

RAMBLING

Research and Innovation

漫谈科研与创新

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It is important to attempt more innovations
when carrying on scientific research

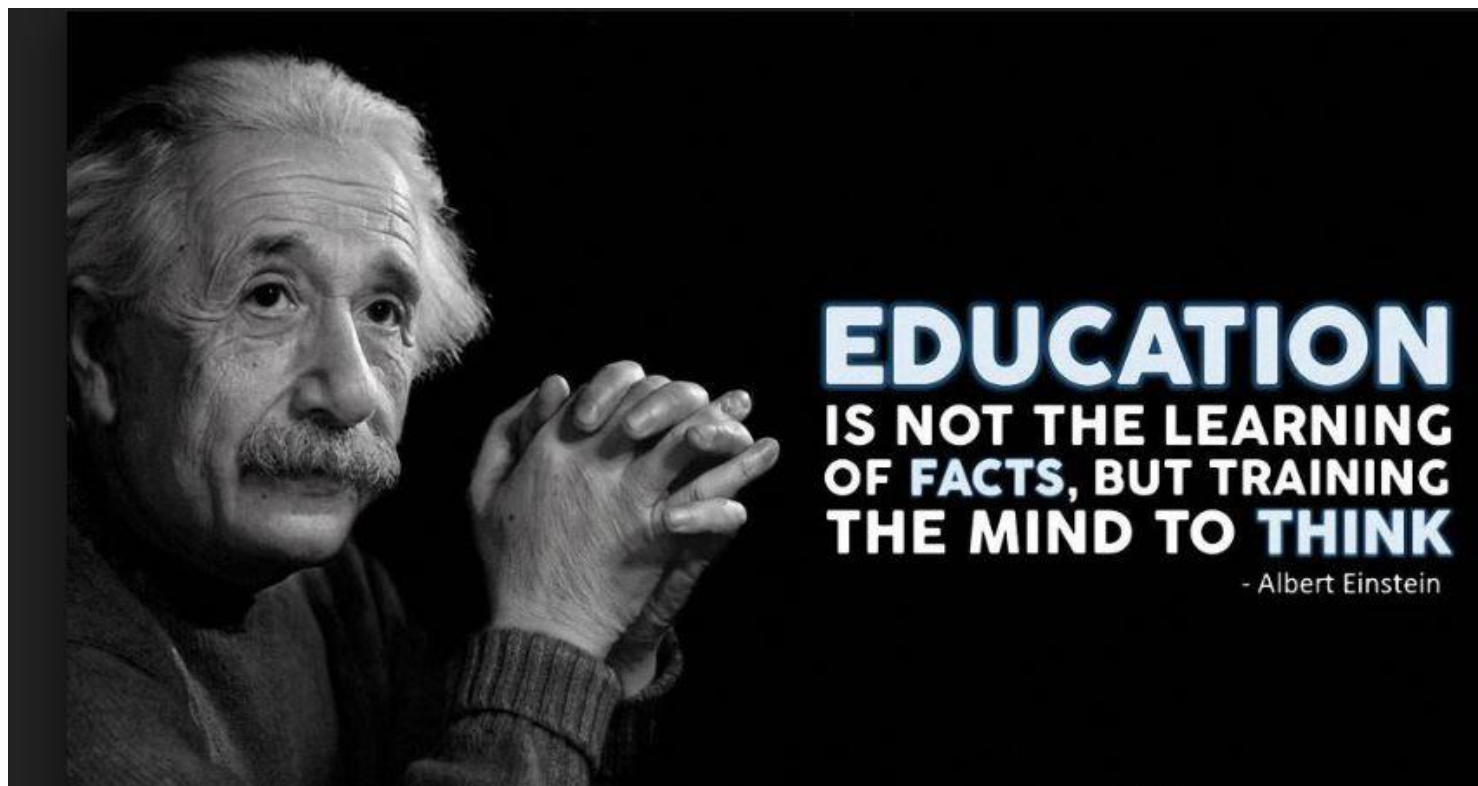
做科研要思考更多的创新

The main task in learning is to
learn to become innovative

做学问的根本在于创新

Learning is augmentation; Research is inauguration

积累叫做求学，创新才叫治学



学会了思考，那又怎么样呢？

→ 一方面能学得更多更好，另一方面能去创新

科研是一个质疑与创新的过程

Example: 光的本质

Newton (1643-1727) believed that light consists of a beam of tiny particles (“photons” 光子) moving in a straight line.

Through the whole 18th century, there was no progress in optical research.

Christiaan Huygens (1629-1695), **Robert Hooke** (1635-1703):

波动学说 Wave theory of light, but there is no experimental verification.

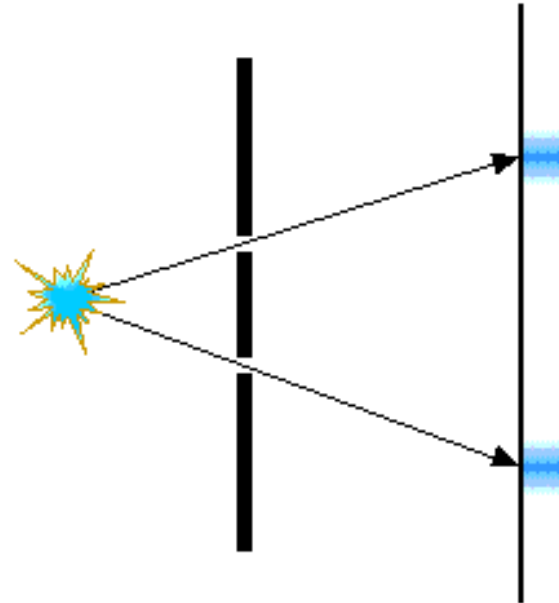
In 1801, the 28-year-old British physicist **Thomas Young** (1773-1829) successfully conducted a double-slit diffraction experiment 双缝衍射, verifying the wave theory of light.



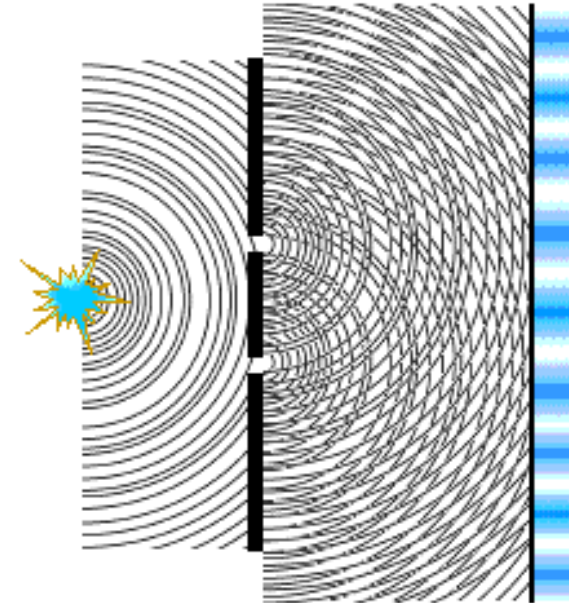
Thomas Young FRS
(13 June 1773 – 10 May 1829)

The Two Logical Possibilities

1. If light consists of particles.



2. If light consists of waves.



T. Young, “Experiments and Calculations Relative to Physical Optics”, 1804

“虽然我仰慕牛顿的大名，但我并不因此非得认为他是万无一失的。
我遗憾地看到他也会弄错，而他的权威有时甚至阻碍了科学进步”。

In Science, technology and engineering

China should contribute more

中国应对人类作出更多更大的贡献

Our young generation bears a heavy responsibility
with a long journey ahead

我国年轻一代任重而道远

**Our hope is that more and more Sci-Tech
Innovations come out from China**

希望越来越多的科技创新出自中国

“千万把自卑的心理放弃，要相信中国会产生许多国际第一流的数学家。
也没有理由中国不能产生牛顿、高斯级的数学家。”

陈省身 1990 年 10 月在台湾成功大学的演讲《陈省身文选》

中国有世界上 1/4 的人口

因此，有理由期望：

世界奥运会有 1/4 的奖牌属于中国运动员

世界科学创造和技术发明有 1/4 属于中国

China has one quarter of world's population. Therefore, it is reasonable to expect that, in the near future, about one quarter of Olympic medals would be won by Chinese athletes and about one quarter of Sci-Tech Innovations would come from China.

Dedicated to **WiE**

(Women in Engineering)

In Science

Mathematics:

Hypatia (希帕蒂娅, 370-415)
Sophie Germain (热尔曼, 1776-1831)
Sofya Kovalevskaya (柯瓦列夫斯卡娅, 1850-1891)
Emmy Noether (诺特, 1882-1938)
班昭 (49-120)
王贞仪 (1768-1797)
... ..

Physics:

Marie Curie (居里夫人, 1867-1934)
Lise Meitner (迈特纳, 1878-1968)
吴健雄 (1912 – 1997)
... ..

Chemistry and Biology:

Alice Ball (鲍尔, 1892-1916)
Barbara McClintock (麦克林托克, 1902-1992)
Dorothy Hodgkin (霍奇金, 1910-1994)
Rosalind Franklin (富兰克林, 1920-1958)
... ..

In Technology

海蒂·拉玛 Hedy Lamarr (1914-2000)

A famed American actress and the inventor of the frequency-hopping method, which is used by many communication protocols, including GPS, Bluetooth, Wi-Fi and CDMA.



跳频扩频技术的共同发明人，被誉为是“跳频扩频之母”。

第二次世界大战开始时，海蒂·拉玛与作曲家乔治·安塞尔为盟军的鱼雷开发了一套无线电导航系统，使用扩频和跳频技术成功地抗击了敌国的通讯干扰。

他们的工作原理已经融入到蓝牙和GPS技术中，与传统版本的CDMA和Wi-Fi使用的方法类似。

程序媛的故事

历史上第一个计算机程序员是英国姑娘艾达·洛夫莱斯 (Ada Lovelace, 1815-1852)，她是著名浪漫主义诗人乔治·拜伦 (George G. Byron, 1788-1824) 的女儿。

Diagram for the computation by the Engine of the Numbers of Bernoulli. See Note G. (page 722 et seq.)

Number of Operation.	Nature of Operation.	Variables acted upon.	Variables receiving results.	Indication of change in the value on any Variable.	Statement of Results.	Data.												Working Variables.				Result Variables.			
						$1V_1$	$1V_2$	$1V_3$	$1V_4$	$1V_5$	$1V_6$	$1V_7$	$1V_8$	$1V_9$	$1V_{10}$	$1V_{11}$	$1V_{12}$	$1V_{13}$	$1V_{14}$	$1V_{15}$	$1V_{16}$	$1V_{17}$	$1V_{18}$	$1V_{19}$	$1V_{20}$
						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
1	X	$1V_2 \times 1V_3$	$1V_4, 1V_5, 1V_6$	$1V_4 = 1V_2$ $1V_5 = 1V_3$ $1V_6 = 1V_2$	$= 2n \dots$...	2	n	2n	2n	2n														
2	-	$1V_4 - 1V_1$	$2V_4$	$1V_4 = 1V_4$ $1V_5 = 1V_4$ $1V_6 = 1V_4$	$= 2n - 1 \dots$	1	...	...	2n-1															
3	+	$1V_5 + 1V_1$	$2V_5$	$1V_5 = 2V_5$ $1V_6 = 2V_5$	$= 2n + 1 \dots$	1	...	...	2n+1															
4	+	$1V_6 + 2V_4$	$3V_6$	$2V_6 = 2V_6$ $2V_7 = 2V_6$ $3V_6 = 3V_6$	$= \frac{2n-1}{2n+1} \dots$			...	0	0														
5	+	$1V_{11} + 1V_2$	$2V_{11}$	$1V_{11} = 2V_{11}$ $1V_{12} = 1V_{11}$ $1V_{13} = 1V_{11}$	$= \frac{1 \cdot 2n - 1}{2 \cdot 2n + 1} \dots$	...	2	...	...	...												
6	-	$1V_{13} - 1V_{12}$	$1V_{13}$	$1V_{13} = 1V_{13}$ $1V_{14} = 1V_{13}$ $1V_{15} = 1V_{13}$	$= -\frac{1 \cdot 2n - 1}{2 \cdot 2n + 1} = A_0 \dots$	...	...	...	...	...										
7	-	$1V_8 - 1V_1$	$1V_{10}$	$1V_8 = 1V_8$ $1V_9 = 1V_8$ $1V_{10} = 1V_8$	$= n - 1 (= 3) \dots$	1	...	n	...	...													
8	+	$1V_2 + 1V_2$	$1V_7$	$1V_2 = 1V_2$ $1V_3 = 1V_2$ $1V_4 = 1V_2$	$= 2 + 0 = 2 \dots$	...	2	...	...	...												
9	+	$1V_8 + 1V_2$	$2V_{11}$	$1V_8 = 1V_8$ $1V_9 = 1V_8$ $1V_{10} = 1V_8$	$= \frac{2n}{2} = A_1 \dots$			...	...	2n	2	...	...										
10	X	$1V_{11} \times 1V_{11}$	$1V_{12}$	$1V_{11} = 1V_{11}$ $1V_{12} = 1V_{11}$ $1V_{13} = 1V_{11}$	$= B_1 \cdot \frac{2n}{2} = B_1 A_1 \dots$			...	...	...												
11	+	$1V_{12} + 1V_8$	$2V_{13}$	$1V_{12} = 1V_{12}$ $1V_{13} = 1V_{12}$ $1V_{14} = 1V_{12}$	$= -\frac{1 \cdot 2n - 1}{2 \cdot 2n + 1} + B_1 \cdot \frac{2n}{2} \dots$	...	...	...	...	...										
12	-	$1V_{10} - 1V_1$	$1V_{10}$	$1V_{10} = 1V_{10}$ $1V_{11} = 1V_{10}$ $1V_{12} = 1V_{10}$	$= n - 2 (= 2) \dots$	1	...	...	...	...											
13	-	$1V_6 - 1V_1$	$1V_8$	$1V_6 = 1V_6$ $1V_7 = 1V_6$ $1V_8 = 1V_6$	$= 2n - 1 \dots$	1	...	...	...	2n-1														
14	+	$1V_1 + 1V_2$	$2V_7$	$1V_1 = 1V_1$ $1V_2 = 1V_2$ $1V_3 = 1V_2$	$= 2 + 1 = 3 \dots$	1	...	...	...	3														
15	+	$2V_7 + 2V_2$	$3V_8$	$2V_7 = 2V_7$ $2V_8 = 2V_7$ $3V_8 = 3V_8$	$= \frac{2n-1}{3} \dots$			...	...	2n-1	3													
16	X	$1V_8 \times 2V_{11}$	$1V_{11}$	$1V_8 = 1V_8$ $1V_9 = 1V_8$ $1V_{10} = 1V_8$	$= \frac{2n-1}{2 \cdot 3} \dots$			...	...	...												
17	-	$1V_6 - 1V_1$	$1V_8$	$1V_6 = 1V_6$ $1V_7 = 1V_6$ $1V_8 = 1V_6$	$= 2n - 2 \dots$	1	...	...	...	2n-2														
18	+	$1V_1 + 2V_2$	$3V_7$	$1V_1 = 1V_1$ $1V_2 = 1V_2$ $1V_3 = 1V_2$	$= 3 + 1 = 4 \dots$	1	...	...	...	4														
19	+	$3V_7 + 2V_2$	$4V_8$	$3V_7 = 3V_7$ $3V_8 = 3V_7$ $4V_8 = 4V_8$	$= \frac{2n-2}{4} \dots$			...	...	2n-2	4													
20	X	$1V_8 \times 4V_{11}$	$1V_{11}$	$1V_8 = 1V_8$ $1V_9 = 1V_8$ $1V_{10} = 1V_8$	$= \frac{2n-1}{2 \cdot 3} \cdot \frac{2n-2}{4} = A_3 \dots$			...	...	...												
21	X	$1V_{12} \times 1V_{11}$	$1V_{12}$	$1V_{12} = 1V_{12}$ $1V_{13} = 1V_{12}$ $1V_{14} = 1V_{12}$	$= B_2 \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{3} = B_2 A_3 \dots$			...	...	...												
22	+	$2V_{12} + 2V_{11}$	$3V_{13}$	$2V_{12} = 2V_{12}$ $2V_{13} = 2V_{12}$ $3V_{13} = 3V_{13}$	$= A_0 + B_1 A_1 + B_2 A_3 \dots$	...	...	...	...	...										
23	-	$2V_{10} - 1V_1$	$1V_{10}$	$2V_{10} = 2V_{10}$ $1V_{11} = 1V_{10}$ $1V_{12} = 1V_{10}$	$= n - 3 (= 1) \dots$	1	...	...	...	...											

Here follows a repetition of Operations thirteen to twenty-three.



First computer programmer
Ada Lovelace

艾达《笔记》 (The Notes, 1842) 编写用分析机来计算伯努利数的算法程序

巾帼“码农”

Grace M. Hopper (赫柏, 1906-1992)

One of the first programmable
computer programmer



美国海军准将、耶鲁数学博士赫柏是现代计算机最早三名程序员之一。

赫柏不仅帮助开发了多种计算机语言，还发明了世界上第一个编译器，被誉为“计算机软件工程第一夫人”和“Cobol 语言之母”。

赫柏在开发最早的机电计算机 MARK II 时，一台计算机出现了故障。她发现问题出自计算机继电器中一只被夹扁的小飞蛾。赫柏将飞蛾夹在工作笔记里，并诙谐地将程序故障称为“bug”。该称谓被沿用至今。

Six Roses 六朵玫瑰：第一批现代通用电子计算机程序员

世界第一台通用电子计算机 ENIAC (Electronic Numerical Integrator And Computer) 于1946年在美国 UPenn 诞生

最早的“码农”是参与ENIAC设计的冯·诺依曼的夫人克拉拉·丹 (Klára Dán, 1911-1963)，她写下了最早的一段编码 (code)

第一批计算机编程技术员是时下芳龄二十多岁的六位姑娘：

Kathleen M Mauchly [Antonelli] (瑪拉提，1921-2006)

Frances Bilas [Spence] (比拉斯，1922-2013)

Betty J Jennings [Bartik] (詹宁斯，1924-2011)

Frances E Snyder [Holberton] (斯奈德，1917-2001)

Ruth Lichterman [Teitelbaum] (李斯特曼，1924-1986)

Marlyn Wescoff [Meltzer] (维斯科夫，1922-2008)

(方括号内的姓氏是她们结婚后的夫姓)



In Engineering

现代汽车是怎样跑起来的？

Bertha Benz:

The Woman Who Taught the World How to Drive

Everyone knows that **Karl Benz** invented the car, but it was his wife Bertha who showed him and the World how to run it for long distances



Bertha Benz taking a spin on her husband's 'Patent Motorwagen' in 1885.

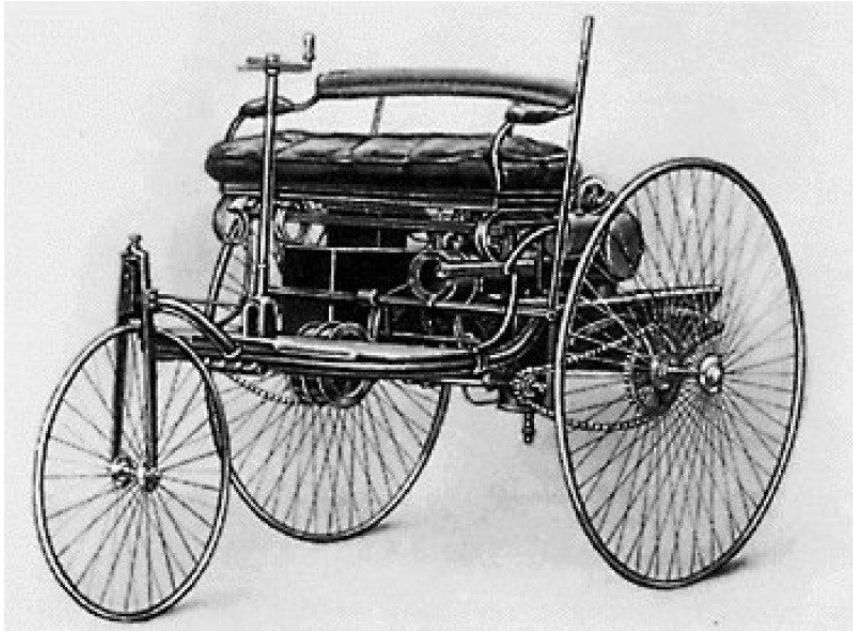
伯莎·本茨（奔驰）
(1849-1944)

被公认为世界上第一个成功地实现了汽车长程试验的司机



In 1885, Karl Benz (1844-1929) invented the world's first car, named Horseless Carriage, using one motor engine on front wheels, with the back wheels powered by a four-stroke engine.

But the car could not move far, so nobody paid attention to it. He began to fall into depression, sure his invention would go nowhere.

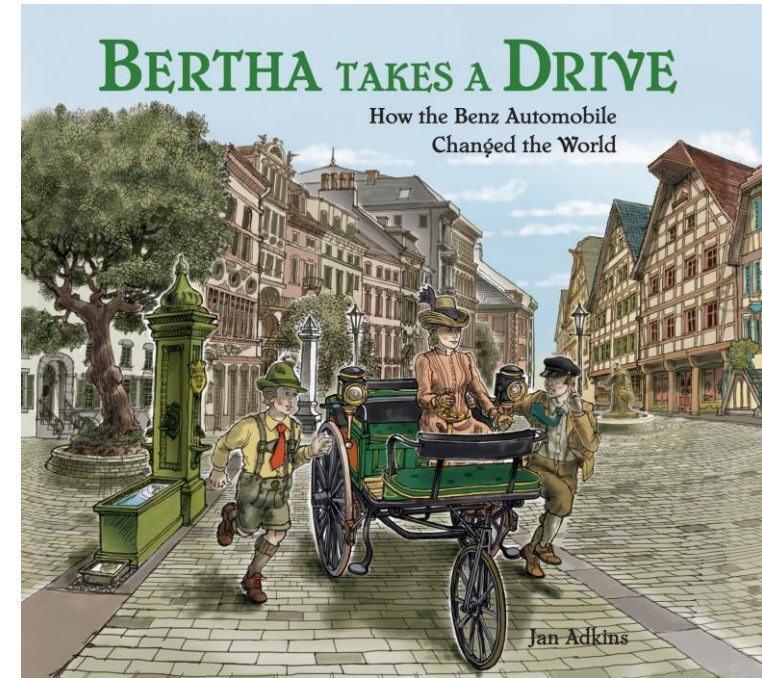


1885年，卡尔·本茨发明了世界上第一辆四冲程发动机驱动的“汽车”，可是跑不远，因而无人感兴趣，让他很泄气。

On the morning of 5 August 1888, Bertha set off with her two sons, Richard and Eugen, to visit her mother in Pforzheim, 66 miles (106 kilometers) from Benz's home.

There were many complications and problems in her way, and the main one is fuel. Bertha added fuel several times on the way, suggesting the idea of distributed gas-stations later on.

Overcoming all difficulties, just after dusk, Bertha sent Karl a telegram from Pforzheim saying she had safely arrived at her mother's house.



1888年8月5日，伯莎·本茨带着两个儿子实现了第一次艰难的 (106公里) 长途驾驶，让现代汽车登上了历史舞台。

Dedicated to **WiE**

You can do it

**THANK
YOU**