China's Scientific Tradition and the Great Inertia

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Outline

- The definition of science
- Scientific elements in Chinese tradition
- Factors contributing to China's failure to achieve a "Scientific Revolution"
- Concluding Remarks

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- **The definition of science**
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The Definition of Science

- What is “science”?
- Latin origin: *scientia* (knowledge)
- Scientific = knowledge-making
- More than a body of rationally gained knowledge…..
- An activity directed at altering and increasing that very body of knowledge…..

The Definition of Science

- Begins as an extension of common sense
- Seeks a higher, rational unity, a deeper understanding which is unknown to common sense
- Establishes a conceptual order in the chaos of perceptual experience
- Never-ending search for invariants

The Definition of Science

- *Dissolubity (divisibility)*
  - *Superposability*

The Definition of Science

- A scientist transcends the physical world and roams at an intellectually higher and abstract realm
- Must also be capable of descending back to our realm of experience and subjecting to the examination of systematic empiricism, hard fact, and cold logic

Galileo Gililei
(1564-1642)

- Theory of inertia
- Each of his manipulations was guided by thought, each of his thought by experimental evidence

Isaac Newton
(1642-1727)

- Found a precise mathematical use for concepts like force, mass, and inertia
- Gave new meanings to the old terms such as space, time, and motion in an equally mathematical language

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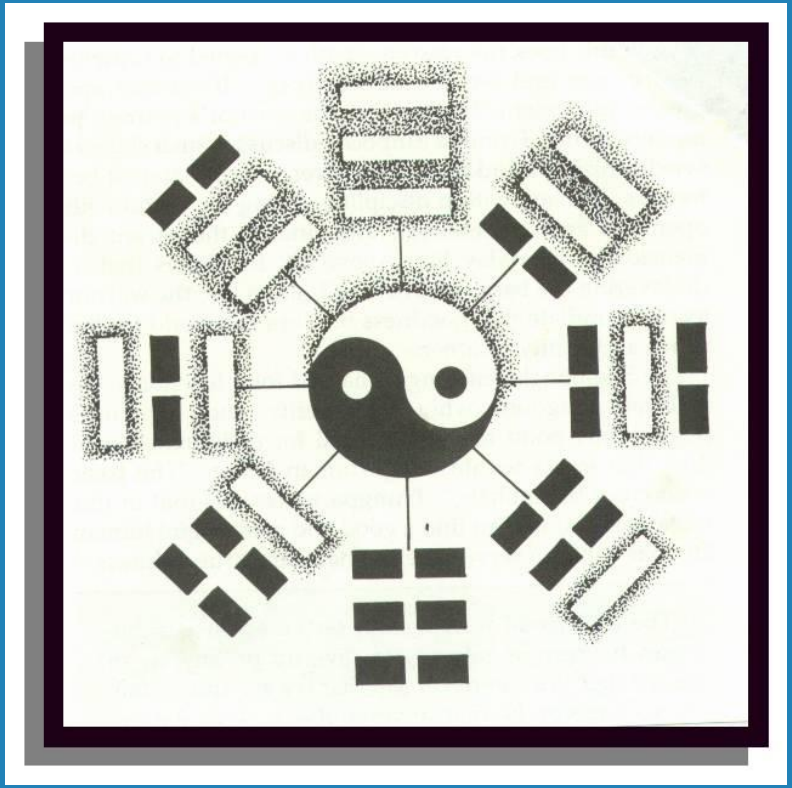
Scientific Elements in Chinese Tradition

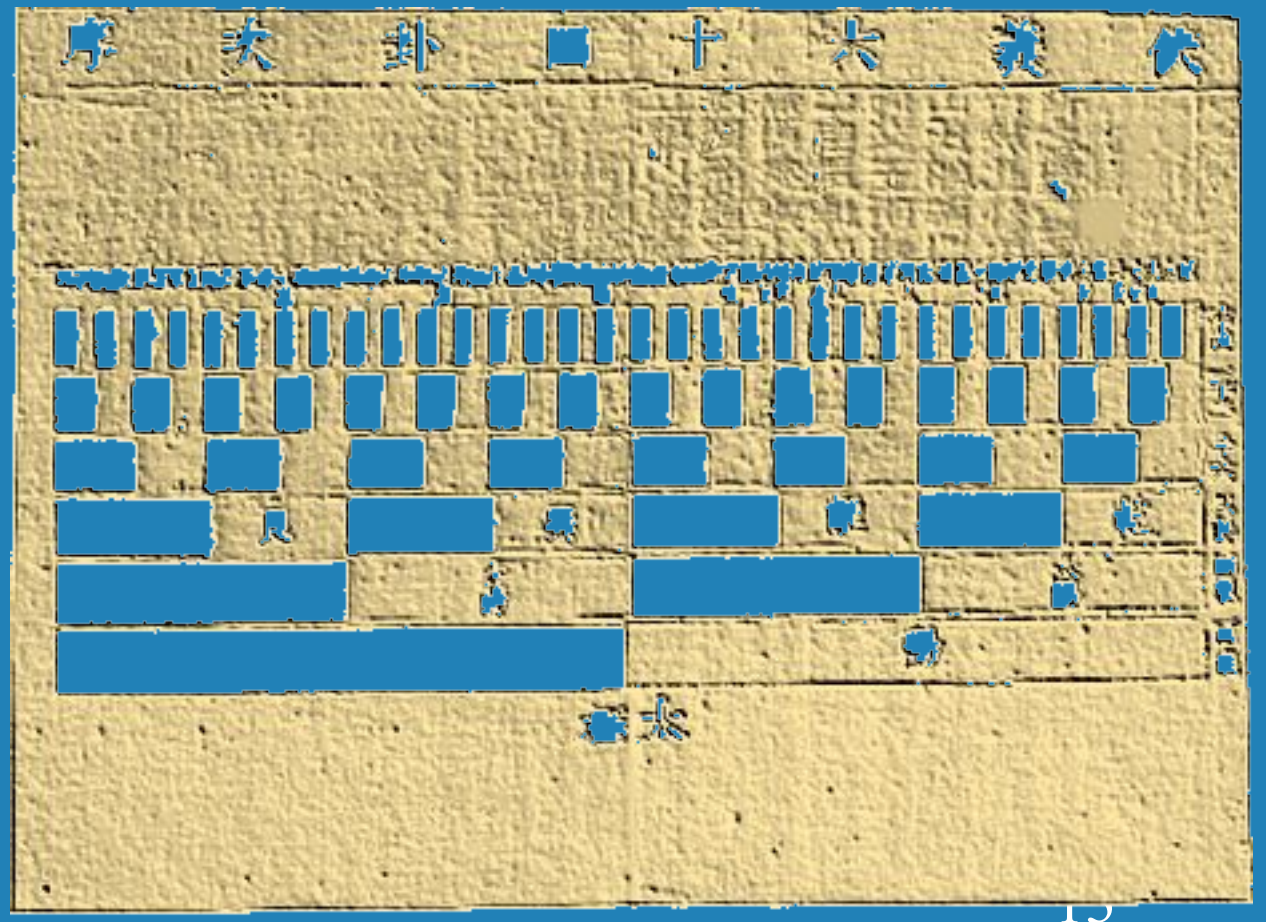
Joseph Needham

Science and Civilisation in China

Scientific Elements in Chinese Tradition



Scientific Elements in Chinese Tradition



Scientific Elements in Chinese Tradition

- China's scientific concepts are hidden in Daoist philosophy
- Daoist thinking developed as a counter-tradition in China

Scientific Elements in Chinese Tradition

- Quantitative Science
  - concerned primarily with numbers and its application to physical reality
  - concrete and empirically provable

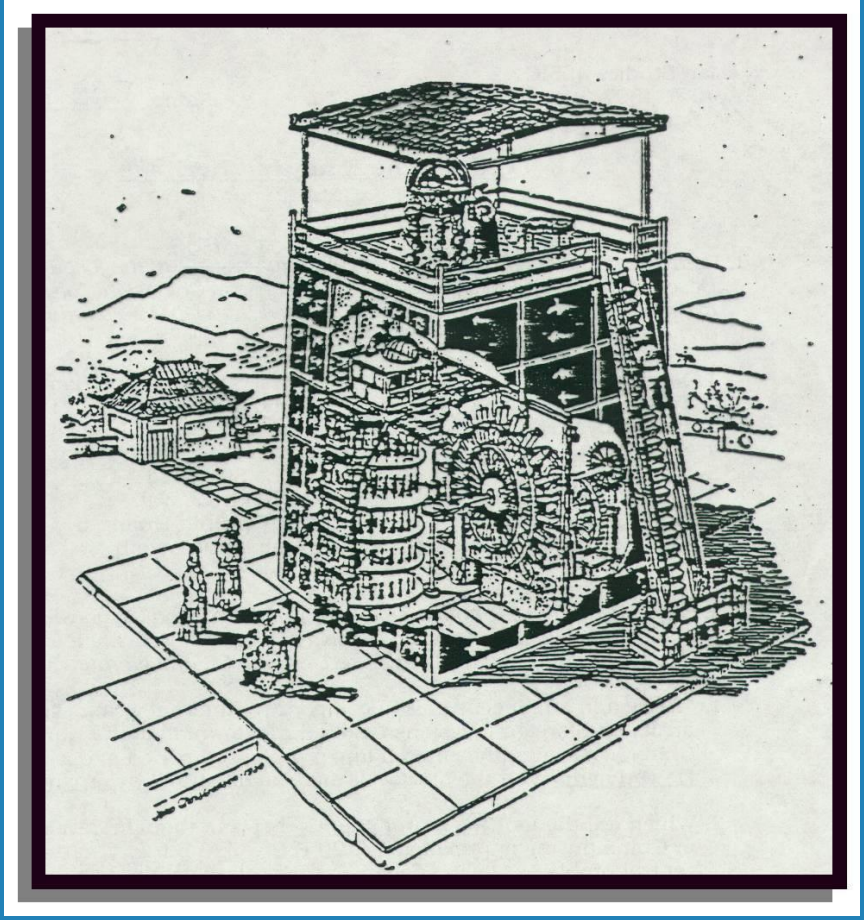
Scientific Elements in Chinese Tradition

- Qualitative Science
  - yin-yang, the five elements or dynamic forces and other verbal concepts
  - abstract but powerfully rational

Scientific Elements in Chinese Tradition

- Astronomy
  - The earliest record of the motion of the five planets, A.D. 1-A.D.5
  - armillary sphere (Han dynasty)
  - Su Song's astronomical clock

Scientific Elements in Chinese Tradition



Scientific Elements in Chinese Tradition

- *The Chinese time*
- *was not a succesion of quantitatively equal and qualitatively indistinguishable units.*

Scientific Elements in Chinese Tradition

- Mathematics
  - gave birth to the European "Scientific Revolution" in the 17th-century
  - *The Nine Chapters* (Han dynasty)
  - *The Calculating Methods* (Han)

Scientific Elements in Chinese Tradition

- Mathematics
  - 3.14 64/625 < pi >3.14 169/625
  - in A.D. 263
  - considered as “insignificant art of literary composition”
  - it cultivates little, if at all, one’s moral character

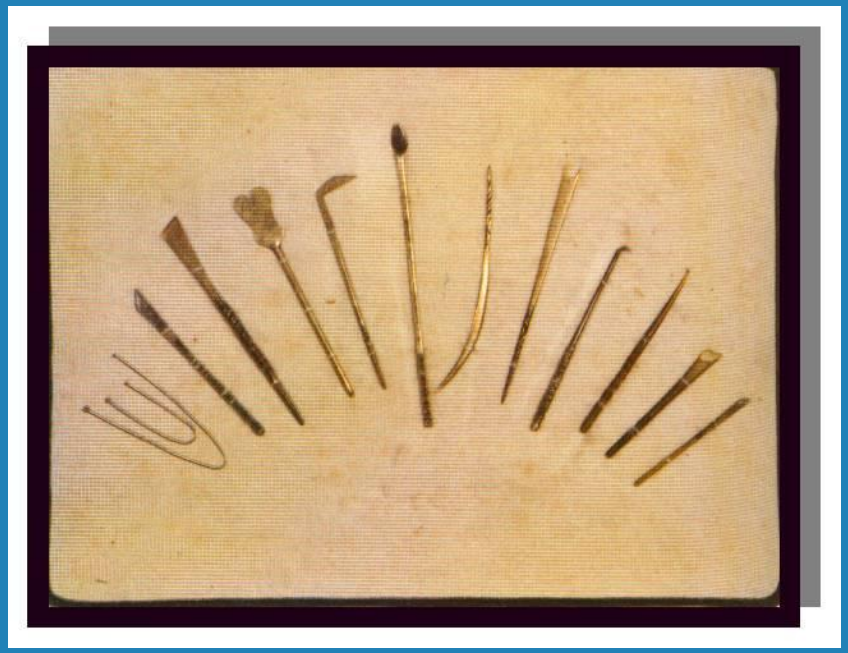
Scientific Elements in Chinese Tradition

- Medicine
  - *Medical Book of the Yellow Emperor*
  - *On Typhoid* (3rd century, 113 prescriptions)
  - Hua Tuo & Bian Que (Han dynasty)
  - Human vivisection (11th century)
  - Circulation of blood by William Harvey in 1618

Scientific Elements in Chinese Tradition

2000 year old exercises

Scientific Elements in Chinese Tradition



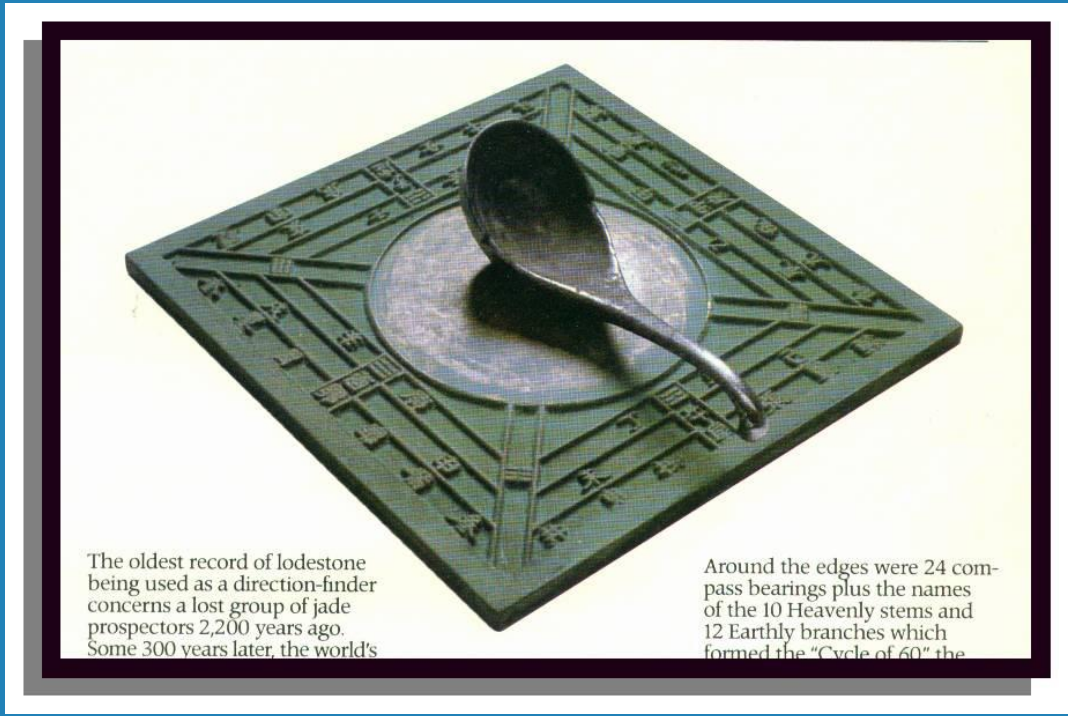
Scientific Elements in Chinese Tradition

- Sir Francis Bacon (1561-1626)
- "Printing, gunpowder and the compass: these three inventions have already changed the face of the entire world and the condition of things. The first is concerned with learning, the second with warfare and the third with navigation.
- The changes in these three areas will give rise to innumerable discoveries in other areas and no matter what empire, religion or constellation or human affairs; no human influence will be as great as that of the discovery of these mechanisms.

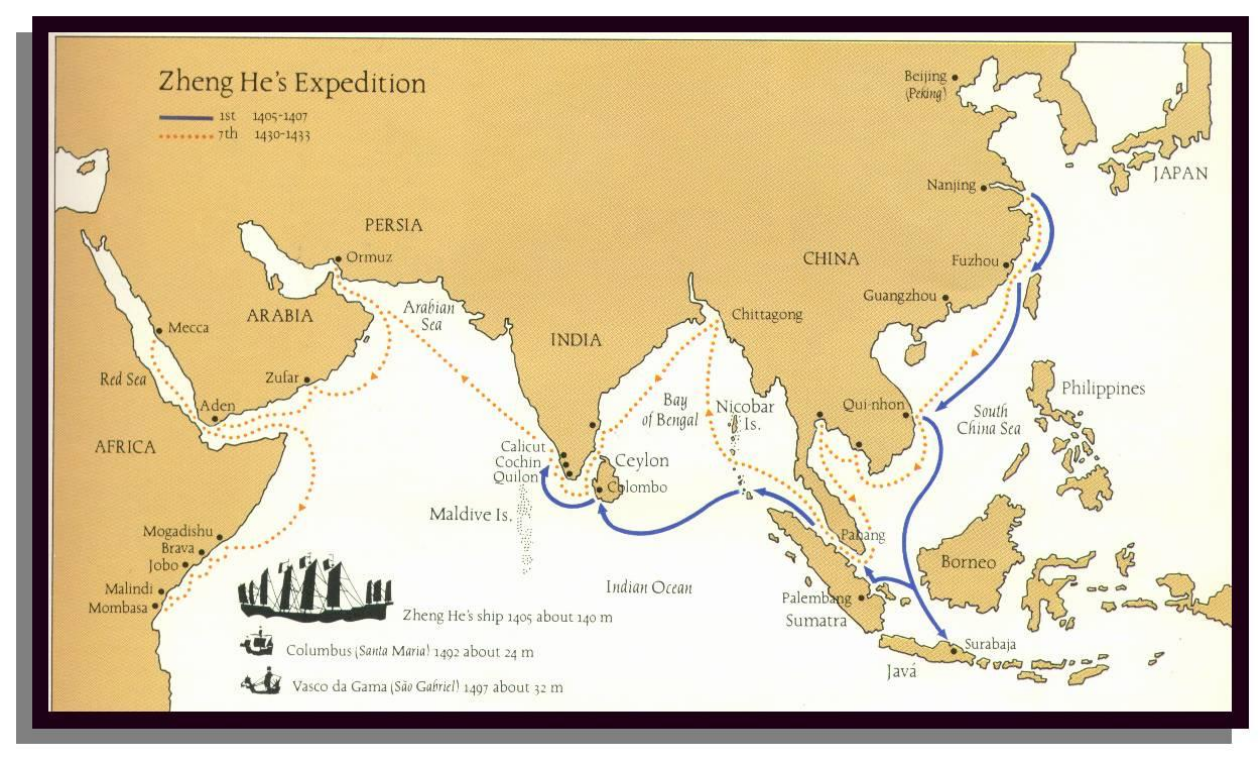
Scientific Elements in Chinese Tradition

- **The Four Inventions**
  - *Compass*
  - *Gun powder*
  - *Paper*
  - *Printing*

Scientific Elements in Chinese Tradition



Scientific Elements in Chinese Tradition

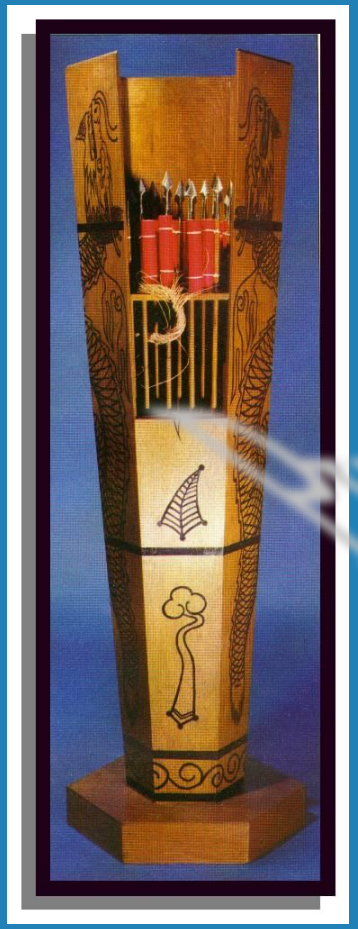


Zheng He's Seven Voyages

1405-1433

Scientific Elements in Chinese Tradition

Scientific Elements in Chinese Tradition



Pyrotechnology

Scientific Elements in Chinese Tradition

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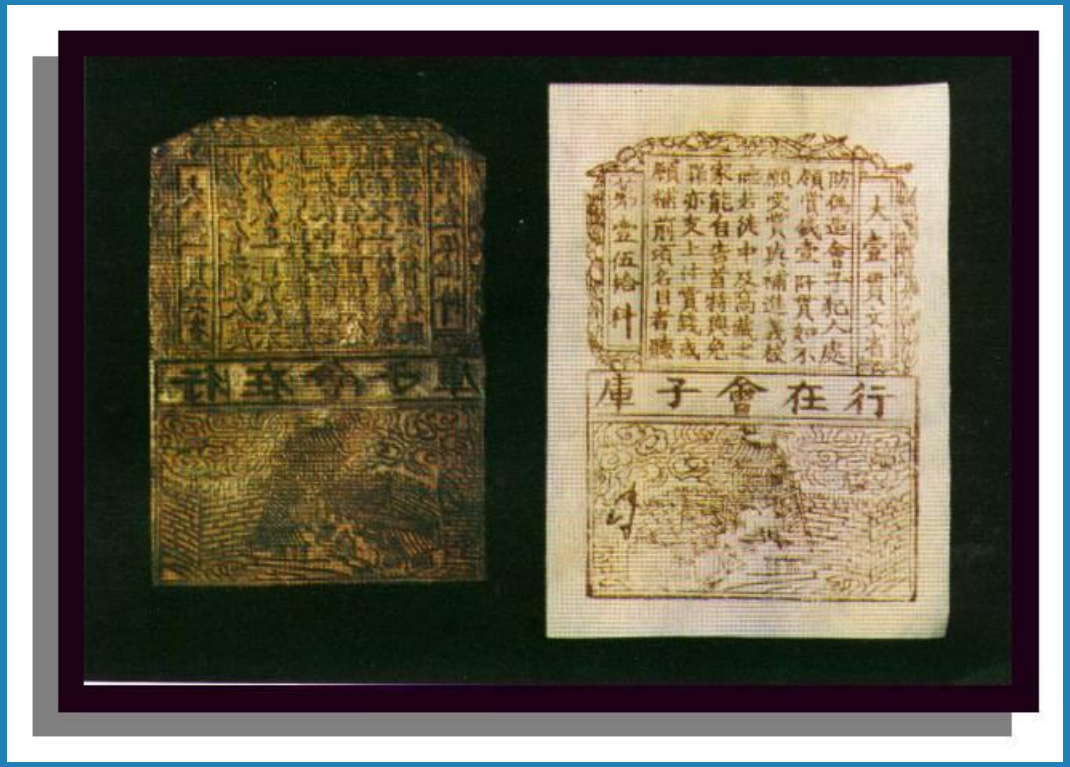

Scientific Elements in Chinese Tradition

The Gutenberg Bible, ca.1455

Scientific Elements in Chinese Tradition

Seismograph

Outline

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- **Factors contributing to China's failure to achieve a "Scientific Revolution"**
- Concluding Remarks

China's Failure to Achieve a "Scientific Revolution"

- Why,
- *if China advanced*
- *so far so early,*
- *did it fall behind in modern times?*

China's Failure to Achieve a "Scientific Revolution"

- Scientia contemplativa
  - vs.
- scientia activa et operativa

China's Failure to Achieve a "Scientific Revolution"

- Cultural factors
- Institutional factors
- Philosophical factors
- Methodological factors
- Other factors

China's Failure to Achieve a "Scientific Revolution"

- Cultural factors
  - Sinocentric view
  - the backview mirror
  - order and harmony….. Avoid disorder and innovation
  - bureaucracy

China's Failure to Achieve a "Scientific Revolution"

- Cultural Factors

- It is the Chinese culture itself that absorbed most of the people's energy and inhibited their inquisitive spirit.

China's Failure to Achieve a "Scientific Revolution"

- Institutional Factors
  - The Civil Service Examination

China's Failure to Achieve a "Scientific Revolution"

- Philosophical Factors
  - Daoist love of nature
  - True knowledge does not lead to the quest for a first cause or for an irreducible atom….. But to the self-transformation whereby man becomes one with the cosmos.
  - Aesthetic vs. scientific

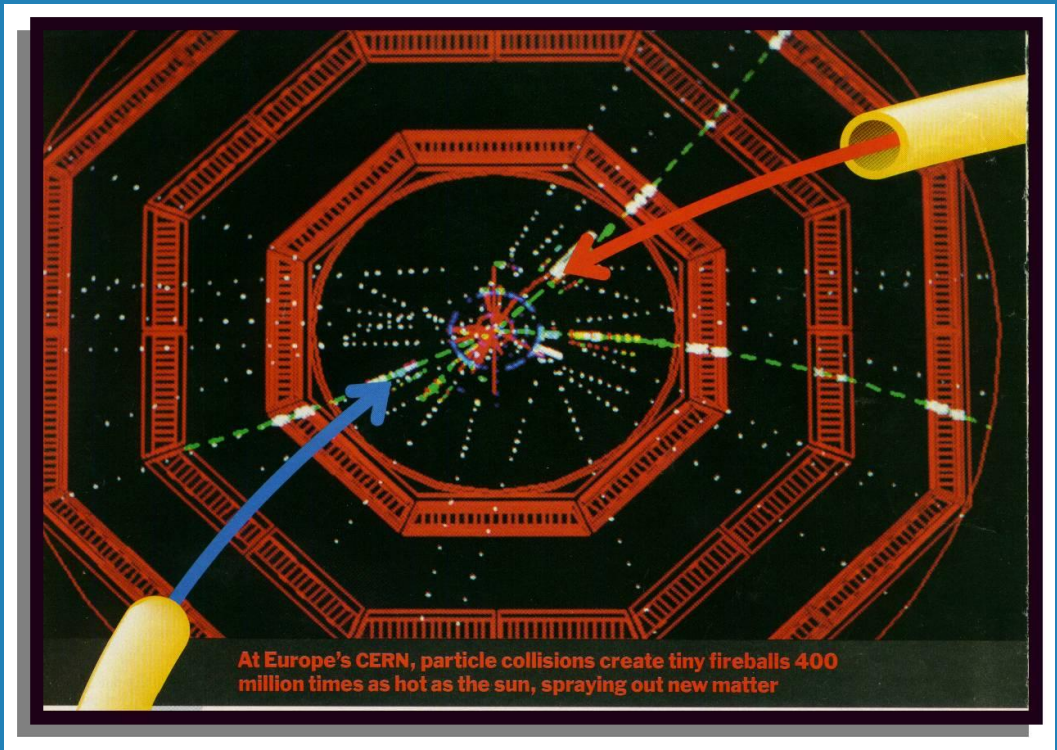
China's Failure to Achieve a "Scientific Revolution"

- Philosophical Factors
  - Moist logic and empiricism
    - Space=that which covers diff. Places
    - Duration=that that extends over different times
    - Cause=the obtaining of what a thing can be
    - Circle=that which has equidistant radii from its center

China's Failure to Achieve a "Scientific Revolution"

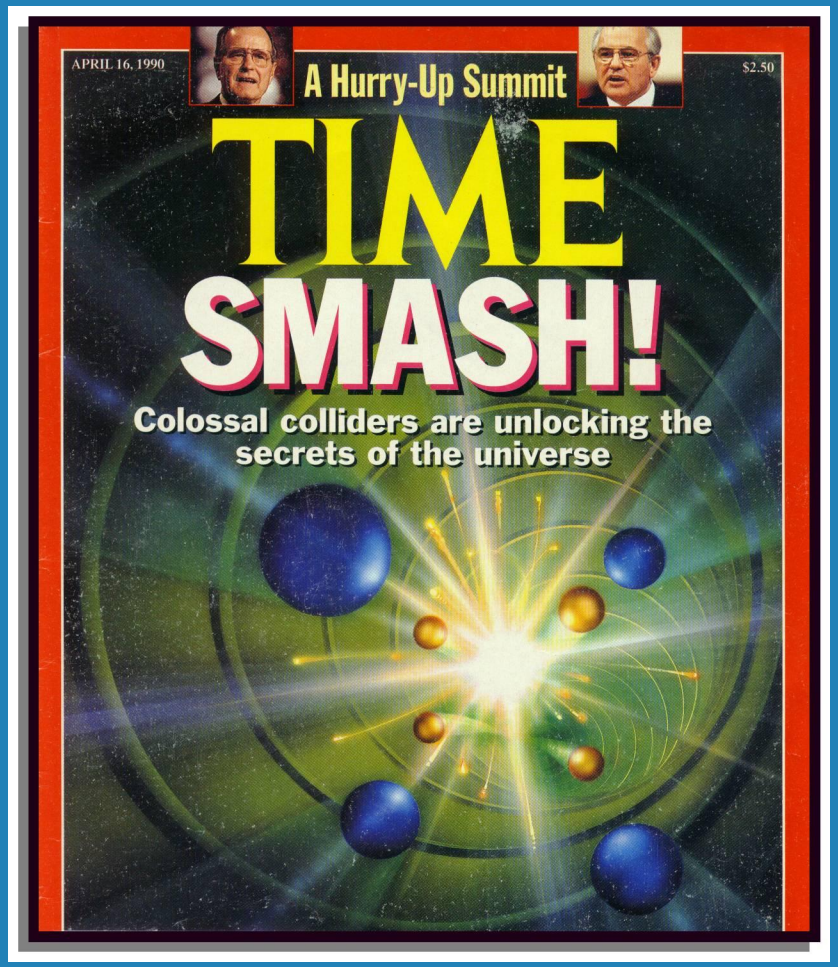
- Methodological Factors
  - *Methods of inquiry*
  - *Criteria of truth*

China's Failure to Achieve a "Scientific Revolution"



CERN: particle collisions create tiny fireballs 400 million times as hot as the sun, spraying out new matter.

China's Failure to Achieve a "Scientific Revolution"



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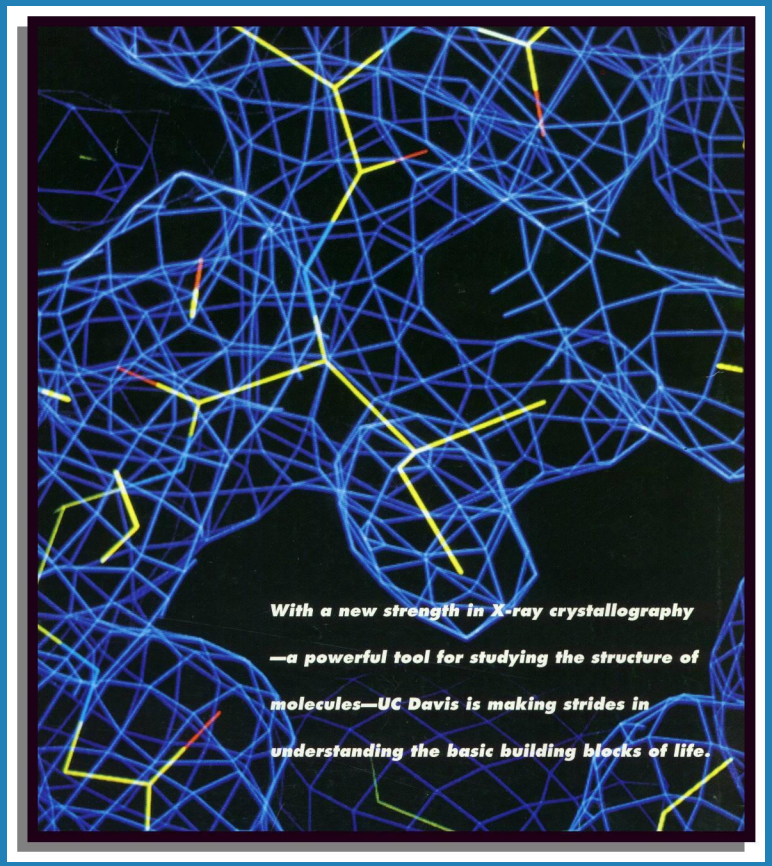

China's Failure to Achieve a "Scientific Revolution"

- Methodological Factors
  - *Methods of inquiry*
  - *Criteria of truth*

China's Failure to Achieve a "Scientific Revolution"

- The Chinese method of inquiry was a synthetic one….
- Its criterion of truth was its compatibility with the transcendental principles of the immutable one.
- The Western…basically an analytical one and its criterion of truth was its precision, exactness, and verifiability.

China's Failure to Achieve a "Scientific Revolution"

- Other Factors

- absence of private
- scientific groups
- etc. etc.

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Concluding Remarks

- *Chinese*
- *claimed no necessity of science.*

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Thank you!

Your
comments and questions
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