

Lecture 1

Origin of Universe

Where did we come from?

- Age of mythology
- Age of religion
- Age of reason and enlightenment
 - Galileo – Heliocentrism 太陽中心論 (1632)
 - Newton – Gravity 萬有引力 (1687)
 - Einstein – $E=MC^2$ (1905)

Are we alone?

Galileo Galilei (1564-1642)

- Father of astronomy, physics, and science

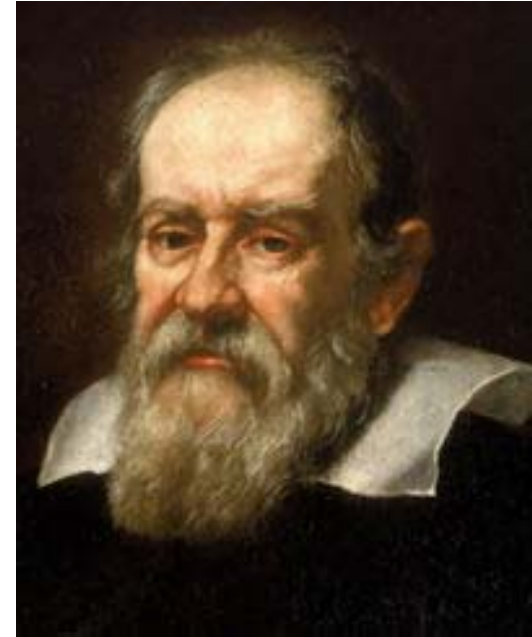
- *Starry Messenger* (1609);

Dialog concerning the two chief world systems

heliocentrism vs geocentrism

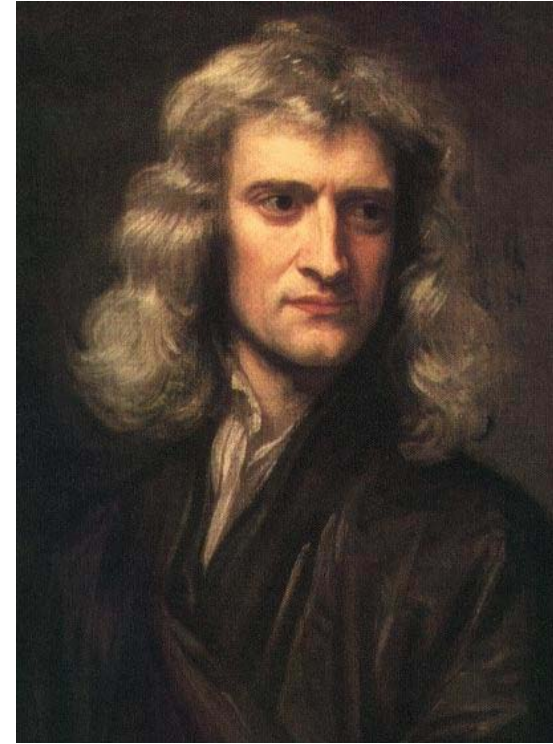
(1632) 太陽中心論與地球中心論

- The Inquisition 天主教審訊
- Father of three daughters



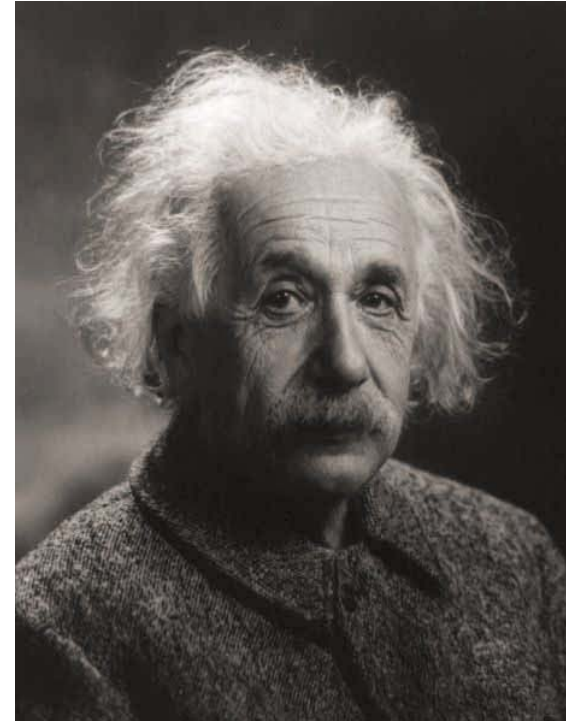
Sir Isaac Newton (1643 –1728)

- 1661 Trinity, Cambridge
- 1665 Galileo, calculus, optics, gravity 引力
- 1669 Lucasian Professor of Mathematics
 - Anglican church, Charles II
- 1687 *Philosophiæ Naturalis Principia Mathematica* 自然哲學的數學原理
 - Natural law and enlightenment
- Royal Society; Newton vs. Leibniz; Royal Mint; Bachelor for life



Albert Einstein (1879 –1955)

- Left school for one year at 15; graduated from ETH 1900; jobless for two years, then work at patent office
- 1905, year of magic: 3 great papers; $E = MC^2$
- 1915 General relativity; 1933 USA



“Subtle is the Lord, but malicious He is not”

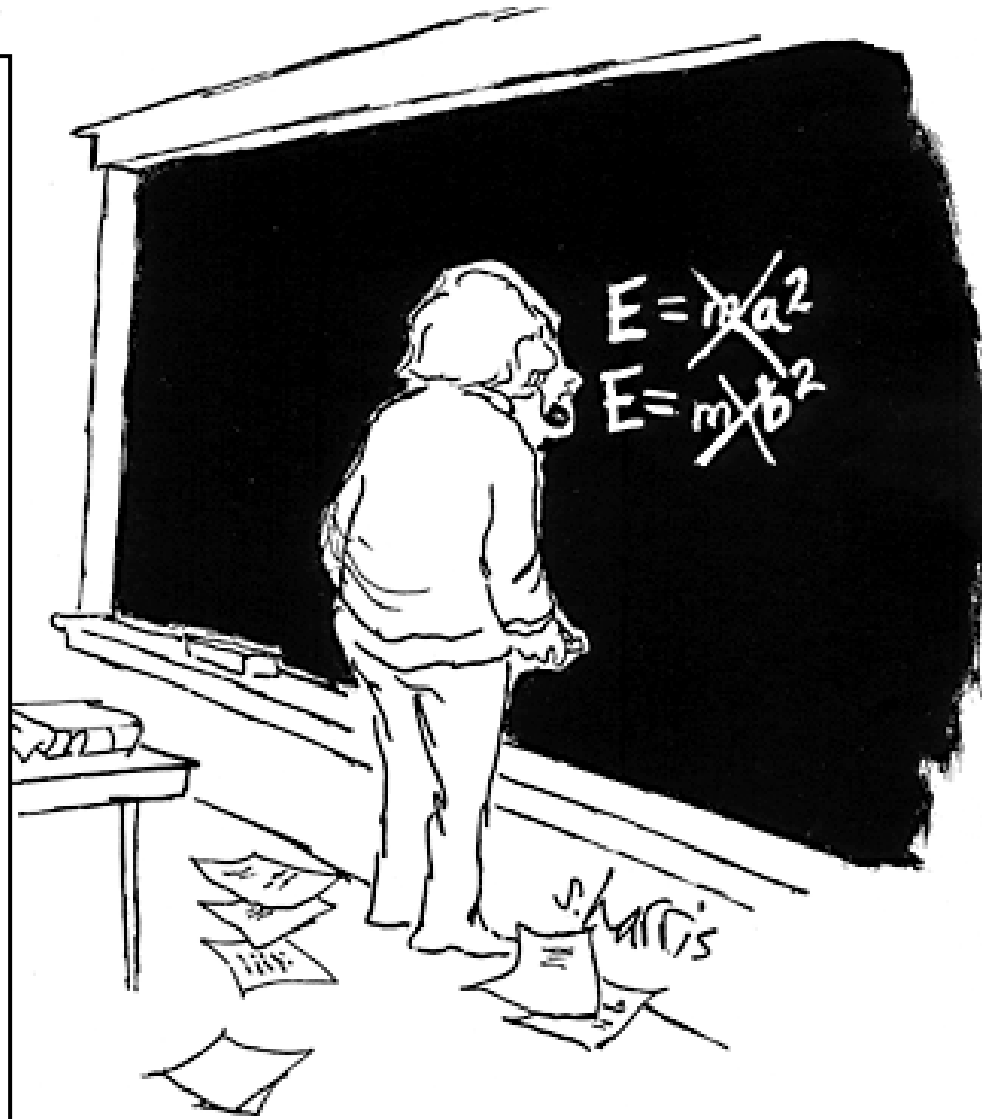
主是諷澀的，但是牠並無惡意。

The power of $E = MC^2$

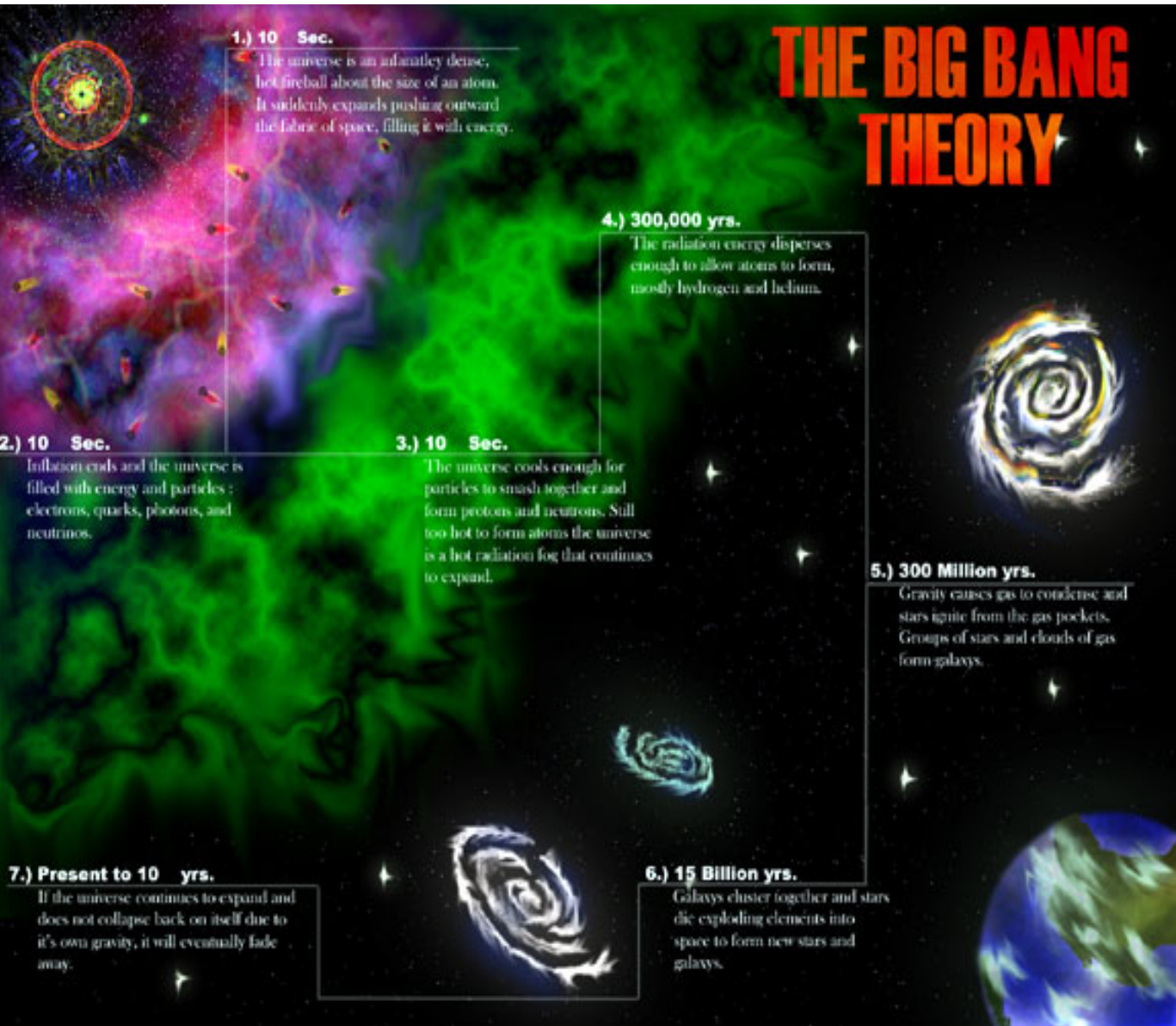
- 能量與物質等價
 - 光、電可互換
 - 不同的物質可互換
- Made possible the view that the universe is dynamic 宇宙從靜態觀變為動態觀
- The Big Bang Theory 大霹靂理論
 - In the beginning there was energy

愛因斯坦為大霹靂理論播了種子

- 牛頓 - 萬有引力，天體運行法則
- 愛因斯坦(1905) $E=MC^2$
- 愛因斯坦(1915) 廣義相對論
- 勒梅特(1927) 大霹靂假設
- 哈伯(1929) 宇宙在膨脹
- 1930 宇宙原始論科學化
- 1937-1960 無線電望遠鏡快速發展，探索宇宙深處
- 1960 發現宇宙溫度、脈沖星、類星體、黑洞等
- 1960 量子粒子物理理論成熟、大霹靂快速發展



大霹靂



勒梅特

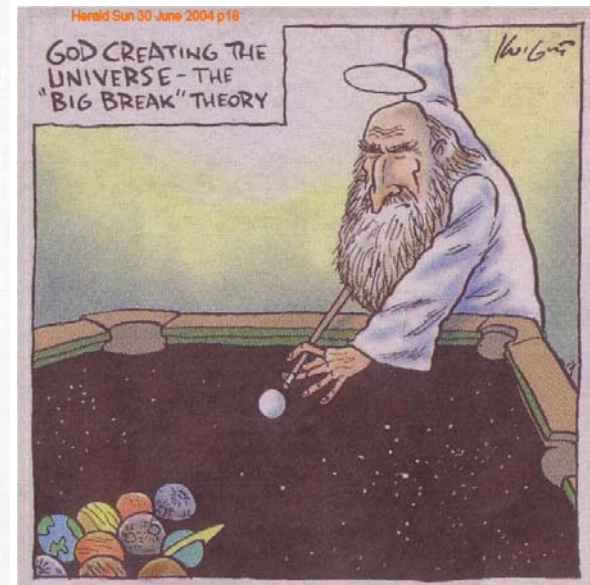
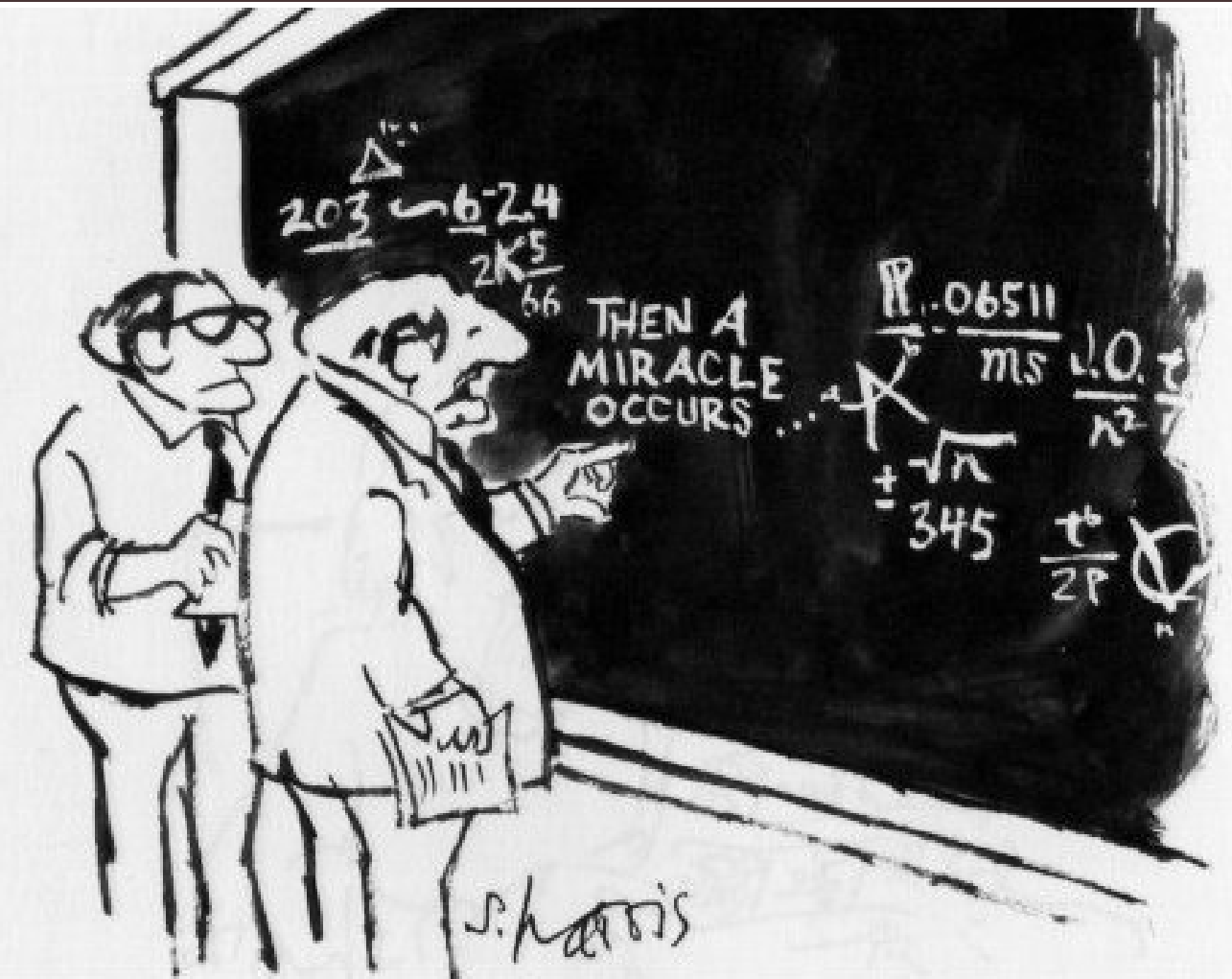
G LeMaitre (1894-1966)
Big Bang Theory 1927



哈伯

E Hubble (1889-1953)
Observed receding universe 1929

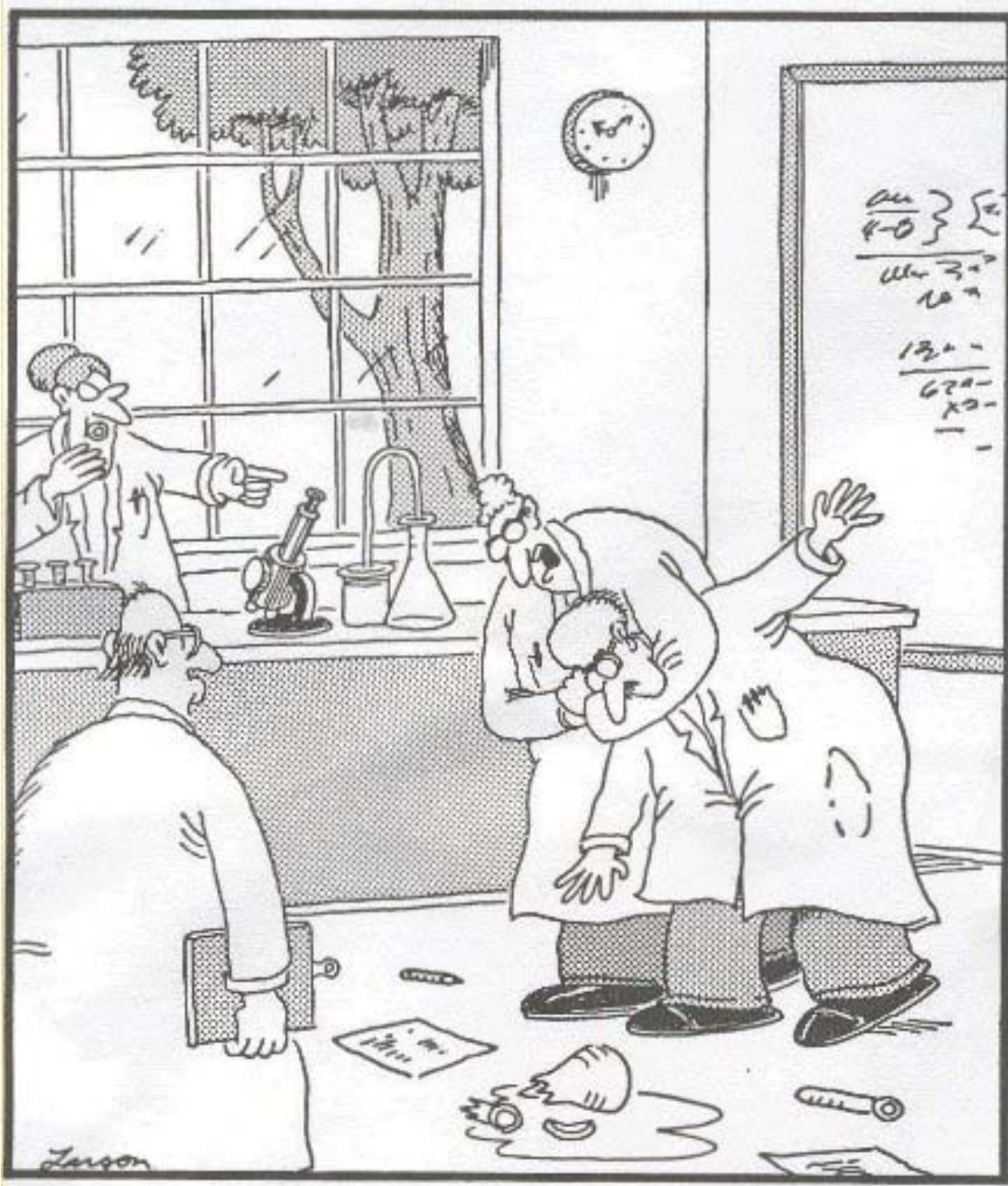
這種研究要很多數據，也要做很多計算



"I think you should be more explicit here in step two."

from *What's so Funny about Science?* by Sidney Harris (1977)

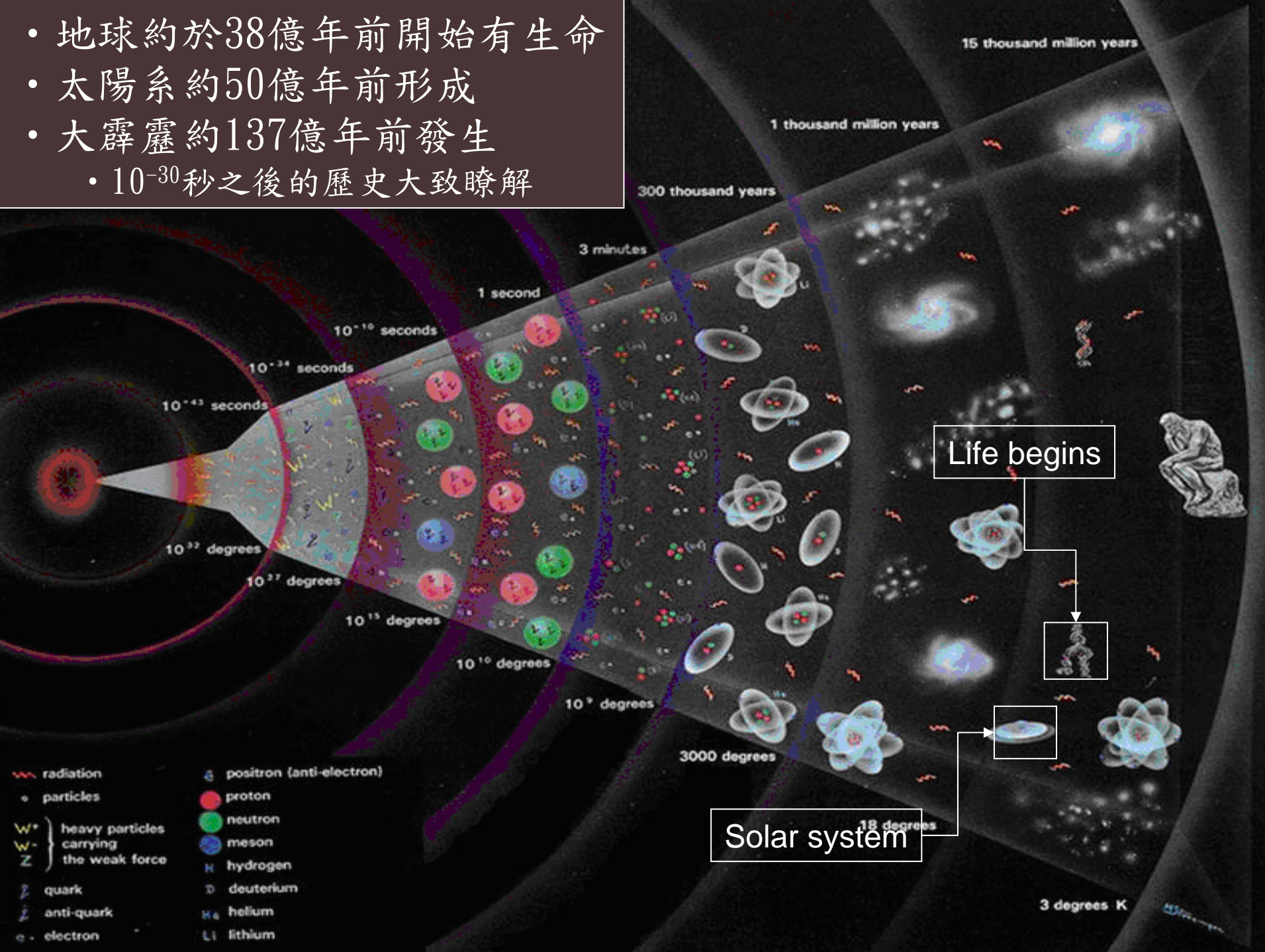
很多重要的科學就是科學家齊心協力的結果



更要做很多實驗、觀測



- 地球約於38億年前開始有生命
- 太陽系約50億年前形成
- 大霹靂約137億年前發生
 - 10^{-30} 秒之後的歷史大致瞭解



Who ordered the Big Bang?

- We can say nothing earlier than 10^{-40} before the Big Bang
- Space and time is not defined before that
- But we may say something about the future of the universe
 - The Big Crunch?
 - Or The Deep Freeze?
 - Or Perhaps something in between?

Links

- http://en.wikipedia.org/wiki/Galileo_Galilei
- http://en.wikipedia.org/wiki/Isaac_Newton
- http://en.wikipedia.org/wiki/Albert_Einstein
- <http://www.westegg.com/einstein/>
- <http://origins.jpl.nasa.gov/about/index.html>