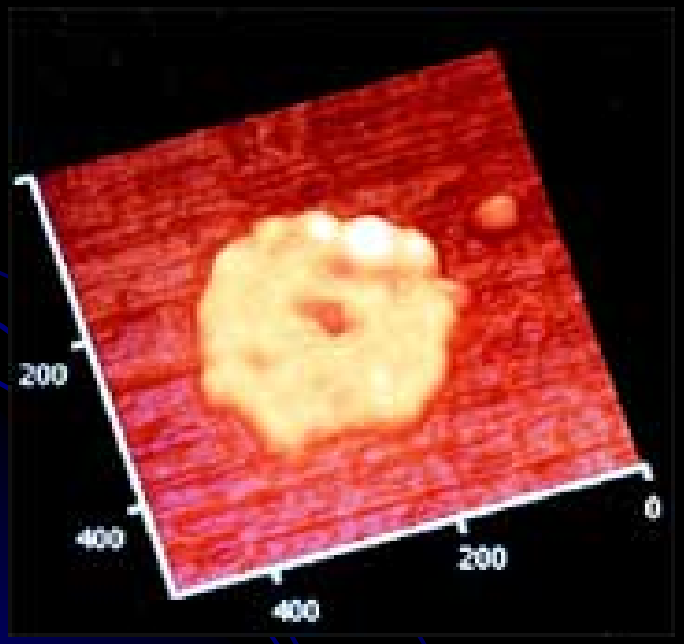
The Enlighten of Jesus Christ
Idol of the science civilization:

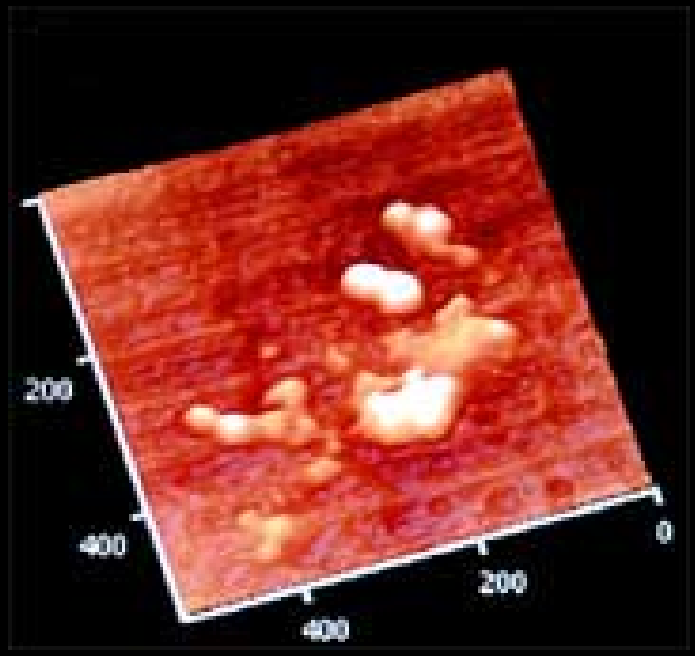
Hard Work Symbol **An** excellent Chapter of Science Education lesson : "Internationally **renowned Chinese-American forensic expert Henry Lee** arrived in Taiwan and helped immediately lasting 19 hours (7 am,Apr.9 till wee hour of Apr.10)**conducting a Marathon investigation into the March 19 shooting of President Chen Shui-bian and Vice President Annette Lu."** and gave **an hour, almost conclusive scientific report this morning 7 am** (4/10/2004, atonement, resurrection day)

NTU-Taida No.1 anti-SARS chemicals

SARS冠狀病毒在接觸「抗煞一號」化合物後，套膜會很快崩解而失去致病性。

「抗煞一號」的正式化學名稱是「**8-hydroxyoctanoic acid**」，是由碳、氫、氧組成的化合物，每個分子大小約廿奈米　（一奈米爲十億分之一公尺），比大小在六十到兩百廿奈米之間的ＳＡＲＳ冠狀病毒還小。





Discovery of Conducting Polymer: “..As soon as we added one drop of bromine into the flask, the conductivity jumped so rapidly, ten times, a hundred times, one-thousand times, ten-thousand times, a million times, ten-millions times…… So, at that moment, the door to the conducting polymer was opened. “


Chwan-Kang Chiang and Hideki Shirakawa in Stockholm, Sweden, 12/9/2000

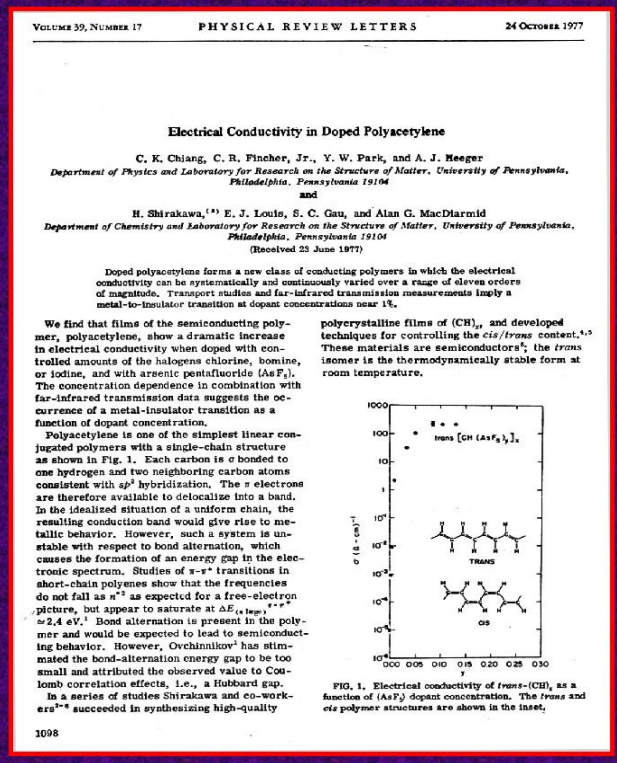
Discovery of Conducting Polymer

“ As soon as we added one drop of bromine into the flask, the conductivity jumped so rapidly, ten times, a hundred times, one-thousand times, ten-thousand times, a million times, ten-million times, . . . So, at that moment, the door to the conducting polymer was opened. ”

Hideki Shirakawa, Nobel Chemistry Lecture in Chemistry 2000

Nobel Prize Paper

Nobel Prize in Chemistry 2000


VOLUME 39, NUMBER 17 PHYSICAL REVIEW LETTERS 24 OCTOBER 1977

Electrical Conductivity in Doped Polyacetylene

C. K. Chiang, C. R. Fincher, Jr., Y. W. Park, and A. J. Heeger
Department of Physics and Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104
and
H. Shirakawa,(*) E. J. Louis, S. C. Gau, and Alan G. MacDiarmid
Department of Chemistry and Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104
(Received 23 June 1977)

Doped polyacetylene forms a new class of conducting polymers in which the electrical conductivity can be systematically and continuously varied over a range of eleven orders of magnitude. Transport studies and far-infrared transmission measurements imply a metal-to-insulator transition at dopant concentrations near 1%.

We find that films of the semiconducting polymer, polyacetylene, show a dramatic increase in electrical conductivity when doped with controlled amounts of the halogens chlorine, bomine, or iodine, and with arsenic pentafluoride (AsF_5). The concentration dependence in combination with far-infrared transmission data suggests the occurrence of a metal-insulator transition as a function of dopant concentration.

Polyacetylene is one of the simplest linear conjugated polymers with a single-chain structure as shown in Fig. 1. Each carbon is σ bonded to one hydrogen and two neighboring carbon atoms consistent with sp^2 hybridization. The π electrons are therefore available to delocalize into a band. In the idealized situation of a uniform chain, the resulting conduction band would give rise to metallic behavior. However, such a system is unstable with respect to bond alternation, which causes the formation of an energy gap in the electronic spectrum. Studies of π-π^* transitions in short-chain polyenes show that the frequencies do not fall as n^{-1} as expected for a free-electron picture, but appear to saturate at $\Delta E_{(n\ \text{large})} \approx 2.4$ eV.[1] Bond alternation is present in the polymer and would be expected to lead to semiconducting behavior. However, Ovchinnikov[2] has stimmated the bond-alternation energy gap to be too small and attributed the observed value to Coulomb correlation effects, i.e., a Hubbard gap.

In a series of studies Shirakawa and co-workers[3-5] succeeded in synthesizing high-quality polycrystalline films of $(CH)_x$, and developed techniques for controlling the *cis*/*trans* content.[4,5] These materials are semiconductors[6]; the *trans* isomer is the thermodynamically stable form at room temperature.

FIG. 1. Electrical conductivity of *trans*-$(CH)_x$ as a function of (AsF_5) dopant concentration. The *trans* and *cis* polymer structures are shown in the inset.

1098

（榮獲二〇〇〇年諾貝爾化學獎的主要論文，領銜作者爲台師大 姜傳康校友）

Taiwan's Uncle Lee(1): 台灣的李表哥----Science

The Nobel Prize in Chemistry 1986: Yuan T. Lee 1/3 of the prize (in Hsinchu, Taiwan) b.1936 ; **Dudley R. Herschbach** 1/3 of the prize USA; **John C. Polanyi** 1/3 of the prize Canada

"for their contributions concerning the dynamics of chemical elementary processes"

Taiwan's Uncle Lee(2): 台灣的李表哥---Art

Ang Lee's performance in Arts: Oscar best movie and best director

2001年以臥虎藏龍獲金球獎最佳導演獎
2006年斷背山獲金球獎最佳導演獎
2006年以斷背山獲奧斯卡金像獎最佳導演獎
2008年以「色，戒」在威尼斯影展得到金獅獎

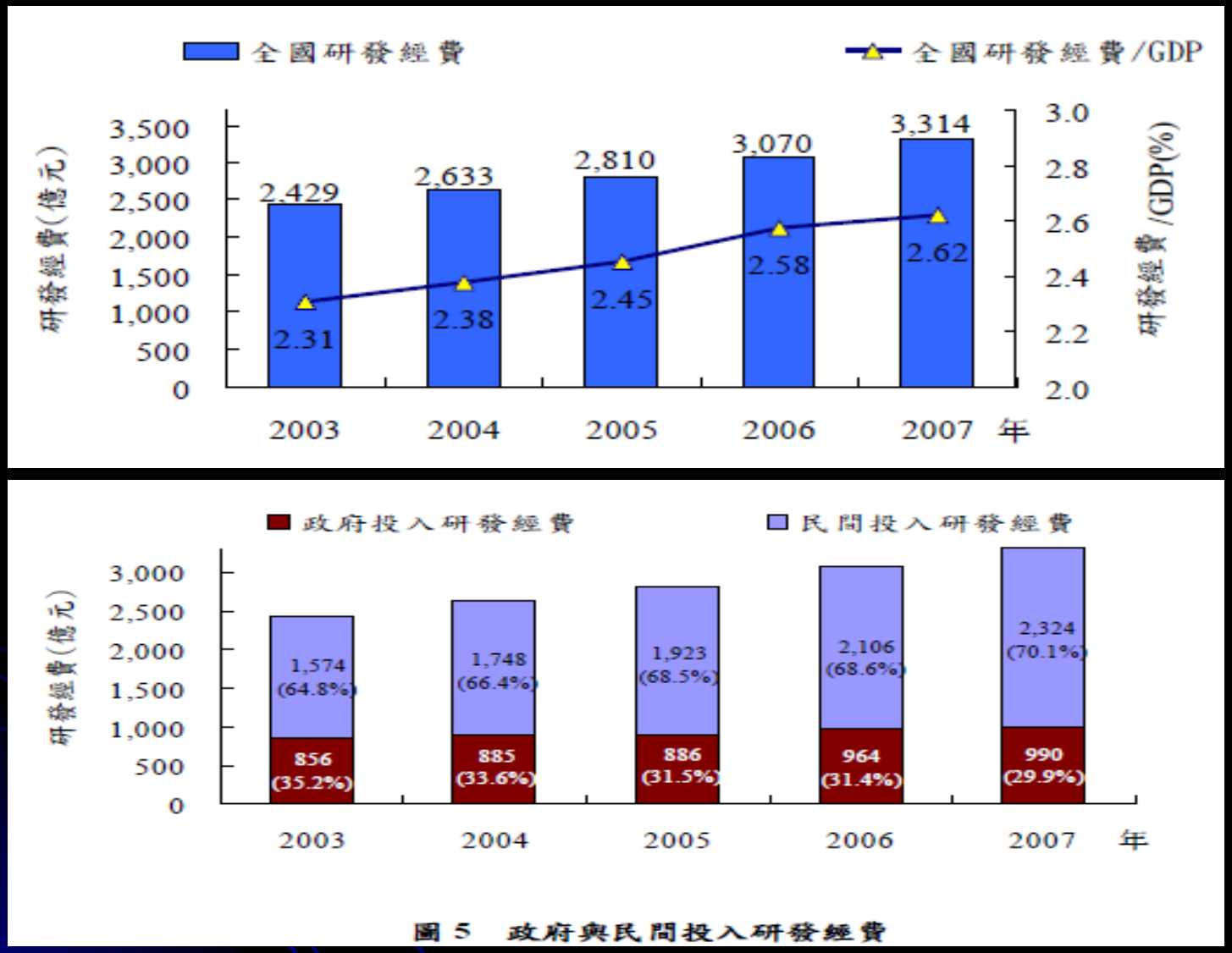


圖 5　政府與民間投入研發經費

Top 20 Ranking of the SCI Papers (Feb.2008)

Country	Total of SCI Papers	SCI Papers per Ten Thousand Population (Rank, 準)	SCI(Rank,經)
USA	321,278	11.18 (8)	1
Japan	84,869	6.65 (13)	2
UK	84,793	14.19 (4)	3
Germany	76,510	9.34 (9)	4
France	53,478	8.88 (10)	5
China	47,753	0.37 (19)	6
Italy	40,999	7.13 (11)	7
Canada	40,901	12.89 (6)	8
Russian	29,292	2.04 (17)	9
Spain	28,459	7.09 (12)	10
Australia	25,600	13.07 (5)	11
Netherlands	23,040	14.33 (3)	12
South Korea	21,716	4.48 (15)	13
India	21,605	0.20 (20)	14
Sweden	16,871	18.91 (2)	15
Switzerland	16,836	23.00 (1)	16
Brazil	14,220	0.77 (18)	17
Taiwan	13,149	5.79 (14)	18
Poland	12,964	3.35 (16)	19
Belgium	12,663	12 (7)	20

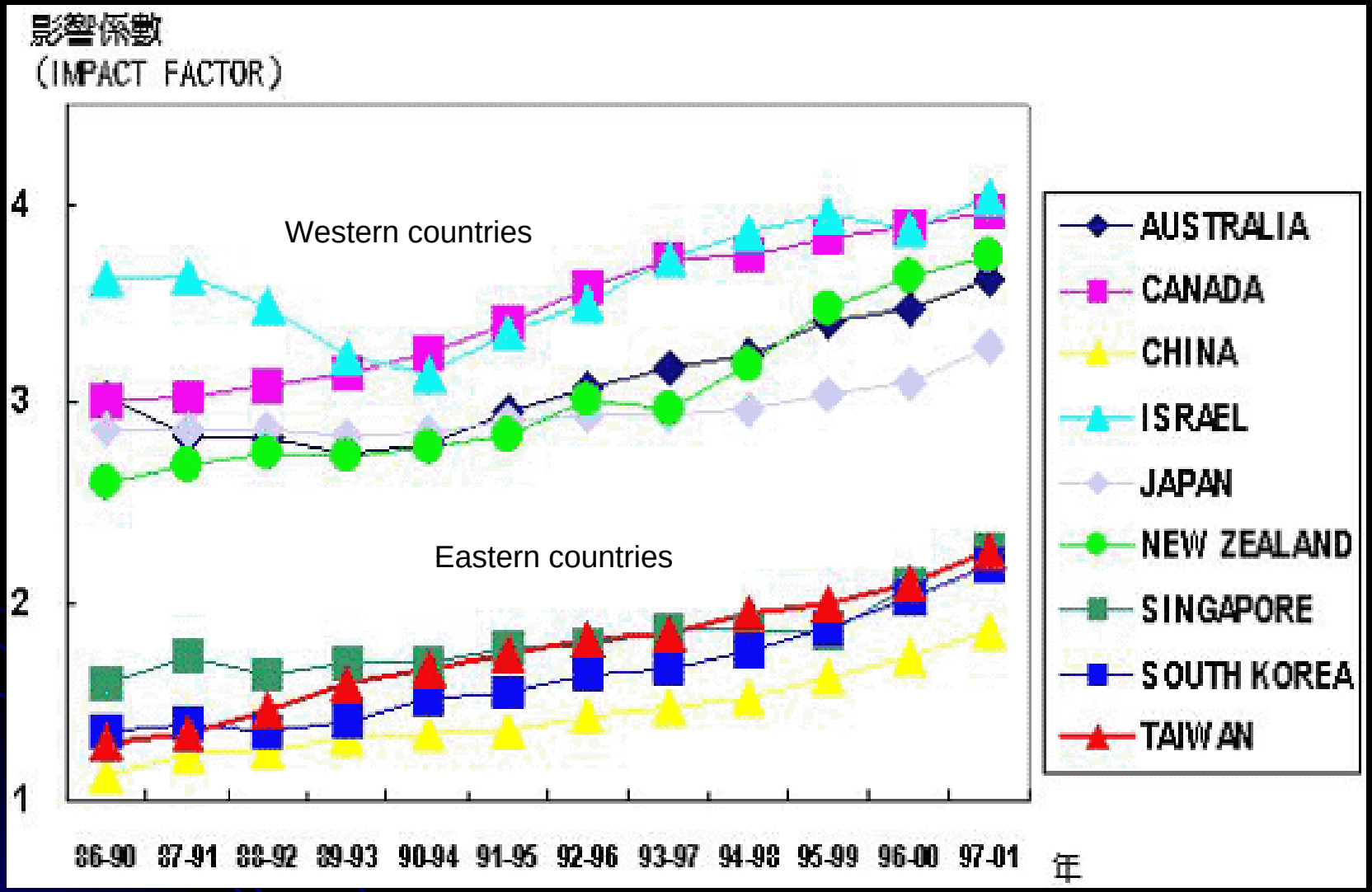
from National Science Council Feb. 2008

表 7　我國近五年 SCI、EI、SSCI 論文

項　目	2003 年	2004 年	2005 年	2006 年	2007 年
SCI 論文篇數	12,484	12,988	15,712	16,578	17,914
篇數排名	18	18	18	17	15
平均每篇論文被引用次數（世界平均 4.82）	2.43	2.53	2.74	2.92	3.05
被引用次數排名	24	24	24	23	23
EI 論文篇數	8,011	10,980	11,661	13,076	16,657
篇數排名	12	11	11	11	9
SSCI 論文篇數	683	787	1,032	1,232	1,548
篇數排名	20	20	18	17	16

資料來源：科學技術統計要覽，2008 年版，行政院國家科學委員會。

Impact Factor in Nature Science



Resource: NSC, April 2003　資料來源：國科會自然處2003年4月

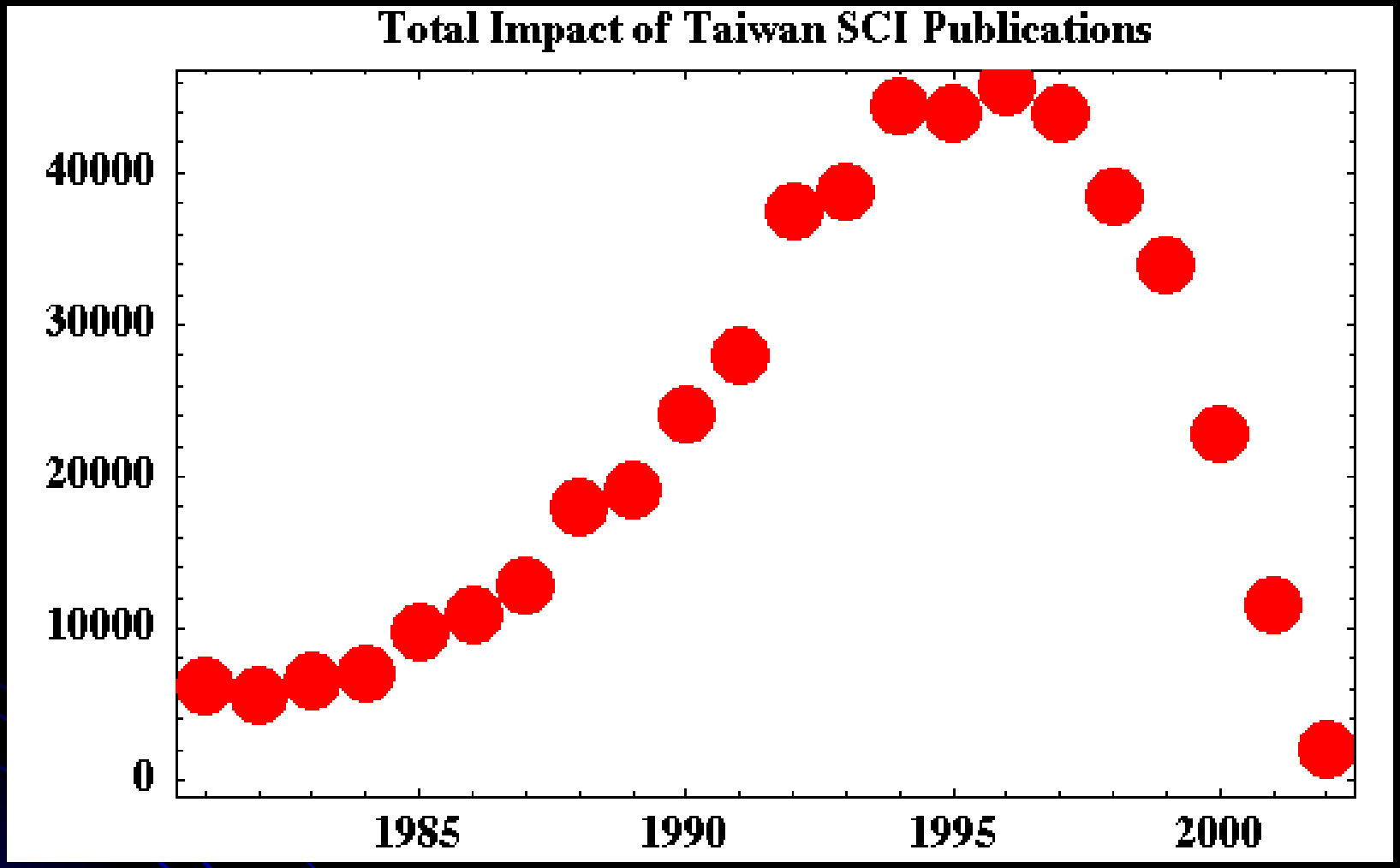


Figure 1: Total Impact = "Number of SCI publications" multiplied by "Average number of citations per paper" = Total Number of Citations. SCI = Science Citation Index

表 8 美國核准專利數（不含新式樣）及排名

國家	2004		2005		2006		2007		2008	
	件數	排名	件數	排名	件數	排名	件數	排名	件數	排名
美國	84,271	1	74,637	1	89,823	1	79,527	1	77,501	1
日本	35,348	2	30,341	2	36,807	2	33,354	2	33,682	2
德國	10,779	3	9,011	3	10,005	3	9,051	3	8,915	3
南韓	4,428	5	4,352	5	5,908	5	6,295	4	7,549	4
中華民國	**5,938**	**4**	**5,118**	**4**	**6,361**	**4**	**6,128**	**5**	**6,339**	**5**
荷蘭	1,273	12	993	12	1,323	11	1,250	11	1,329	10
中國	404	20	402	18	661	16	772	16	1,225	12

資料來源： U.S. Patent and Trademark Office。

洛桑國際管理學院世界競爭力排名

--2008 The world competitiveness ranking

評比項目	美國	新加坡	HK	澳洲	瑞典	愛爾蘭	TWN	China	日本	印度	韓國
整體排名	1	2	3	7	9	12	13	17	22	29	31
1.經濟表現	1	3	5	15	22	24	21	2	29	18	47
2.政府效能	18	1	2	5	11	7	16	12	39	23	37
3.企業效率	3	2	1	6	8	4	10	33	24	20	36
4.Basic Constructions	1	3	19	16	5	23	17	31	4	49	21
(1)基本建設	2	1	3	10	17	32	19	16	18	40	27
(2)Tecknology	1	2	8	22	3	23	5	32	16	41	14
(3)Science	1	8	27	18	6	23	4	10	2	29	5
(4)健康與環境	20	14	16	13	4	19	32	49	9	51	26
(5)教育	12	11	24	6	3	15	19	42	22	54	35

資料來源：瑞士洛桑國際管理學院（International Institute for Management Development ,IMD）,

The world competitiveness yearbook 2008.

Science - *The Ruler of the Education"-
Promotion Base: Science Education Center

college of Science, National Taiwan Normal University, Taipei, Taiwan

5 periods of Science Education Reform
Toward Taiwan's Creativity State of Art (1950--2009)

Imported Science Education:

- 1st Period : 1949-1957 Classical Science Education (mixed experience from Mainland China and Japan)
- 2nd Period: 1958- 1973 Spunick (Academic Orient) Science Education (Junior High Naffied Science from UK and Senior High Science from USA)

Self-running DIY Science Education:(after SEC founded)

- 3rd Period: 1974-1995 (Science, Technology and Society) Science Education
- 4th Period: 1995-2002 (Free Market) Science Education (constructivism revisit)
- 5th Period: 2002- (Integrated) Science Education

35 years History and Mission of (Centralized to De-centralized) Science Education Centre ,National Taiwan Normal University and 30 years Steering Committee, Ministry of Educaiton

- **The Science Education Center was established in 1974 with the support of the Ministry of Education, Republic of China on Taiwan. *(Dr. Kuan-Jen Yang(Bio.), the Dean of the College of Science, was the first director of Science Education Center. He initiated the Reformation Projects for Improvement of Junior High School Science and Mathematics Curricula.*)---3rd Generation of Science Education Innovation.**
- ***Dr. Chin-Chi Chao (Phys.), the second director of center, started to execute the projects of Science Education Steering Committee in September 1979.***
- ***Professor Min-Tong Wey (Chem.) was the third director of center from August 1980 to July 1995--- Debut of the 4th Generation of Science Education Innovation.***

Executive Directors of 4th ~ 8th Transision of the De-Centralized) Science Creative Education

- Dr. Jau-D Chen (mathematics professor)was the fourth director of center from August 1995 to January 2000;
- then Dr. Ching-Song Shern (physics professor) was the fifth director of center from February 2000 to July 2000;
- ***Dr. Tai-Shan Fang,*** *professor of chemistry , sixth director of center from Aug. 2000 to Aug. 2005;*
- Dr. Chen-Yung Lin, professor of Life Sciences September 2005 to July 2006. (7^{th})
- Dr. Chun-Yen Chang, Professor of Dept. of Earth Sciences, is currently the Director of the Science Education Center since August 2006. (8^{th})

Math → Phys → Chem → Bio → Earth

GOALS & TASKS
RESEARCH • DISSEMINATION & SERVICE • PUBLICATION

- *1.Conduct variety of researches that lead to improvement of mathematics and science teaching and learning.*
- *2.The development and dissemination of high school mathematics and science instructional materials, teaching aids, and evaluation materials and methods.*
- *3.**Conduct international symposia, workshop, and conferences on topics of mathematics and science education.***
- *4.Conduct workshops or activities for mathematics and science teachers, which provide opportunities for innovation of teaching and learning.*
- *5.Collecting and exhibiting international mathematics and science education materials.*

GOALS & TASKS
RESEARCH • DISSEMINATION & SERVICE • PUBLICATION (continued)

- 6.Publish Science Education Monthly Journal, report of research projects, instructional materials, and curriculum materials.
- 7.Conduct projects for senior high school mathematics and science gifted students.
- 8.Participated the study of the International Association for the Evaluation of Education Achievement (IEA).
- 9.Conducting mathematic and scientific workshops for high school students.
- 10.Establish a science education network.
- 11.Associated with Department of Ministry Education in disseminating creative science education.

Current

Multi-phases running Science Education towards Creative Taiwan

-"knowledge" economics era's science education -

- **The 5th period of Taiwan's Science Education Innovation (1995--2010), the 6 top-elite-classes are created around the island run by the cooperation of the local top university and senior high school.**
- **Centre of Science Education: Curricula and education materials, integrated nine-years progressive and coherent teaching and learning materials、*enquiry-centered teaching strategy and DIY and action research on material and biological science materials; deferring the career-oriented to 12 grade compulsory science education.***
- **Extra-curriculum activities on Science Education:(as follows)**

Extra-curriculum activities on Creative Science Education

1.middle school weekend science study camp(*25 years history, continued and enhanced)*

2.basic science nursing senior high students project *(a five years experimental project , from 2002 to 2007 replace the 19 years history of science-talent senior high students project)*

3.annual national science fair *(STS science fair from 2002 instead of original 43 years science fair)*

4.annual Taiwan International Science Fair:*(to replace the original 43 years national science fair)*

5.annual national science olympiads:*(12 years old to replace the original practical tasks competition from 1984)*

6.all level science odysseies: *(5 years creative STS competitions)*

Extra-curriculum activities on Science Education (continued)

7.TIMSS-R and TIMSS-2003, 2007 (IEA): ***(Taiwan ranked as No. 1 in Science and No.3 in Mathematics for 14 yearold group in TIMSS-R) (The results of TIMSS-2003 will be released in Dec. 2004)***

8.International Science Olympiads:Sinior High ***(Mathematics and Chemistry ,18years; Physics, 16 years; Information, 16 years 、Biology, 11years, Earth Science, 3 years); Junior High (IJSO, 5 years)***

9.Reform the Joint-Senior High Exam and Joint-Colleges Exam systems: *(Exam-oriented science education is the most serious problem in Education)*

10. Academic Fellow Dr. Mrs.Wu's Summer Science Study Camp *(11 years old civil foundation supporting to resurrection of the youngsters interesting in Science)*

11. Annual national science week: *watering and greening Taiwan*

12. 3rd (APEC) Youth Science Festival was held 2004 in Beijing, China ***(1st：1999 in Korea ,2nd：2001 in Singapore; 4th will be in Thailand 2010)***

現在高中除了數理資優班、語文優班之外，今年起 **(2009) 正式開了 6 classes (180 students) Science Magnetic Class)** ，也可以設置「科學班」，並開始招生。

近年來，我國學生在國際重要評比項目中，科學及數學的表現相當亮眼，「PISA 2006」國際評比中，我國學生「數學素養」世界第一，「科學素養」排名第四；2007年TIMSS調查研究結果，小四學生數學和科學排名世界第三和第二；國二學生數學和科學排名世界第一和第二，表現相當優異；我國國中及高中學生參加國際數理學科奧林匹亞競賽成績也名列前茅，足見我國中小學科學教育基礎扎實，學生在科學領域學習表現頗具潛力。在全球知識經濟洪流中，我國更勢必憑藉培育各領域優秀人才以提升國際競爭力，因此，教育部希望藉由在高中階段開設科學班，爲我國持續培育優秀科學創造力人才。

The assessment system in Taiwanese secondary schools was long dominated by so-called objective testing, which have been criticized for its failure for monitoring students' high-order scientific thinking/abilities. The Science Education Center promoted the use of alternative assessment in the science classroom in Taiwan and conducted a three-year long project, from 1998 to 2000, to develop items of performance assessment for students in secondary schools. Performance assessment provides activities with authentic context, which offer opportunities for students to solve problem. During the process of performance assessment, students' knowledge and high-order thinking are monitored and evaluated. The promotion of alternative assessment paved the foundation for later creativity research and game in Taiwan. The Science Education Center afterward held a series of creativity contest and attracted attention from many smart students.

The Science Education Center was funded to carry out the TIMSS-R (1999), TIMSS 2003, and TIMSS 2007 projects since 1997, which is an international study on achievement of science and mathematic for primary and secondary students. The TIMSS project needed cooperation among scientists, science educators, and science teachers. The Science Education Center demonstrated its efficient administration and research quality to complete this internationally large scale of study. With this reputation, the Science Education Center was funded by the Ministry of Education to conduct two more national assessments on secondary students' achievement of science and mathematics, with the aim to evaluate the effectiveness of current curriculum. Later, the Ministry of Education funded a project on the investigation of the profile of science and mathematics teachers and on the feedback and attitudes of science and mathematics teachers on the current curriculum. The result of survey study will inform the Ministry of Education the implementation of the current curriculum.

PISA 與TIMSS的特性

	PISA	TIMSS
對象	年滿15歲學生	小四及國二學生
評量主軸	素養(literacy)	成就(achievement)
試題	情境化	較類似學校考題
	閱讀、數學、科學	數學、科學

2003 TIMSS (Taiwan’ s Performance)

- The International Association for the Evaluation of Educational Achievement, IEA: Third International Mathematics and Science Study-Repeat, TIMSS-R :

  For Grade 8 (14 years old) rank as No.1 in Nature Science and No.3 in Mathematics, among 38 participating countries。

IJSO and *OECD/Pisa 2006*

- **The first International Junior Science Olympiad (IJSO) will be held from 5 - 14 December 2004 in Jakarta,Indonesia . 6 students with two accompanying persons.** *Test Competion* , Consist of 25 problems (multiplechoice) each problem has 2 point. If student made mistake there will be a penalty. Total 50 Points. *Theoritical* , Consists of 3 problems, each problem has 10 pont. No penalty for mistake. Total 30 point. . *Experimental,* Consists of 2 problems, each problem has 10 point. No penalty for mistake. Total 20 point. **(MOE, orgnized by NTNU)). This year will be the 6th IJSO (in 亞塞拜然), 31 to 43 countries, Taiwan Ranked as No.1~2, 2 times got 6 golds, 3 times got 5 golds and 1 silver.**

- ***OECD Programme for International Student Assessment (PISA) Invitation to a Joint Meeting of PISA 2003 and PISA 2006 National Project Managers*** : (NSC, executed by NKNU)

  March – June 2005 Field Trial

  March – June 2006 Main study

  December 2007 International results released by the OECD Secretariat

Taiwan tops the league for school maths (From Financial Times, December 5th, 2007)

By David Turner in London

Taiwan has topped a prestigious international league table of 15-year-olds' mathematical ability, vaulting ahead of far richer countries.

The island state's performance in the Pisa tests of mathematics and reading, devised by the Organisation for Economic Co-operation and Development and published yesterday, reinforces its reputation as a hightechnology Asian tiger.

Taiwan also earned fourth place in the parallel Pisa science rankings, published last week, although in reading it was in 16th place.

PISA2006 台灣與歐亞洲國家國際評比

滿15歲學生(數學素養)

15 Years Old Mathematic Literacy:
Ranked as No.1

	台灣 Taiwan		日本 Japan		韓國 Korea		香港 Hong Kong		芬蘭 Finland		瑞典 Sweden	
	總分	排名	總分	排名	總分	排名	總分	排名	總分	排名	總分	排名
PISA 2003	N/A		534 (101)	6	542 (92)	3	550 (100)	1	544 (84)	2	509 (95)	17
PISA 2006	549 (103)	1	523 (91)	10	547 (93)	3	547 (93)	3	548 (81)	2	502 (90)	21

PISA 台灣與歐亞洲國家國際評比

滿15歲學生(科學素養)

15 Years Old Science Literacy:
Ranked as No.4

	台灣 Taiwan		日本 Japan		韓國 Korea		香港 Hong Kong		芬蘭 Finland		瑞典 Sweden	
	總分	排名	總分	排名	總分	排名	總分	排名	總分	排名	總分	排名
PISA 2003	N/A		548 (109)	1	538 (101)	4	539 (94)	3	548 (91)	1	506 (107)	15
PISA 2006	532 (94)	4	531 (100)	5	522 (90)	10	542 (92)	2	563 (86)	1	503 (94)	22

PISA 台灣與歐亞洲國家國際評比

滿15歲學生(閱讀素養)

15 Years Old Reading Comprehensive Literacy:
Ranked as No.16

	台灣 Taiwan		日本 Japan		韓國 Korea		香港 Hong Kong		芬蘭 Finland		瑞典 Sweden	
	總分	排名	總分	排名	總分	排名	總分	排名	總分	排名	總分	排名
PISA 2003	N/A		498 (106)	14	534 (83)	2	510 (85)	10	543 (81)	1	514 (96)	8
PISA 2006	496 (84)	16	498 (102)	15	556 (88)	1	536 (82)	3	547 (81)	2	507 (98)	10

台灣參加1992~2009國際奧賽得獎成績統計

Metals Obtained by Taiwan's Contestants of International Science Olympiads (1992~2009)

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	國際排名
數學(IMO) 6人(73~104國)	3銀 2銅	1金 4銀 1銅	4銀 1銅	4銀 1銅	2銀 3銅	4銀 2銅	3金 2銀 1銅	1金 5銀	3金 2銀 1銅	1金 5銀	1金 4銀 1銅	1金 2銀 2銅	3金 3銀	3金 2銀 1銅	1金 5銀	2金 3銀 1銅	2金 4銀	1金 5銀	5~17名
物理(IMO) 5人(47~86國)	… … …	… … …	1銅	1銀 1銅	2金 1銀 1銅	2銀 2銅	1銀 2銅	2金 2銀 1銅	2金 2銅	2金 1銀 2銅	3金 1銀 1銅	3金 1銀 1銅	1金 3銀 1銅	5金	3金 1銀 1銅	1金 2銀 2銅	5金	3金 2銀	1~17名
化學(IChO) 4人(33~69國)	1金 1銀 1銅	1金 1銀	3銀 1銅	3銀 1銅	1金 2銀 1銅	2金 1銀 1銅	1金 2銀 1銅	2金 1銀 1銅	2金 2銀	4銀	2金 2銀	1金 2銀 1銅	1金 2銀 1銅	2金 2銀	3金 1銀	2金 2銀	2金 1銀 1銅	4金	1~13名
生物(IBO) 4人(36~56國)	… … …	… … …	… … …	… … …	… … …	… … …	… … …	3金 2銀	3金 1銀	2金 2銀	3金 1銀	1金 2銀 1銅	1金 3銀	2金 2銀	3金 1銀	2金 2銅	4金	2金 2銀	1~8名
資訊(IOI) 4人(50~86國)	… … …	… … …	1銀 2銅	3銀	3銀 1銅	1金 2銀	2銀 2銅	1銀 3銅	3銀 1銅	1銀 1銅	1金 2銀 1銅	1金 1銀 1銅	2銀 2銅	3銀 1銅	3銀 1銅	2金 1銀 1銅	2金 1銀 1銅	2金 2銀	四次4~10名十二次沒名
地科(IEO) 4人(7~14國)	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	3金 1銀	2金 2銀	4金	1名

Resource(資料來源)：MOE(教育部中教司)（2009）

台灣參加 1992~2009 國際奧賽得獎成績統計

年次 領域	19 92	19 93	19 94	19 95	19 96	19 97	19 98	19 99	20 00	20 01	20 02	20 03	20 04	20 05	20 06	20 07	20 08	20 09	國際 排名
數學 (IMO) 6 人(73~104 國)	… 3 銀 2 銅 (17)	1 金 4 銀 1 銅 (5)	… 4 銀 1 銅 (13)	… 4 銀 1 銅 (12)	… 2 銀 3 銅 (12)	… 4 銀 2 銅 (14)	3 金 2 銀 1 銅 (5)	1 金 5 銀 … (9)	3 金 2 銀 1 銅 (8)	1 金 … 5 銀 (9)	1 金 4 銀 1 銅 (7)	1 金 2 銀 2 銅 (16)	3 金 3 銀 … (6)	3 金 2 銀 1 銅 (7)	1 金 銀 … (10)	2 金 3 銀 1 銅 (9)	2 金 4 銀 … (9)	1 金 5 銀 … (11)	5~17 名
物理 (IMO) 5 人(47~86 國)	… … … …	… … … …	… … 1 銅 (17)	… 1 銀 1 銅 (17)	2 金 1 銀 1 銅 (6)	… 2 銀 2 銅 (15)	… 1 銀 2 銅 (12)	2 金 2 銀 1 銅 (7)	2 金 … 2 銅 (6)	2 金 1 銀 2 銅 (5)	3 金 1 銀 1 銅 (7)	3 金 1 銀 1 銅 (3)	1 金 3 銀 1 銅 (7)	5 金 … … (1)	3 金 1 銀 1 銅 (5)	1 金 2 銀 2 銅 (15)	5 金 … … (2)	3 金 2 銀 … (4)	1~17 名
化學 (IChO) 4 人(33~69 國)	1 金 1 銀 1 銅 (6)	2 金 2 銀 … (1)	… 3 銀 1 銅 (8)	… 3 銀 1 銅 (13)	1 金 2 銀 1 銅 (7)	2 金 1 銀 1 銅 (1)	1 金 2 銀 1 銅 (8)	2 金 1 銀 1 銅 (5)	2 金 2 銀 … (3)	… 4 銀 … (9)	2 金 2 銀 … (3)	1 金 2 銀 1 銅 (10)	1 金 2 銀 1 銅 (7)	2 金 2 銀 … (5)	3 金 1 銀 … (2)	2 金 2 銀 … (3)	2 金 1 銀 1 銅 (5)	4 金 … … (1)	1~13 名
生物 (IBO) 4 人(36~56 國)	… … …	… … …	… … …	… … …	… … …	… … …	… … …	3 金 2 銀 … (2)	3 金 1 銀 … (2)	2 金 2 銀 … (1)	3 金 1 銀 … (3)	1 金 2 銀 1 銅 (8)	1 金 3 銀 … (4)	2 金 2 銀 … (5)	3 金 1 銀 … (3)	2 金 … 2 銅 (6)	4 金 … … (2)	2 金 2 銀 … (4)	1~8 名
資訊 (IOI) 4 人(50~86 國)	… … …	… … …	1 銀 2 銅 (?)	3 銀 … (10)	3 銀 1 銅 (6)	1 金 2 銀 (8)	2 銀 2 銅 (?)	1 銀 3 銅 (?)	3 銀 1 銅 (?)	1 銀 1 銅 (?)	1 金 2 銀 1 銅 (?)	1 金 1 銀 1 銅 (?)	2 銀 2 銅 (?)	3 銀 1 銅 (?)	3 銀 1 銅 (?)	2 金 1 銀 1 銅 (?)	2 金 1 銀 1 銅 (?)	2 金 2 銀 … (4)	四次 4~10 名 十二次 沒名
地科 (IEO) 4 人(7~14 國)	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	… … …	3 金 1 銀 … (1)	2 金 2 銀 … (1)	4 金 … … (1)	1 名
獎牌 總數 10-19-23-27 人次	1 金 4 銀 3 銅 (8/10)	3 金 6 銀 1 銅 (8/10)	8 銀 5 銅 (13/19)	11 銀 3 銅 (14/19)	3 金 9 銀 6 銅 (18/19)	3 金 9 銀 5 銅 (17/19)	4 金 7 銀 6 銅 (17/19	8 金 10 銀 15 銅 (23/23	10 金 8 銀 4 銅 (22/23)	5 金 13 銀 3 銅 (21/23)	10 金 10 銀 3 銅 (23/23)	7 金 8 銀 6 銅 (21/23)	6 金 13 銀 4 銅 (23/23)	12 金 9 銀 2 銅 (23/23)	10 金 11 銀 2 銅 (23/23	12 金 9 銀 6 銅 (27/27)	17 金 8 銀 2 銅 (27/27)	16 金 11 銀 (27/27)	

各系奧賽學生學業平均成績與全部學生學業平均成績差異摘要表(Academic Performance in Undergraduates)

學系(Aca.)	數學系 Math	物理系 Phy	化學系 Chem	生科系 Bio	醫學系 Medi	電機系 EE	資訊系 IT
全部學生平均(All)	70.20	76.80	73.90	77.62	81.45	79.33	76.49
奧賽學生平均(ISOs)	77.61	81.16	81.64	77.07	82.17	81.44	79.85
成績差異 Difference	7.41	4.36	7.74	-0.55	0.73	2.11	3.36
差異百分比 Variation	10.55%	5.67%	10.48%	-0.71%	0.89%	2.66%	4.40%

奧賽學生大學學業成績分析

(1)參與奧林匹亞競賽的選手進入大學各學系之後，整體奧賽學生全部學期學業成績表現較一般生成績表現佳。

(2)各學系的整體奧賽學生平均成績與一般生平均成績差異百分比的比較發現，醫學系的差異性最少，數學系和化學系的差異最大。

Comparison of the Peer Undergraduates: No difference in Biological and Medical Science students, but much better and significant performance in Math and Physic, Chemistry students.

(3)個別奧賽學生平均成績高於一般生平均成績的人數比低於一般生的人數都為相對較多。不過也有少數奧賽學生成績表現在一般生平均成績之下。

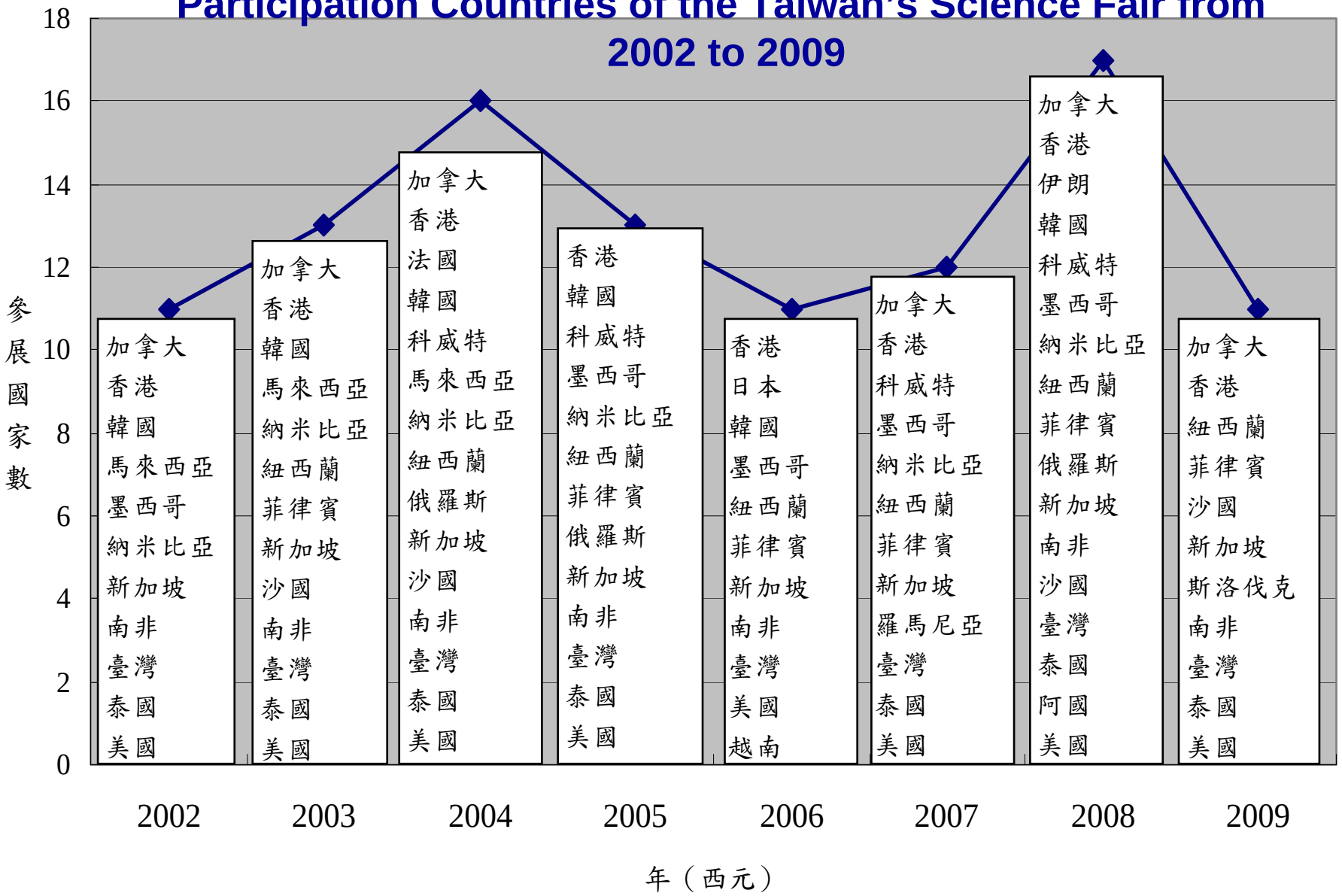
(4)多數奧賽學生在入學當學年學業成績排名都較佳，但之後各學期成績排名百分比名次則略有逐年增加趨勢。

(5)各學期的成績差異百分比的趨勢線經分析，發現奧賽學生成績表現趨近於一般生的平均表現。

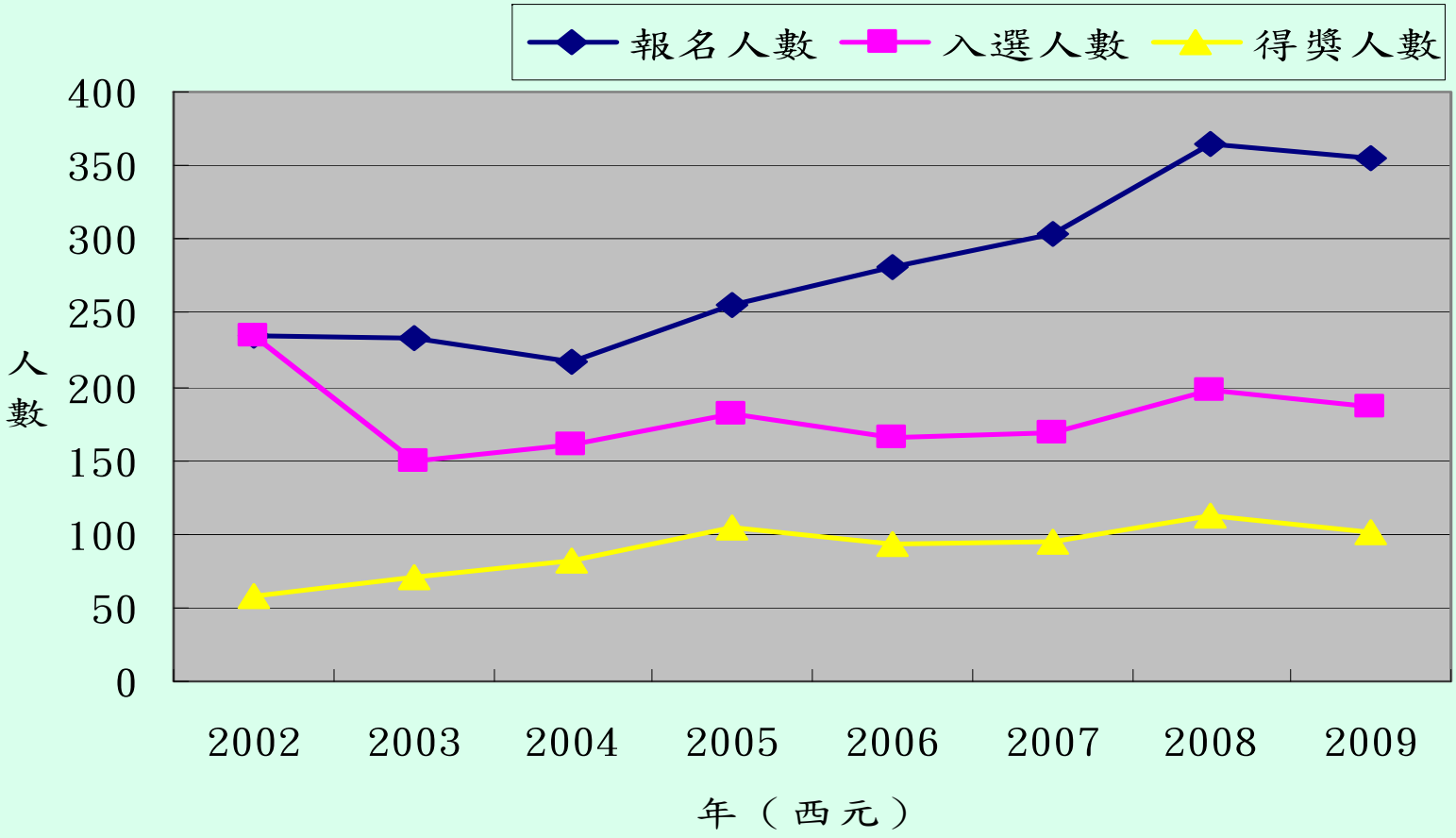
臺灣國際科學展覽會歷年參展國家數統計表

（2002-2009）

Participation Countries of the Taiwan's Science Fair from 2002 to 2009



臺灣國際科學展覽會歷年參展人數統計
（2002-2009）



（歷年入選人數÷歷年報名人數）×100% = 66%

（歷年得獎人數÷歷年報名人數）×100% = 32%

（歷年國外參展人數÷歷年國內參展人數）×100% =10%

Prizes obtained by Taiwan’s Contestants of ISEF

時間/西元	No.of Conste s-tants	No.of Obtai ned prize	Young Top Prize	Field Top Prize	Organiz er’s Prize	Special Prize	Total
1982-2002	97	67	-	3	48	75	126
2003	SARS，未派員出國						
2004	20	15	-		11	4	15
2005	11	10	-	1	5	7	13
2006	12	11	-	2	8	9	19
2007	10	6	-	1	5	2	8
2008	10	4	1	1	4	3	9
2009	11	7	-	1	4	6	11
總計	171	120	1	9	85	106	201

備註:

美國國際科技展覽競賽有18類科，於1997年起設英特爾青年科學家獎(每年3名)歷年來僅有6名美國以外國家之學生（加拿大2名、德國2名、中國大陸1名)獲獎

我國於2008年由蘇意涵獲得殊榮

韓國(Korea Science Magnetic School)

韓國近年在國際科學奧林匹亞競賽都獲得不錯的成績。

2002年成立Busan Academic of Science(釜山科學高中)

釜山科學高中是韓國科學技術部為了培育世界級科學家而特別設立的學校，自2004年春天起每年自全韓挑選144名資優中學生，全部住校、密集授課，要在前兩年內上完高中與大學的課程，第三年將準備送他們到韓國或國外的知名大學參與科學研究。

2005年 Korea Science Academy

資優科學高中: 年收200名全部住校(200 students)

日本(Japan Science Magnetic School)

- 2005至韓國取經
- 英語教學
- 先通識(奈米，生物，環境與訊息)後專業
- 實驗為主，理論為輔，貴重儀器專業管理，一流學者參與
- 培養未來能領導世界的科學家
- 一年收237 students.

中國大陸(Mailand China)

科大少年班1978年三月創辦，至今30年。首批21名中，最大15歲，最小11歲。

A.H.UST Junior Class was founded in March 1978 and has 30 years history. The first class of 21 students, the eldest is 15-year-old, the youngest 11 years old.

成功案例: 微軟公司全球副總裁張業勤，中國雅虎社區總經理李俊凌，英國伯明翰大学計算機學院首席教授姚新

Success Stories: Microsoft's vice president Zhang Yeh Qin, the Chinese general manager of Yahoo's community Li Junling, University of Birmingham School of Computer Science, chief Professor Xin Yao.

爭議案例: 寧鉑出家為僧，與甘政自我封閉

Dispute Cases: Ning Bo ended up with a Buddhist monks and nuns, and Ganzheng self-enclosed

黑道大哥「教你去做」、「做給你看」、「帶著你做」、「看著你做」、「讓你去做」五個循序漸進步驟，養出2個柏克萊女兒；

A Taiwan Gangster father employed five sequential steps： 1,"teaching you to do", 2,"doing by himself to you", 3,"taking you to do", 4,"looking at you to do", 5,"letting you do “ to cultivate his 2 daughters becoming the US Berkeley Graduates

52歲的呂代豪回憶，他在民國65年越獄，曾在太平洋漂流了24小時，隔年二月被抓回管訓隊，被銬上36公斤腳鐐，背30公斤的沙包，整天被吊在樹下，他生不如死，背英文字典打發時間，每天背500個英文單字，比外國人還行，光「雞皮疙瘩」他就會5個不同單字。

呂代豪說，後來朋友送他一本「英文名人演講稿一百篇」，他照背不誤，從「麥帥爲子祈禱文」背到羅斯福的「四大自由」，足足背了6、7百段，出口成章，托福考了630分，順利到美國讀碩、博士。

「黑道牧師」養了一對可愛的千金，他教孩子的絕招，就是「教你去做」、「做給你看」、「帶著你做」、「看著你做」、「讓你去做」。

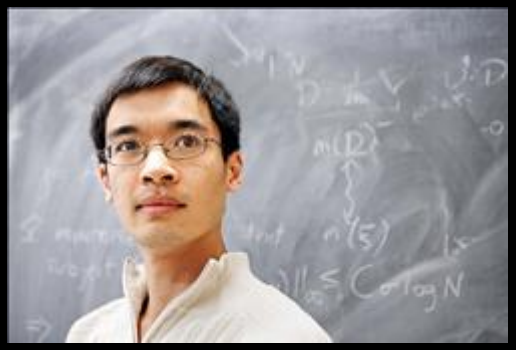
呂代豪感嘆，台灣的傳統教育，通常只有第一、第五個步驟，即教你做，跳到直接讓你做，沒人帶領、陪著檢討，成效不佳。

呂代豪的大女兒呂永潔說，黑道老爸的教育常出怪招，例如他篤信背演講稿的功效，小時候常要她參加英文演講比賽，距比賽還很早，就催著她背講稿，有次說要飯後散步，結果帶她到一個圓形劇場背講稿，還不斷指導「手勢、手勢、要真情流露」，現在想想實在很鮮。

數學界的莫扎特：華裔數學家陶哲軒 UCLA新偶像

The mathematical community Mozart: Chinese mathematician

Terence Tao, UCLA New idol



・他是天才兒童，自己學會了認字

・他也3歲的陶哲軒已經展示出6歲孩子才有的讀、寫和算術能力是個活潑淘氣的孩子，在自己編寫的電腦程式中搞惡作劇

・他的智商高達221，比正常人的智商高出近100

・二十歲拿到博士學位。

・他31歲就獲得了數學界最高獎項

今年一月，有四百名聽眾擠進洛杉磯加州大學的禮堂，聆聽一場有關質數的演講，還有三十五人在隔壁教室觀看演講實況轉播，另外八十名向隅聽眾則不得其門而入，這種冷門的講題竟能吸引這麼多聽眾，實在罕見。

當天發表演講的數學系教授陶哲軒（見圖，紐約時報）用詞有禮、態度從容，還帶著些許澳洲鄉音，他之所以格外受人矚目，因爲他是世上少見的數學奇才。陶哲軒兩歲就識字，九歲開始研讀大學數學課程，二十歲拿到博士學位。(got Ph.D. at 20)

現年三十一歲的陶哲軒研究範圍非常廣泛，從質數到圖像壓縮都有，去年夏天他更贏得相當於數學諾貝爾獎的費爾茲獎及獎金高達五十萬美元的麥克阿瑟獎學金。(got "Nobel Prize equivalent " at age 31)

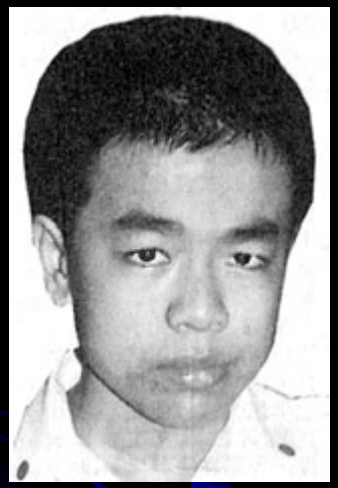
陶哲軒的同僚戲稱他是搖滾巨星和數學界的莫札特，他本人也忍不住拿自己的超人氣開玩笑：「人一旦出名就會愈來愈出名，這是芭黎絲・希爾頓效應。」不過，名氣並未影響陶哲軒的生活，他的辦公室裡還貼著日本漫畫「亂馬1/2」的海報，平常一樣穿著普通的運動衫、牛仔褲和破球鞋去上課，看起來跟研究生沒有兩樣。

他兩歲時就能用積木教年紀較大的玩伴數數，還能用積木拼出「狗」和「貓」等字。陶哲軒五歲時入校就讀，父母和學校師長特別設計了專屬課程，讓他能以自己的速度通過每一項科目。陶哲軒在數學與科學上的表現迅速跳級，但其他科目的成績則與同齡生較接近，英文課作文尤其令他頭大，例如老師要求他寫一篇家中現況的作文，結果陶哲軒竟然詳細列出每間房中的所有物品。七歲半時，他開始到當地高中上數學課。

父親陶象國深知，天才兒童長大後，發展常不如預期。陶家父母決定不讓陶哲軒過早進入大學，而是請來數學教授專門指導陶哲軒，數年後才到大學進修數學及物理課程，贏得多項國際數學大獎，直到十四歲才正式成爲大學生。陶哲軒兩年內就完成大學學業，一年後取得碩士學位，再轉往美國普林斯頓大學攻讀博士，二十歲拿到博士學位。◘（取材自紐約時報）

馬來西亞華裔華裔神童張世明15歲讀博士
Malaysia's well-known Oversea Chinese "child prodigy"
壓力過大31歲憂鬱症早逝

Depression and early death at 31



2007.01.11　中國時報　楊明暐/綜合報導

據報道，張世明是馬來西亞家喻戶曉的華裔“神童”，張世明居住在馬來西亞芙蓉武吉亞沙花園，他早年的智商高達148，這種智商在全世界人口中僅佔2%。張世明11歲從小學畢業，12歲從初中一年級一躍跳到了大學一年級，到馬來西亞英迪學院攻讀美國大學課程。1989年，13歲的張世明進入美國麻省理工學院求學，創下了吉尼斯世界紀錄，成了美國麻省理工學院最年輕的外國留學生。

1992年，不滿16歲的張世明又考進美國紐約康奈爾大學，攻讀博士學位。1997年**(MIT Ph.D at age 20))**，張世明博士畢業，留在美國繼續從事研究工作。

然而張世明從美國大學拿到博士學位後，就仿佛銷聲匿跡了，人們幾乎再也沒有听到過他的消息。直到2002年，張世明的父親張其霖發表一份聲明，稱張世明在美國獲得博士學位後，由于年紀太輕，沒能適應美國社會的現實環境和工作壓力，再加上眾人都對他這個“神童”投以異樣的眼光，導致他心理壓力過大，性格變得異常孤僻和沉默寡言。

Yi-Han Su, 17, of Chinese Taipei, was one of three students who received top honors at the 2008 Intel International Science and Engineering Fair in Atlanta, Friday, May 16, 2008. Su was awarded for her efforts to identify a high-activity catalyst that could improve methanol reforming reactions in order to generate hydrogen more efficiently.

Sana Raoof, left, 17, of Muttontown, N.Y., Yi-Han Su, 17, center, of Chinese Taipei and Natalie Saranga Omattage, right, 17, of Cleveland, Miss., pose after receiving top honors at the 2008 Intel International Science and Engineering Fair in Atlanta, Friday, May 16, 2008. The young women each received a $50,000 scholarship from the Intel Foundation as part of their award. The 2008 Intel International Science and Engineering Fair brought together more than 1500 students from 51 countries, regions and territories to compete for more than $4 million in awards and scholarships.

2005 37th IChO Press Conference

第37屆2005國際化學奧林匹亞記者(July 15,2005)

"Some countries give their students a significant incentive to win a gold medal. Tai-Shan Fang, who was head mentor for the team from Chinese Taipei (otherwise known as Taiwan) for 18 years, said that any student from Taiwan who wins a gold medal will receive 200,000 Taiwanese dollars (approximately $6,200 U.S.) and paid tuition through their Ph.D. studies if they choose to major in chemistry. "We are trying to cultivate the best R&D in chemistry," said Fang." **Adapted from (C and E News, NOVEMBER 17, 2008 VOLUME 86, NUMBER 46 PP. 74-76):** Chemistry, Culture, And Camaraderie, The international chemistry olympiad offers an experience worth its weight in gold By Linda Wang)

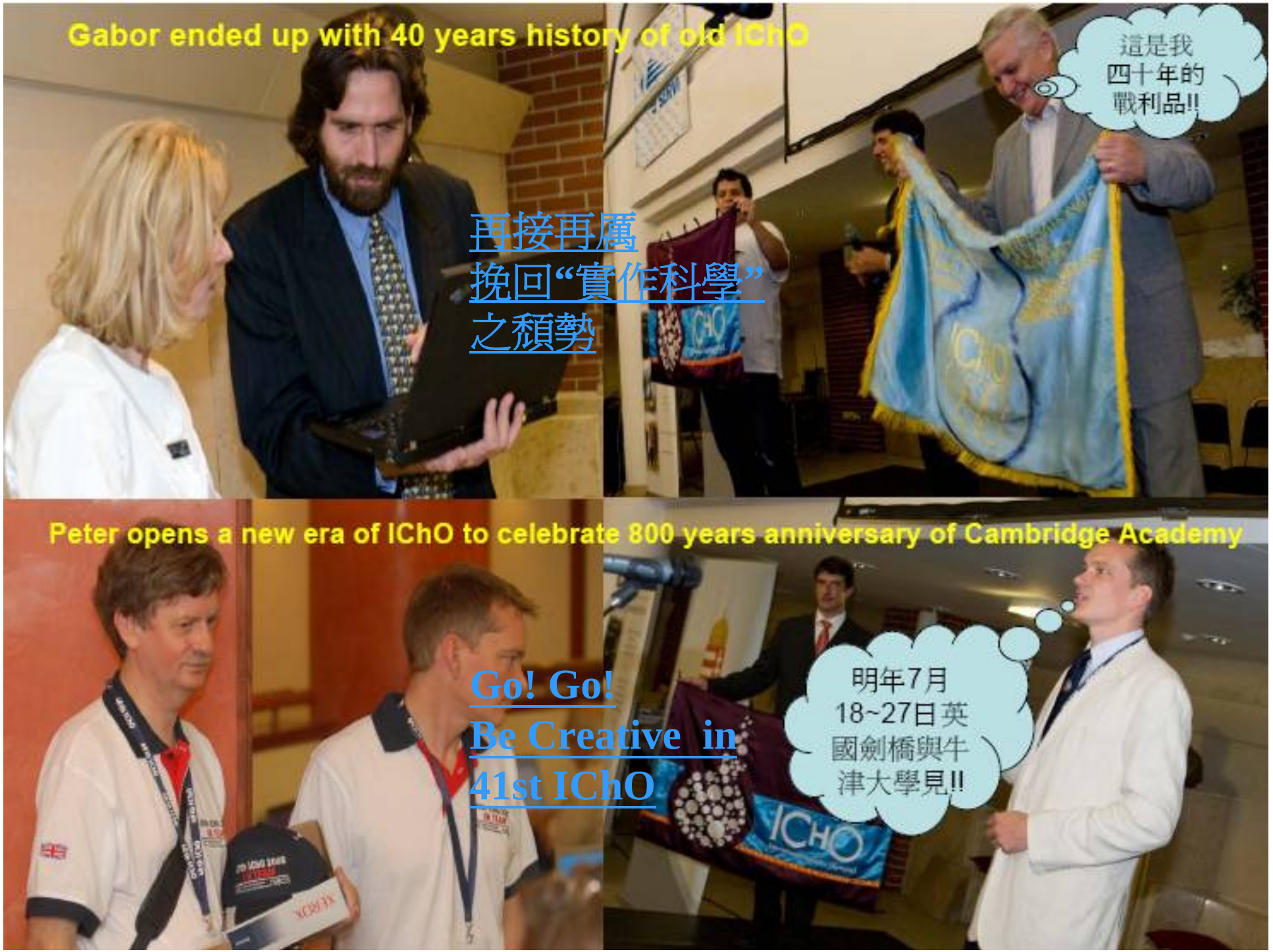
Newton's Law (f=ma) vs. Relativity Law ($E = mc_2$)

E=hv vs. E=kT

Bell Taiwan Lab: NTU “new physics“ challenge “standard model“

測量到68個正反B介子對(一億五千萬分之68的機率)衰變爲ΦKs介子的電荷宇稱隨時間演變質(-0.96) 與理論值+731相度完全相反, 可能可以證實"超對稱理論" (8/13)

台大物理博士班學生陳凱風是新物理徵兆的測量者，他昨天透過越洋視訊會議表示，剛看到實驗數據時，他「下巴差點掉下來」。


Gabor ended up with 40 years history of old IChO
這是我
四十年的
戰利品!!
再接再厲
挽回“實作科學”
之頹勢
Peter opens a new era of IChO to celebrate 800 years anniversary of Cambridge Academy
Go! Go!
Be Creative in
41st IChO
明年7月
18~27日英
國劍橋與牛
津大學見!!
ICHO

中華民國98年7月27日／星期一 農曆己丑年六月初六

中國時報 A1 要聞 20

國際化學奧賽 我首度四金大滿貫

林志成／台北報導

在英國舉行的二〇〇九年第四十一屆國際化學奧林匹亞競賽昨天在劍橋大學閉幕，全部六十七個國家、約二五〇個選手參賽中，我國四位學生全部得到金牌，是一九九二年參賽以來，第一次「大滿貫」，團體總分也全球第一。

在國際奧林匹亞競賽中，成績排前十分之一的學生可拿到金牌。我國四名學生在個人賽中排名分別是楊泓翊全球第三、陳洋廷第九、葉志成第十四、葉旭航第十七，四人都排在前十分之一，皆得金牌，是這次參賽國家中，唯一四名選手都奪金的國家。

台北時間昨天深夜十一時三十分頒獎典禮還在進行，確認獲得金牌的建中學生陳洋廷立即打電話回台灣告訴爸爸「我得金牌了」，兩人高興得不得了。陳洋廷還要爸爸趕緊打電話告訴他的建中老師，分享喜悅。陳爸爸說，洋廷今年大學甄選入學時，同時考上台大電機系及台大化學系，他決定選自己所愛的化學系，很有想法。

▶我國參加國際化學奧林匹亞競賽四位學生全得金牌，由左至右是建中陳洋廷、師大附中葉志成、台中一中葉旭航。坐者是台南一中楊泓翊。（教育部提供）

我代表隊由台師大化學系教授方泰山率領前往英國參賽，經過數天激戰，比賽結果揭曉。我國自一九九二年開始參加國際化學奧林匹亞競賽，曾在一九九三年、一九九七年兩度得到世界第一。今年是首度得到四面金牌。

依教育部公布的國際數理學科奧賽績優學生升學優待辦法，奧賽獲金、銀、銅牌分別可得二十萬元、十萬元與五萬元獎金，且都可保送大學院校化學系。

葉志成從小父母就非常注意他的教育，並用心營造外語學習環境，他的語文能力相當優秀，日文、英文是強項。他高一開始對化學產生興趣。九月起進台大化學系就讀。

葉旭航去年即代表我國參加第十九屆國際生物奧賽獲金牌。九月他將進台大醫學系就讀。

楊泓翊是今年我代表團年紀最輕的國手，他從小便對數理學科相當有興趣，期許自己抱持最初求知若渴的熱忱學習他喜愛的化學。

責任副總編輯／張景為 編輯／林佳綠

自由時報

台灣今年有4名高中生參加國際化學奧林匹亞競賽，囊括4金，創參賽以來最好成績。站者由左而右是陳洋廷、葉志成、葉旭航，坐者是楊泓翊。（教育部提供）

化學奧賽四金大滿貫 全球第一

楊泓翊 排名全球第三

（記者胡清暉／台北報導）台灣參加今年國際化學奧林匹亞競賽傳回捷報，四位代表選手獲得四金的「大滿貫」，創下台灣參賽以來獲得金牌最多的紀錄，團隊成績全球第一，同時也是唯一全部選手獲金牌的國家。其中，成績最好的是今年升上台南一中二年級的楊泓翊，他也是今年代表團年紀最小的選手，排名全球第三。

今年國際化學奧林匹亞競賽在英國舉行，共六十七國、約二百五十名選手，昨晚於英國劍橋大學頒獎。台灣今年共選派四名高中學生參賽，由台灣師範大學化學系教授方泰山負責培訓，成員除了楊泓翊之外，還包括建中陳洋廷、師大附中葉志成、台中一中葉旭航，四人均獲得金牌。

根據教育部統計，台灣歷年參加國際化學奧林匹亞競賽，在一九九三、一九九七年分別以二金二銀、二金一銀一銅拿下國際排名第一，二〇〇六年獲得三金一銀，國際排名第二，去年二金一銀一銅，國際排名第五，今年四金，創下十八年來最好成績。

年紀最小的楊泓翊，從小便對數理學科相當有興趣，小六時就代表我國參加印尼主辦的科學奧林匹亞競賽，除課業競賽，他喜歡球類及各種運動，其中最喜歡的就是羽球及空手道。

陳洋廷、葉志成進台大

陳洋廷、葉志成都準備進入台大化學系就讀。此次排名全球第九的陳洋廷，國中時常在學校實驗室操作各式實驗，在建中資優班就讀期間，專題研究課程讓他受益良多，平日喜歡閱讀小說、散文、傳記及看電影，未來立志要從事科學研究。

至於今年甫從師大附中畢業的葉志成，從小便時常閱讀外文推理小說，日文和英文都是他的強項，高一時參加儀隊，高二時擔任社長，增進了他人際溝通的技巧和處事能力。

葉旭航 去年生物賽摘金

曾參與台中一中「高瞻計畫」生化班生物組的葉旭航，藉由參與專題課程，深入接觸生物研究的奧妙，此外，時常閱讀文學作品，對音樂及運動都很有興趣，也很喜歡彈鋼琴、下圍棋。

葉旭航去年代表台灣參加國際生物奧林匹亞競賽就已榮獲金牌，這次參加化學奧林匹亞競賽又奪一金，今年將進入台大醫學系就讀。

小啓：今日「教育最前線」專版暨機智達人專欄暫停乙次。

中華民國卅九年十月二日創刊 社址／台北市大理街一三二號 創辦人／余紀忠 榮譽董
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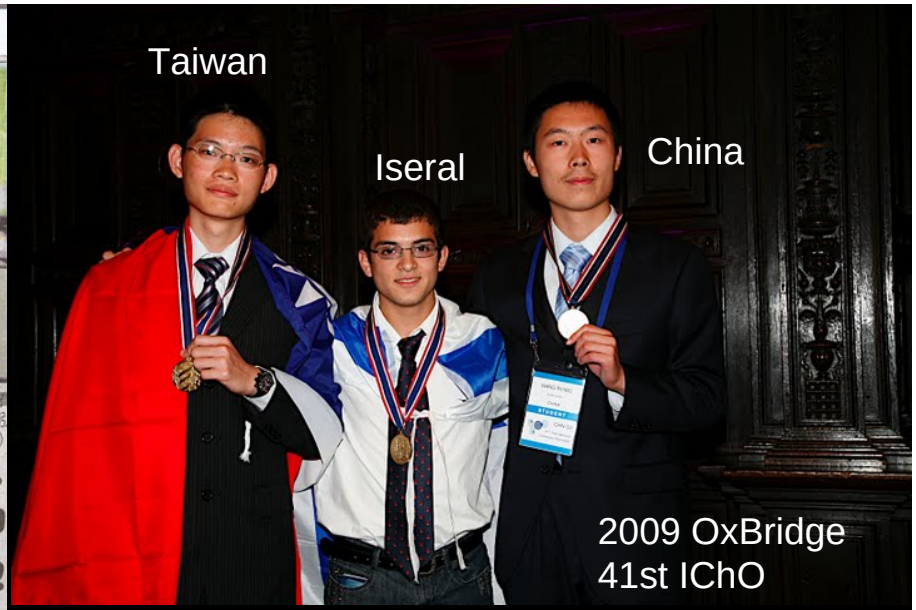

神勇的台灣代表團榮獲2009年英國牛橋高能“電荷分離”的第41屆國際化學奧林匹亞
4金大滿貫、名列全球第一

Efficiency of the (Tradition and Simplified) Chinese and English Font)

23/08/09 - The practical and theoretical examination papers can now be found online.

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41stIChO-Practical-Taiwan.pdf(678k)

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41st INTERNATIONAL CHEMISTRY OLYMPIAD
UK JULY 18-27, 2009

NAME:

STUDENT CODE: CHN-S3

说 明

- 确保在每一页试卷（也是答卷）页眉上提供的位置处已写上你的姓名和参赛号。
- 考试时间为 5 小时。只有发出开始（START）的指令后方可开始答题。
- 只能使用组委会提供的计算器。
- 所有解答必须写在指定的框内，写在其他地方的任何解答均不予评分。若需要，可在试（答）卷纸背面打草稿。
- 必要时，须示出计算过程，并写在适当的框内。若只写出最终的正确结果而无计算过程，则不得分。
- 无正确单位的数字答案毫无意义。应有单位的地方而无单位，将加重扣分。你也要注意正确使用有效数字。
- 所有气体均按理想气体处理。
- 当发出停止（STOP）指令后必须立即停止答题。拖延时间将取消你的考试资格。
- 做完试题后，必须将试（答）卷装入提供的信封，但不要封口。
- 未经监考人员允许，不得离开考试大楼。
- 本试（答）卷共 42 页（不含封页）。
- 若提出要求，可提供本试题的英文版本（The official English version）。

41st INTERNATIONAL CHEMISTRY OLYMPIAD
UK JULY 18-27, 2009

NAME:

STUDENT CODE: UK-S4

Instructions

- Ensure that your name and student code are written in the spaces provided at the top of each page.
- You have 5 hours to work on the problems. Begin only when the START command is given.
- Use only the calculator provided.
- All results must be written in the appropriate boxes. Anything written elsewhere will not be marked. Use the reverse of the sheets if you need scrap paper.
- Write any relevant calculations in the appropriate boxes when necessary. If you provide no working and only the correct result for a complicated calculation, you will receive no marks.
- **Numerical answers are meaningless without the appropriate units. You will be heavily penalised if units are not given where required.** You should also take care to report answers to an appropriate number of significant figures.
- Treat all gases as ideal.
- You must stop work immediately when the STOP command is given. A delay in doing this may lead to your disqualification from the exam.
- When you have finished the examination, you must put your papers into the envelope provided. Do not seal the envelope.
- Do not leave the examination hall until instructed by the supervisors.
- This examination has **42** pages.
- The official English version of this examination is available on request only for clarification.

41st INTERNATIONAL CHEMISTRY OLYMPIAD
UK JULY 18-27, 2009

學生姓名：

學生代碼：TWN-S4

一般規定

- 確定在每一頁寫下你的姓名。
- 考試時間共 5 個小時。要等到宣布開始後才能作答。
- 只能用主辦單位所提供的計算機。
- 所有的答案必須寫在指定的區域。寫在任何其它地方，都不予計分。可用本卷的反面作為草稿紙。
- 寫下所有相關計算，若一複雜的計算只有正確答案而無過程或計算式，將不予計分。
- 所有答案為數字者，一定要有單位。若無單位，會被扣很多分。你須注意答案的有效數字。
- 所有的氣體都可看成是理想氣體。
- 在停止作答命令宣布後，你需要立刻停止作答，延後停止作答可導致喪失資格。
- 完成考試後將所有試卷，置入信封，不要封住信封。
- 保持坐在自己的位子上，直到被通知離開。
- 本試題共 41 頁。
- 主辦單位可提供英文試卷。

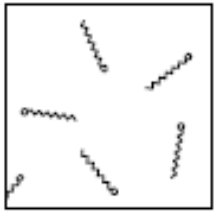
關鍵性的勝利實作試題 (38藍分,佔總分14%紅分)"利用微導電度計測量界面活性劑的臨界微胞電荷分離濃度"

Gold Metal Key P3 Task of the 41st OxBridge 2009 IChO):

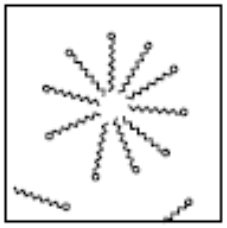
The Critical Micelle Concentration of a Surfactant

關鍵性的勝利實作試題 P3: (38 藍分,佔總分 14%紅分)

"利用微導電度計測量界面活性劑的臨界微胞電荷分離濃度"



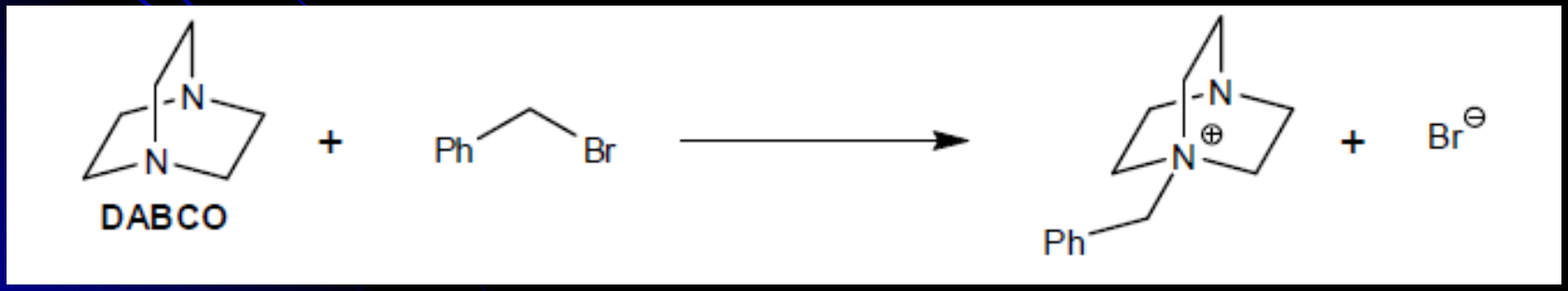
在低濃度時，SDS 只有自由的分子單體;



在高濃度時 SDS 的微胞與一些自由的分子單體

呼應準備題(In response to the 41st OxBridge 2009 IChO Preparatory "**Problem P5 "-**

"The Menshutkin Reaction"—SN2



The not-so-periodic table of the International ... ads

聖母(天主)與聖子(基督)的電荷分離(取材自CHATSWORTH HOUSE & GARDEN典藏)

結論

1.社會的進步是由有創意的人推動，而由有細心與耐心的人去執行的。資優教育與通才教育都 是造成社會進步的主因，因此從教育的角度，兩者都需要行政者的重視與政府的資源，缺一不可。
2.資優與通才分野定在那裡，決定教育資源如何投入。
3.資優教育應多做少說，以降低被培育的社會壓力與一般大眾的情緒反彈。
4.鼓勵文史教師用中文教西方文化，而英文教師用英文教大中華文化。

Conclusion

1. **Social progress is driven by the creative people, and is implemented by the careful and patience people 。 The implementation of both gifted education and/or general education is the main cause of the social progress, therefore, from an educational point of view, both those who need administrative attention and government resources, are indispensable。**
2. **Fixed the driving force line between the gifted and versatile, there comes to decide how to invest resources for the creative education。**
3. **The hide-gifted education should do more to reduce the societal pressure that has been fostered by the general public back-lash。**
4. **Encourage “Chinese” and “History” teacher to teach western civilization with Chinese, whereas that of English teacher to teach Chinese civilization with English.**


Thank you very much
for your attention
and
Your comment is
highly appreciated
謝謝！ 聆聽！
敬請指教!!