

Chinese Contributions to the World of Science During the Past 100 Years

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演讲者
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华人百年科学成就

Acknowledgements: Most Data Were Adapted from Wikipedia and Other Sources from Web

Chinese (ethnic Chinese from the Greater China area and the rest of the world) have made great contributions to the world of science during the past 100 years in

Physics

Chemistry

Biology

Agriculture

Technology

Mathematics

.....

China has come a long way



3 days ago, China launched the 2nd Lunar Orbiter



50 years ago, they started building China's S&T infrastructure



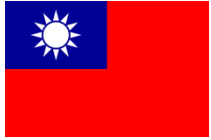
2,300 years ago, the Chinese abacus was invented



1,600 years ago, he proved $3.1415926 < \pi < 3.1415927$

During Past 100 Years, China has experienced a lot

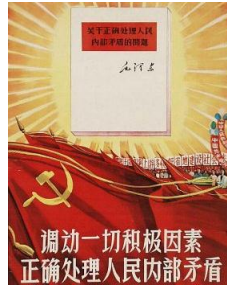
ROC: 1912-



100 Flower Moment: 1956



Long March: 1934-'36



PRC&USA : 1979/1/1



Special Economic Zone: 1980



Expo 2010

CPC: 1921-



PRC: 1949-



Mao Death: 1976/9/9



1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010



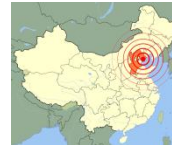
Qing: 1644-1912



Japanese Invasion: 1931/9/18



Japan Surrender: 1945



Tangshan Earthquake: 1976



HK to PRC: 1997/7/1



May 4th Movement 1919



Nanking Massacre: 1937-'38

Culture Revolution: 1966-76



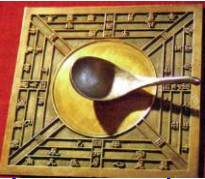
Tiananmen Protest: 1989/6/4



Major Science & Tech Advances in China Over 100 Years



Gun Powder



Compass



Printing



Paper Making



K. C. Wang:
Cloud Chamber



1930 1940



Y. H. Woo: Compton Effect (1927)

C. H. Teng: Bombs



1st A-bomb: 1964



1st Nobel: 1957

1960

Bovine insulin: 1965



1st Yangtze Bridge: 1968



1st Satellite: 1970



1st H-bomb: 1967

1970

Father of Hybrid Rice



1st Fields Medalist: 1982

1980

2nd Nobel: 1976



1990

H. S. Tsien: Spacecraft



China 1st Man in Space: 2003



D. C. Tusi: 1998



China 1st Spacewalk: 2008



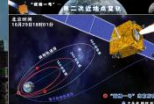
2000

2010

C. K. Kao: 2009



HZ Bay Bg (36km): '08



Lunar: '07

Shenzhou 1: 1999



Contributions in Physics



Born 26 February 1897
Jiangxi, Qing Dynasty China

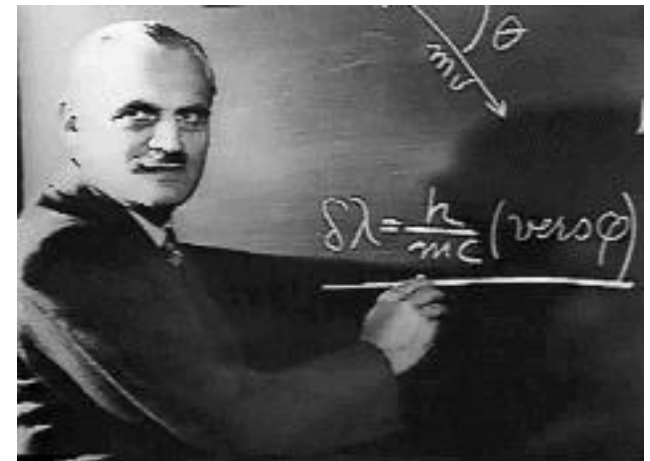
Died 30 November 1977 (aged 80)
Beijing

Institutions Tsinghua University
National Central University

Alma mater University of Chicago

Known for Compton Effect

□ When he was a graduate student at the University of Chicago he studied x-ray and electron scattering, and verified the Compton effect which gave the Nobel Prize in Physics.



Prof. Y. H. Woo (吴有训) [1897-1977]: Verifying Compton Effect Allowing Compton to Win Nobel (1927)



**Prof. C.Y. Chao (赵忠尧) [1902-1998]:
Nuclear Physicists, scattering of gamma rays**

❑ Chao earned a Ph.D. degree in physics under supervision of Nobel Prize laureate Robert Andrews Millikan at the California Institute of Technology in 1930.

❑ Chao studied the scattering of gamma rays in lead by pair production in 1930. When the positron was discovered by Carl David Anderson in 1932, confirming the existence of Paul Dirac's "antimatter", it became clear that positrons could explain Chao's earlier experiments, with the gamma rays being emitted from electron-positron annihilation.



Anderson (Nobel, 1936)



Millikan (Nobel, 1923)



Prof. K. C. Wang(王淦昌) [1907-1998]:
Nuclear Physicists, work leading to two Nobels

2010/10/3

Born	May 28, 1907 Changshu, Jiangsu, China
Died	December 10, 1998 (aged 91) Beijing, China
Alma mater	Qinghua University University of Berlin
Doctoral advisor	Lise Meitner
Known for	anti-sigma minus hyperon
Influenced	Frederick Reines
Notable awards	JINR Prize (1961)
	National Natural Science Award (1982)
	National Science and Technology Progress Award (1985) Two Bombs and One Satellite Meritorious Award (1999)

❑ In 1930, Wang first proposed to use a cloud chamber and experiment conducted one year later by the English physicist **James Chadwick**, thus discovering a new type of particle, the neutron, **1935 Nobel**.

❑ Wang first proposed the use of beta-capture to detect the neutrino in 1941. **Frederick Reines and Clyde Cowan** employed his suggestion and detected the neutrino in 1956 **winning 1995 Nobel**.

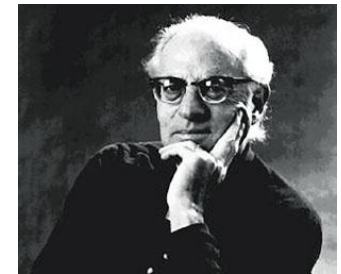
❑ Wang also led a group to **discover the anti-sigma minus** hyperon particle at Joint Institute for Nuclear Research, Dubna, Russia in 1959.



Chadwick (Nobel, 1935)



Reines (Nobel, 1995)



Cowan (Nobel, 1995)



Prof. H. W. Peng(彭桓武) [1915-2007]:

Study with Max Born and Developed HHP Theory with Walter Heitler and James Hamilton to study cosmic ray,

- ❑ Peng studied at University of Edinburgh and worked with prominent physicist Max Born.
- ❑ Peng obtained his degree in philosophy and science doctorate degree in 1940 and 1945, respectively.
- ❑ In 1941, Peng went to research at Dublin Institute for Advanced Studies. From August 1941 to July 1943, Peng cooperated with Walter Heitler and James Hamilton to study cosmic ray, and developed HHP theory.
- ❑ Together with Born, Peng was awarded Macdougall–Brisbane prize by Royal Society of Edinburgh in 1945. He was elected as a member of Royal Irish Academy in 1948.



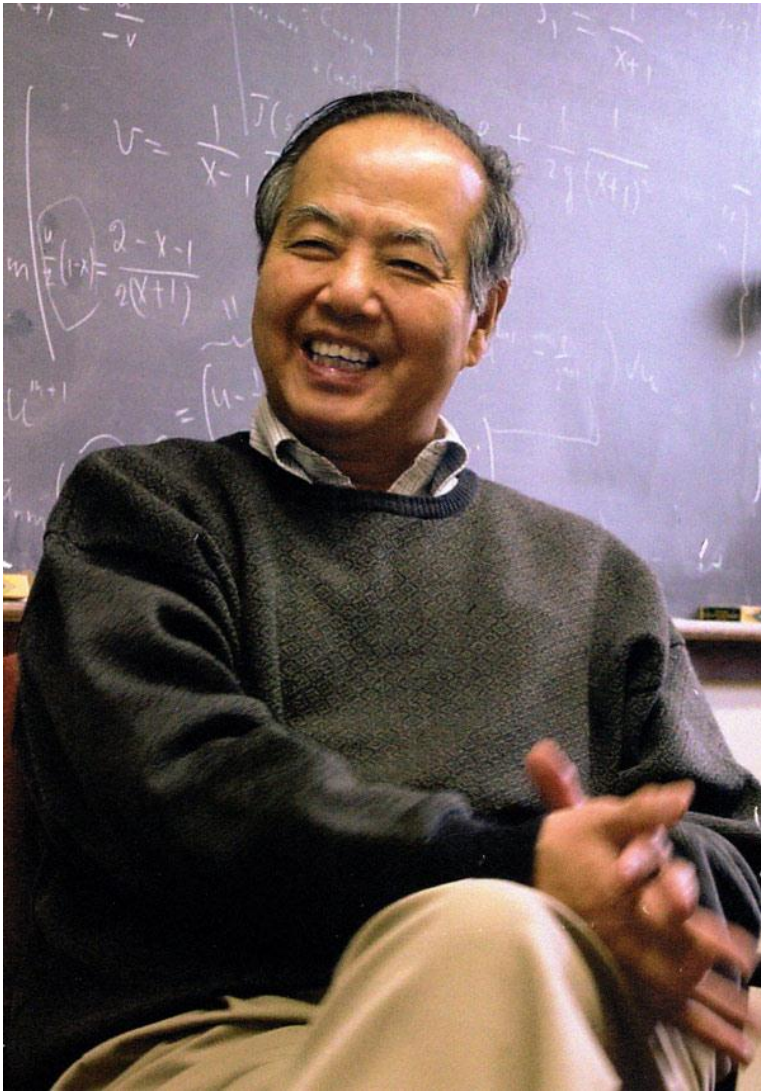
Ph.D. Advisor: Max Born (Nobel, 1954)



Prof. H. S. Tsien [1911-2009]:

Father of China's A- and H-bombs and Spacecraft

Born	December 11, 1911 Hangzhou, China
Died	October 31, 2009 (aged 97) Beijing, China
Fields	Aeronautics
Institutions	California Institute of Technology
Alma mater	Shanghai Jiao Tong University MIT California Institute of Technology
Doctoral advisor	Theodore von Kármán
Known for	Jet Propulsion Laboratory China's Space Programs



**Prof. T. D. Lee: Nobel Prize (1957) Winner in Physics
For Discovery of Parity Non-Conservation
Leading to other Important Discoveries**

2010/10/3

Born	24 November 1926 Shanghai, China
Institutions	Columbia University
Alma mater	Zhejiang University National Southwestern Associated University University of Chicago
Doctoral advisor	Enrico Fermi
Known for	Parity violation Lee Model Non-topological solitons Particle Physics Relativistic Heavy Ion (RHIC) Physics
Notable awards	Nobel Prize in Physics (1957) Albert Einstein Award (1957)



Born	1 October 1922, Hefei, Anhui, China
Institutions	Institute for Advanced Study Stony Brook University Chinese University of Hong Kong Tsinghua University University of Chicago
Alma mater	National Southwestern Associated University Tsinghua University University of Chicago
Doctoral advisor	Edward Teller
Known for	Parity violation Yang-Mills theory Yang-Baxter equation
Notable awards	Nobel Prize in Physics (1957) Rumford Prize (1980) National Medal of Science (1986) Benjamin Franklin Medal (1993) Albert Einstein Medal (1995)

**Prof. C. N. Yang: Nobel Prize (1957) Winner in Physics
For Discovery of Parity Non-Conservation
Leading to other Important Discoveries**

2010/10/3



**Prof. C. S. Wu: Wolf Prize (1978) Winner
For Parity Non-Conservation Experiment**

2010/10/3

Born	May 31, 1912, Shanghai, China
Died	February 16, 1997 (aged 84) New York City
Institutions	Institute of Physics, Academia Sinica University of California at Berkeley Smith College Princeton University Columbia University
Alma mater	China National Central University Zhejiang University University of California at Berkeley
Doctoral advisor	Ernest Lawrence
Known for	Parity violation experiments Beta decay research The Manhattan Project
Notable awards	Wolf Prize (1978) National Medal of Science (1975) Bonner Prize (1975)



**Prof. Sam C. C. Ting: Nobel Prize (1976) Winner in Physics
For discovery of a heavy elementary particle of a new kind**

Born	January 27, 1936, Ann Arbor, Michigan
Institutions	European Organization for Nuclear Research (CERN) Columbia University MIT
Alma mater	University of Michigan
Doctoral advisor	L. W. Jones, M. L. Perl
Known for	Discovery of the J/ψ particle
Notable awards	Nobel Prize for Physics (1976) Ernest Orlando Lawrence Award (1975) De Gasperi Award (1988)

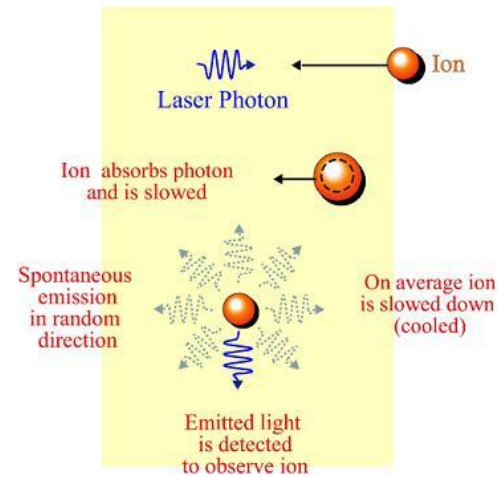
J/ψ Particle: Their discovery of the meson particle has led to rapid changes in high-energy physics at the time, which was then known as "November Revolution", referring to the date of the discovery: November 11, 1974.



Secretary Steven Chu: Nobel Prize (1997) Winner in Physics
for development of methods to cool and trap atoms with laser light

2010/10/3

Born	February 28, 1948 St. Louis, Missouri
Alma mater	University of Rochester (B.A./B.S.) University of California, Berkeley (Ph.D.)
Profession	Scientist (Experimental physics) (Nobel Laureate 1997) 12 th US Department of Energy Secretary



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Born	February 28, 1939 Henan, China
Fields	Experimental physics Electrical engineering
Institutions	Princeton University Bell Laboratories
Alma mater	University of Chicago (Ph.D.) Augustana College (B.S.)
Known for	Quantum Hall effect
Notable awards	Nobel Prize in Physics (1998)

**Prof. D. C. Tsui: Nobel Prize (1998) Winner in Physics
for Quantum Hall Effect**

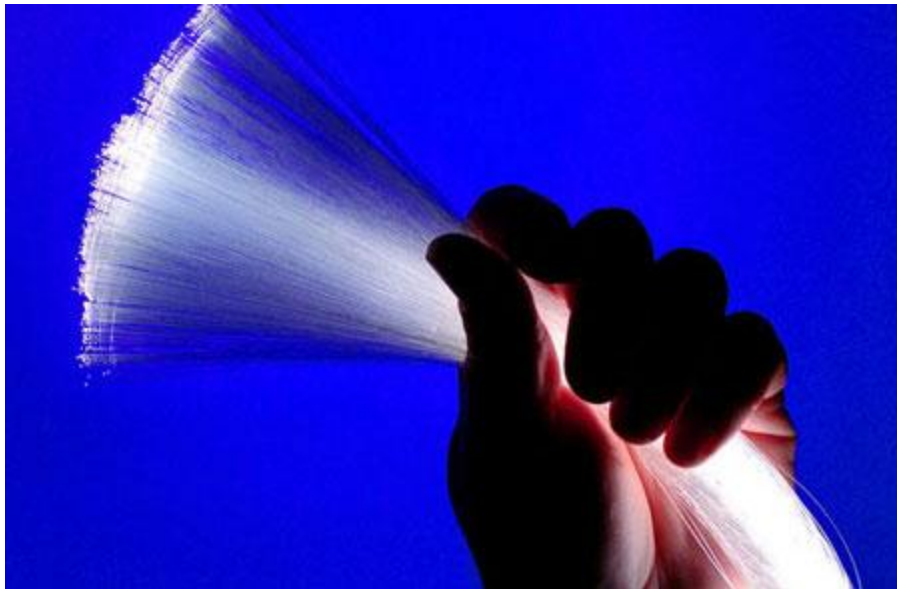
2010/10/3



Prof. C. K. Kao: Nobel Prize (2009) Winner in Physics for Fiber Optic

Born	4 November 1933, Shanghai, China
Institutions	Chinese University of Hong Kong ITT Corporation Standard Telephones and Cables
Alma mater	University College London (Ph.D. 1965, issued by University of London) Woolwich Polytechnic (B.S. 1957, issued by University of London) St. Joseph's College, Hong Kong (1952)
Doctoral advisor	Harold Barlow
Known for	Fiber optics Fiber-optic communication
Notable awards	IEEE Morris N. Liebmann Memorial Award (1978) IEEE Alexander Graham Bell Medal (1985) Marconi Prize (1985) Faraday Medal (1989) James C. McGroddy Prize for New Materials (1989) Prince Philip Medal (1996) Japan Prize (1996) 3463 Kaokuen (1996) Charles Stark Draper Prize (1999) Asian of the Century (1999) Nobel Prize in Physics (2009) Grand Bauhinia Medal (2010)

Prof. Dr. C. K. Kao, the Father of Fiber Optics



**Groundbreaking achievements
concerning the transmission of light in
fibers for optical communication**

2010/10/3

❑ In 1965, Kao with Hockham concluded that the fundamental limitation for glass light attenuation is below 20 dB/km, only 1/50 commonly believed limit then.

❑ Kao proposed that such glass fiber could be used for long-distance information transfer and his ideas were widely disbelieved.

❑ 1968, Kao with M. W. Jones measured the intrinsic loss of bulk-fused silica at 4 dB/km, the first evidence of ultra-transparent glass

❑ Bell Labs in Villarceaux, France, tested carry 155 channels, each 100 Gbit/s over a 7000 km fiber. Recently, Bell Labs broke a 100 Petabit per second kilometer barrier

❑ NTT sends 69.1 Tbit/s over a single 240 km fibre.

Contributions in Chemistry



Prof. Auqin Tang (唐敖庆) [1915-2008]:
Quantum Chemist

Born	November 18, 1915 Jiangsu, China
Died	July 15, 2008 (aged 93) Beijing, China
Fields	Quantum Chemistry
Alma mater	Tsinghua University Columbia University
Known for	Statistical theory of chemical reactions

- ❑ In 1950s, he derived the potential function for computing the rotational energy variation properties.
- ❑ In 1960s, he proposed the theoretical model of the Ligand Field Theory. Awarded National Natural Science First Prize in 1982 for this work.
- ❑ In 1970s, he introduced three theorems for systematic analysis of the Molecular orbital graph theory



Born	November 19, 1936 Hsinchu City, Taiwan
Institutions	University of Chicago Lawrence Berkeley National Laboratory University of California, Berkeley Academia Sinica (Taiwan)
Alma mater	National Taiwan University (B.Sc.) National TsingHua University (M.S.) University of California, Berkeley (Ph.D.)
Notable awards	Nobel Prize in Chemistry (1986)

**Prof. Y.T. Lee: Nobel Prize (1986) Winner in Chemistry
for dynamics of chemical elementary processes**



**Prof. Roger Y. Tsien: Nobel Prize (2008) Winner in Chemistry
For Discovery of Green Fluorescent Protein**

Born	February 1, 1952, New York City
Residence	San Diego, California
Fields	Biochemistry
Institutions	UC San Diego UC Berkeley
Alma mater	Harvard University University of Cambridge
Known for	Green Fluorescent Protein Calcium imaging
Notable awards	Nobel Prize in Chemistry (2008) E. B. Wilson Medal (2008) Rosenstiel Award (2006) Wolf Prize in Medicine (2004) Keio Medical Science Prize (2004) Dr A.H. Heineken Prize (2002) Artois-Baillet Latour Health Prize (1995) Gairdner Foundation International Award (1995)

Contributions in **Biology**

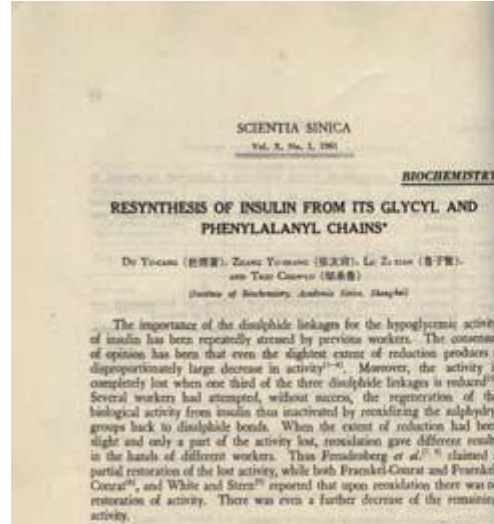
The total synthesis of crystalline bovine insulin (结晶牛胰岛素合成) fully accomplished in 1965



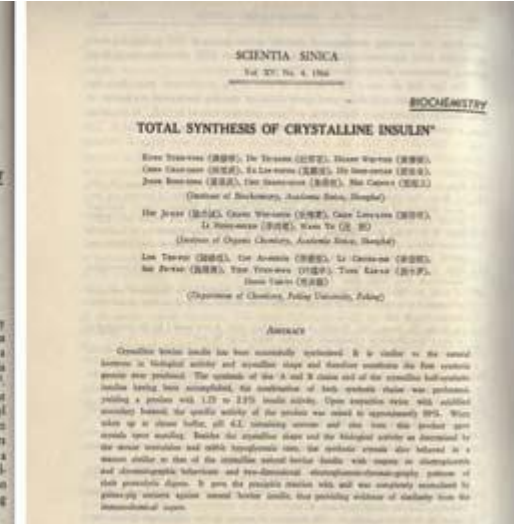
Researchers of Institute of Biochemistry. Taken in front of the institute building during the National Day of 1959.



Evaluation meeting. Taken in December 13, 1978. Council Members of the Chinese Academy of Sciences were seated, researchers involved were standing.



1. Du Y C, Chang Y S, Lu Z X, et al. Resynthesis of insulin from its glycyL- and phenylalanyl chains. *Sci Sin*, 1961, 10: 84–104



1. Kong Y T, Du Y C, Huang W T, et al. Total synthesis of crystalline bovine insulin. *Sci Sin*, 1966, 15: 544–561

Source: Zhang Y S. The first protein ever synthesized *in vitro*—a personal reminiscence of the total synthesis of crystalline insulin. *Sci China Life Sci*, 2010, 53: 16–18, doi: 10.1007/s11427-010-0008-5

Contributions in Agriculture

Yuan Longping (袁隆平), The father of hybrid rice



Yuan Longping (袁隆平) [1930-]: Father of hybrid rice

- ❑ Since first cultivation of in 1976, Yuan's hybrid rice has been grown in dozens of countries in Africa, America, and Asia (India, Vietnam, Myanmar and Bangladesh)—providing a robust food source in high famine risk areas.
- ❑ By his achievement, the Earth is able to produce extra rice equivalent to the food requirement by 60,000,000 people. The Yuan's "Super Rice" he is testing expects to yield 30% more than those of common rice.
- ❑ 60% of China's total rice grown is of Yuan's hybrid rice species. Worldwide, 20% rice production is through Yuan's methodology.
- ❑ In 1979, his technique for hybrid rice was introduced into the United States, the first case of intellectual property rights transfer from new China.
- ❑ Awards: State Preeminent Science and Technology Award of China in 2000, the Wolf Prize in agriculture and the World Food Prize in 2004. A foreign associate of the U.S. National Academy of Sciences (2006)

Contributions in Mathematics



Prof. S. S. Chern: Wolf Prize (1983) Winner in Mathematics

Born	October 26, 1911, Zhejiang, China
Died	December 3, 2004 (aged 93) Tianjin, China
Institutions	Tsinghua University Institute for Advanced Study University of Chicago University of California, Berkeley Nankai University CMS
Alma mater	Nankai University Tsinghua University University of Hamburg
Doctoral advisor	Wilhelm Blaschke
Known for	Chern–Simons theory Chern–Weil theory Chern class
Notable awards	National Medal of Science (1975) Wolf Prize (1983) Lobachevsky Medal (2002) Shaw Prize (2004)

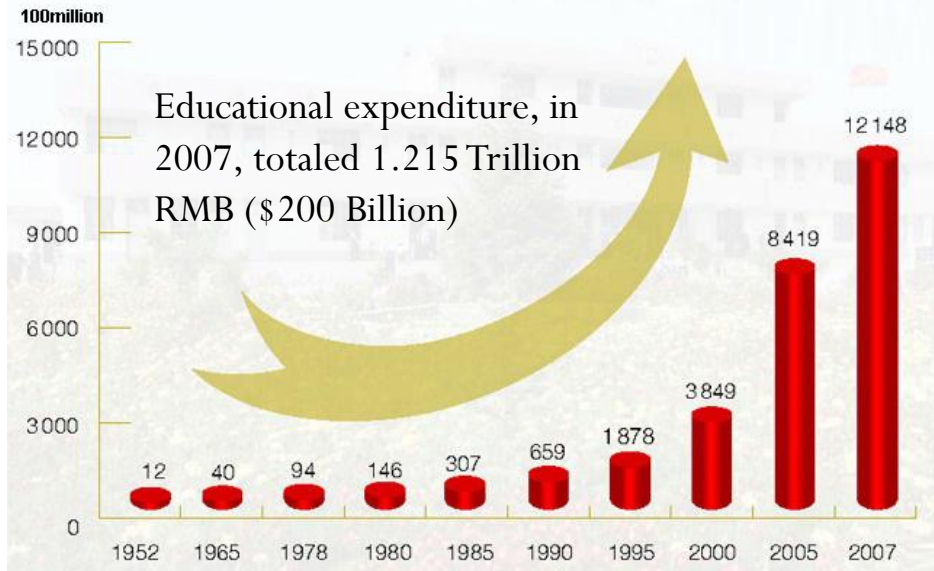


Prof. S.T. Yau: Fields Medalist (1982)

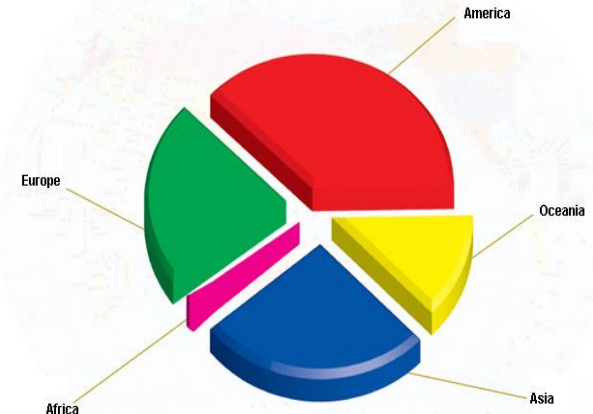
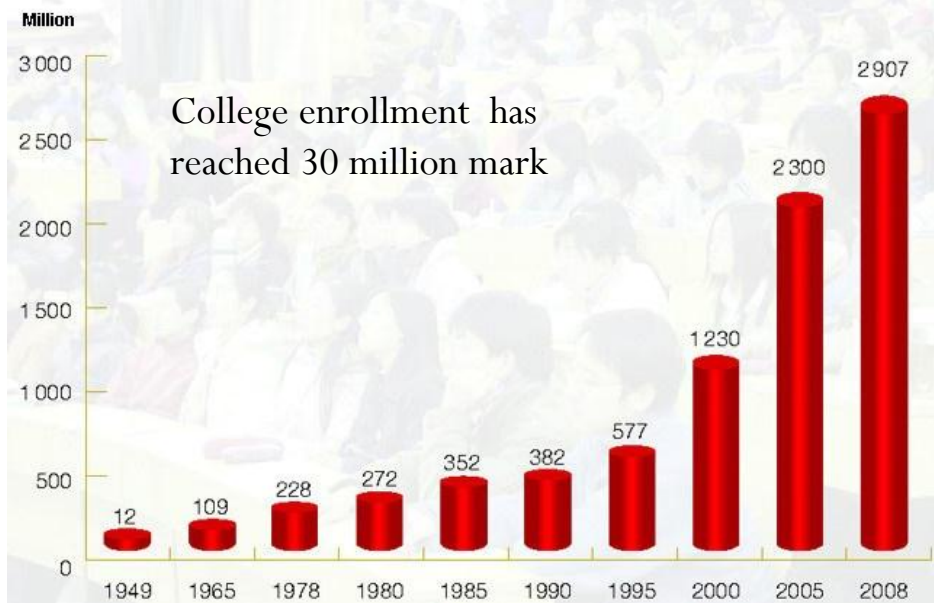
Born	April 4, 1949 Shantou, Guangdong, China
Fields	Mathematics
Institutions	Harvard University, Chinese University of Hong Kong Zhejiang University
Alma mater	Chinese University of Hong Kong (B.A. 1969) University of California, Berkeley (Ph. D 1971)
Doctoral advisor	Shiing-Shen Chern
Notable awards	Veblen Prize (1981) Fields Medal (1982) Crawford Prize (1994) National Medal of Science (1997) Wolf Prize (2010)

The next 100 years?

Chinese are making new efforts in education



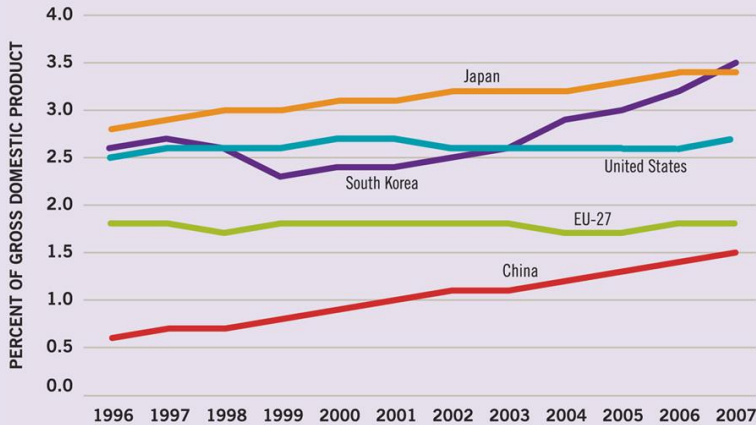
- Of 26,891 Ph.D.'s in S&E in US in 2003, 2,500 (9.2%) were born in China (NSF 2007)
- Ph.D.'s in 2006 more likely got undergraduate studies at Tsinghua or Peking than any US universities, e.g., Berkeley (Melvis 2008)
- As of 2000, 8.9% of doctorate holders in U.S. science and engineering occupations were born in China (NSF 2007)



1,400,000 Chinese Students Study Abroad

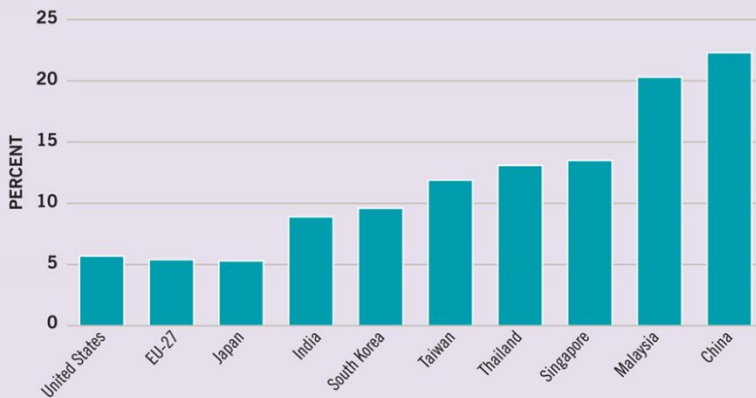
Chinese are making investment in technology

R&D expenditures as share of economic output for selected countries: 1996–2007



SEI 2010: Comparison of Country R&D Intensities, Chapter 4.

Average annual growth of R&D expenditures for United States, EU-27, and Asia-8 economies: 1996–2007



SEI 2010: Global Patterns of R&D Expenditures, Chapter 4.

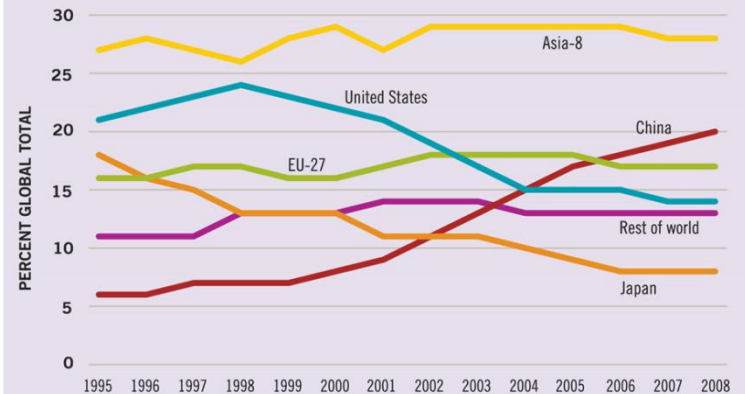
Average annual growth rates in number of researchers, by country/economy: 1995–2007



NOTE: Estimated number of researchers (in millions) is for 2007 and shown below country/economy. U.S. 2007 estimate based on long-term growth rate.

SEI 2010: Global S&E Labor Force, Chapter 3.

Exports of high-technology manufactured goods, by country/economy: 1995–2008



NOTES: China includes Hong Kong. Excludes intra-EU trade.

SEI 2010: Trade of High-Technology Goods, Chapter 6.



Even greater contributions
during the next 100 years!



Acknowledgement

- PRC Ministry of Science and Technology for Annual Report (2008)
- PRC Ministry of Education for Website and data book
- Wikipedia
- Many Other Websites that are not listed here
- Fu Foundation Professor David E. Keyes of Columbia
- The University of Akron and Professor Dean LIN, Yang
- Stony Brook and Columbia students and friends
- My daughter Julia Deng