



# PHY1033C/HIS3931/IDH 3931 : Discovering Physics: The Universe and Humanity's Place in It Fall 2016

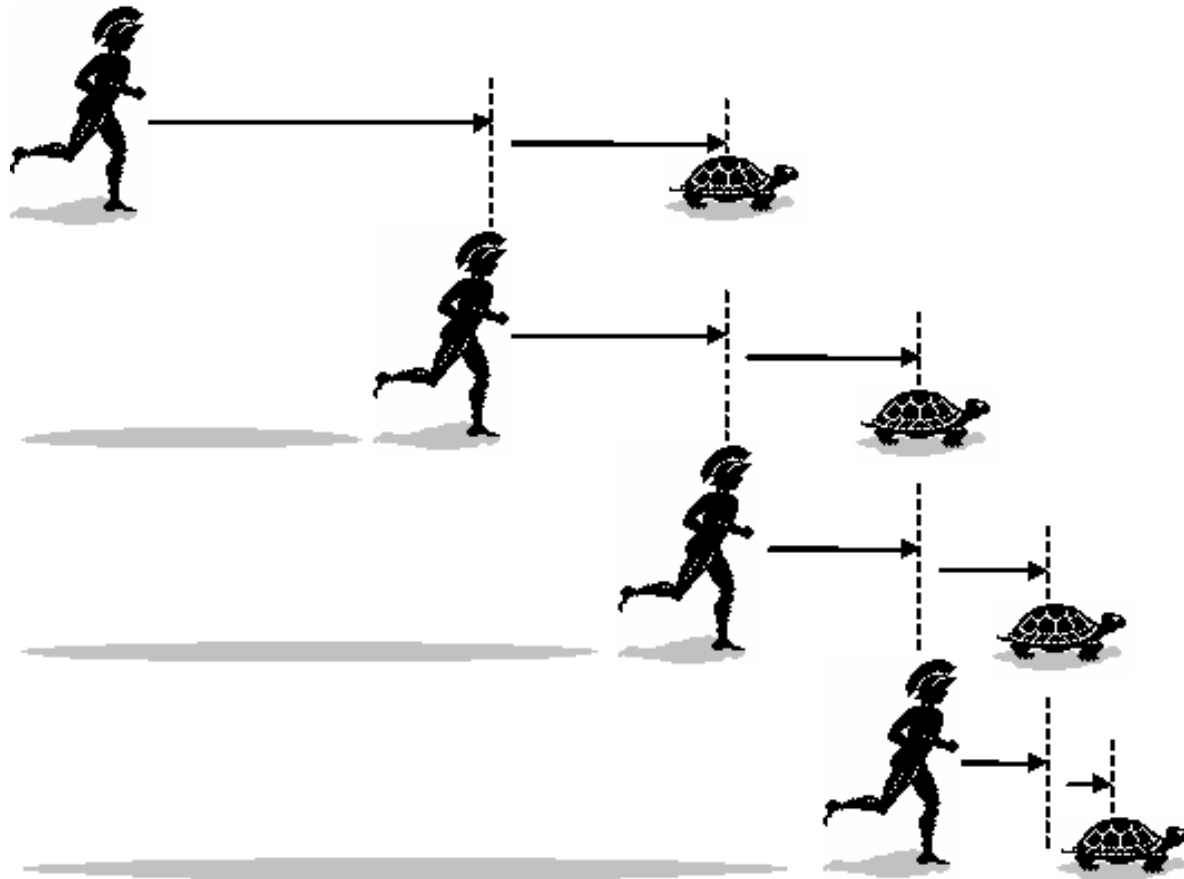
Prof. Peter Hirschfeld, Physics



# Science, history and progress I

- How should a historian/scientist think about ancient civilizations?
- Thomas Kuhn (*The Structure of Scientific Revolutions*): “Aristotle wasn’t a bad physicist; he was a good Greek philosopher”
- Weinberg (*To Explain the World*): “What is most striking is not so much that Zeno and Parmenides were wrong, as that they did not bother ...to explain how their theories about ultimate reality accounted for the appearance of things.”

(Zeno’s paradox [Zeno of Elea 490–430 ])



Zeno: Achilles can never catch tortoise!

Whenever Achilles reaches somewhere the tortoise has been,  
he still has farther to go

# Other points raised by Weinberg

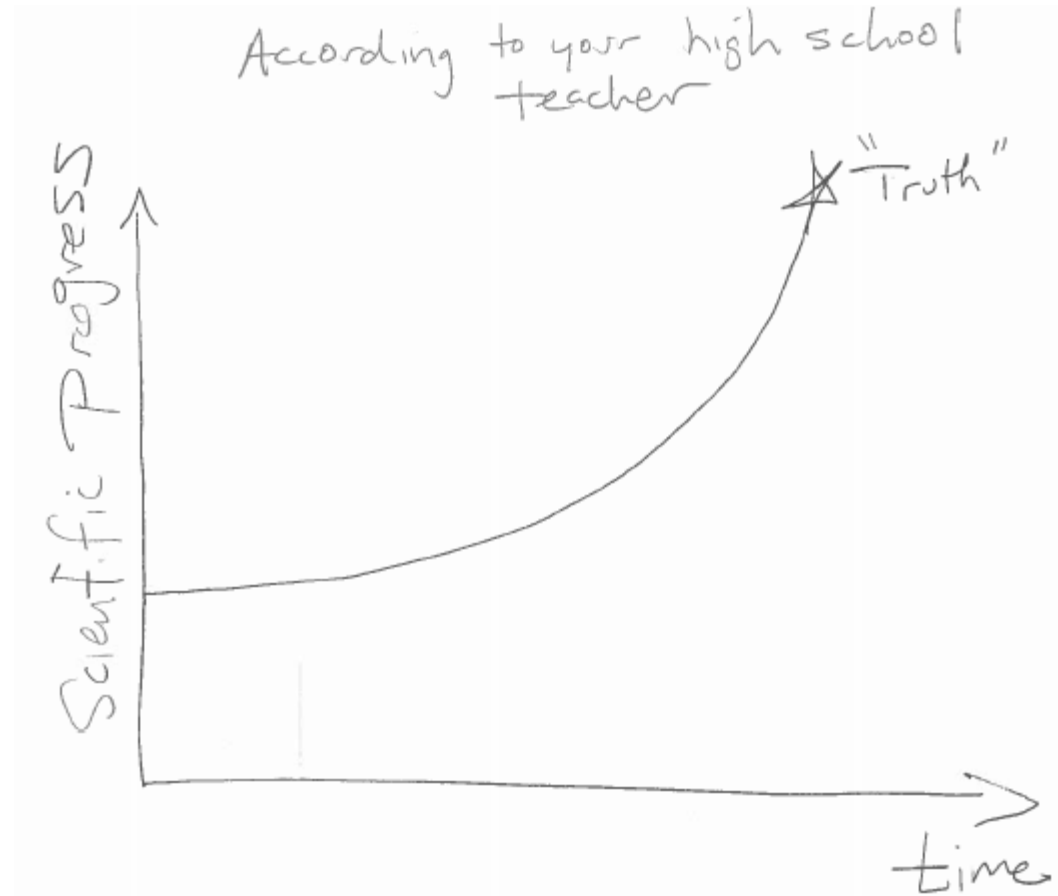
- subtitle: “Discovery of Science” – what does it mean?
- He separates himself from “social constructivists” who try to explain results of sciences as “products of a particular cultural milieu”
- Western science vs. elsewhere
- Science: nothing to say about God
- Is the scientific method “finished”?

# Science, history and progress II

Thomas Kuhn: science progresses through *paradigm shifts*

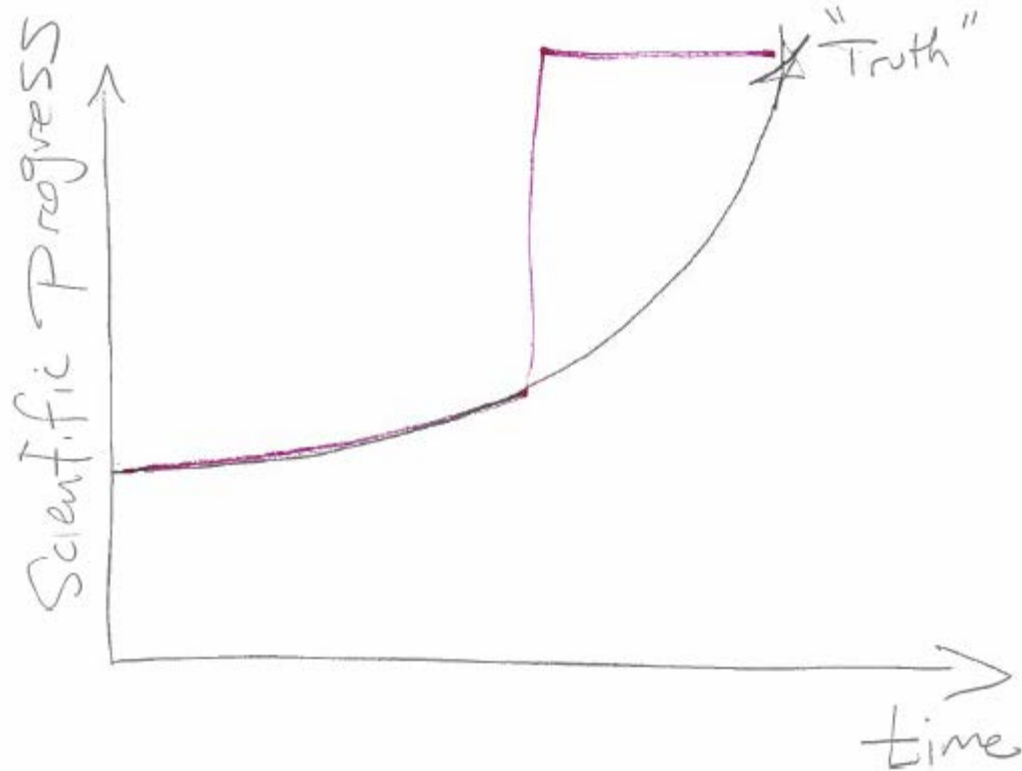
1. The recognition of novelty
2. From novelty to anomaly
3. The development of crisis
4. Paradigm shift

# How science progresses



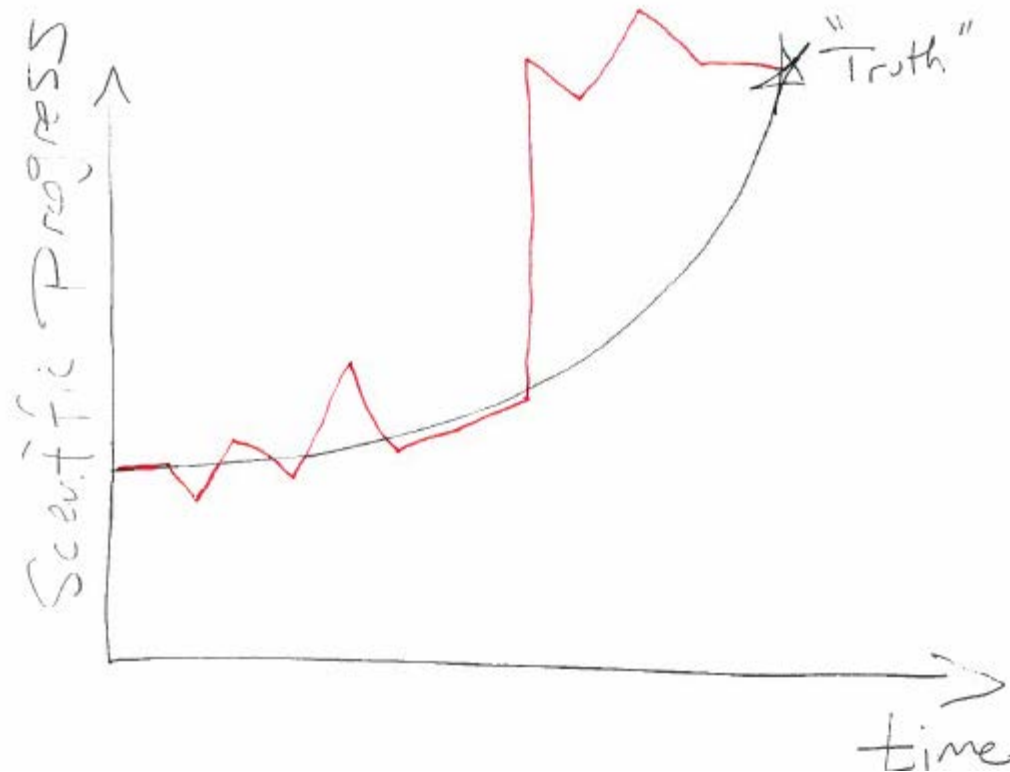
# How science progresses

According to Thomas Kuhn



# How science progresses

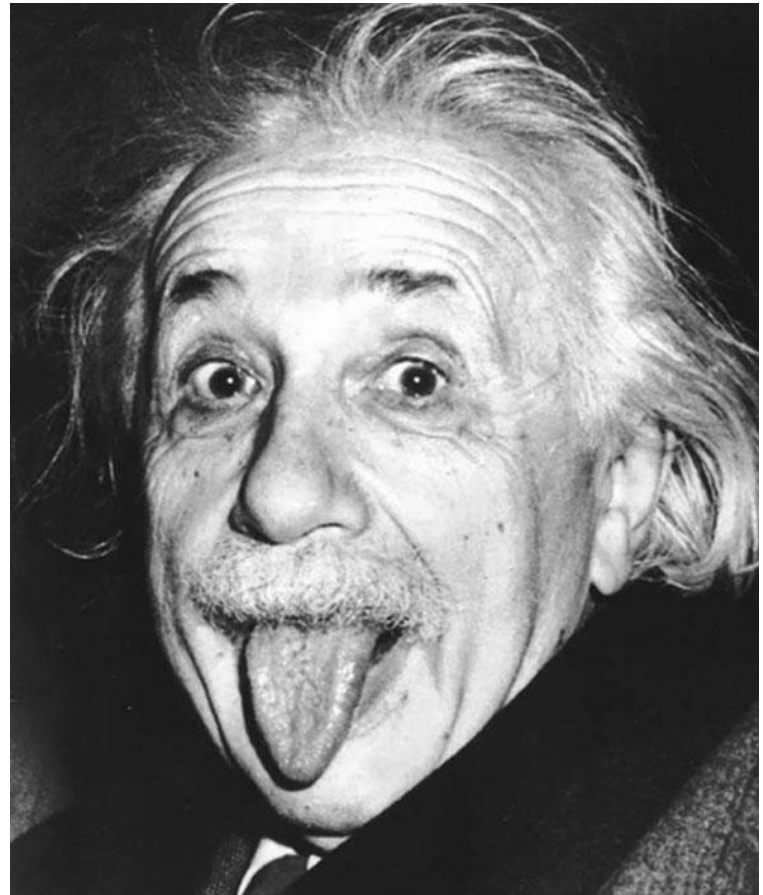
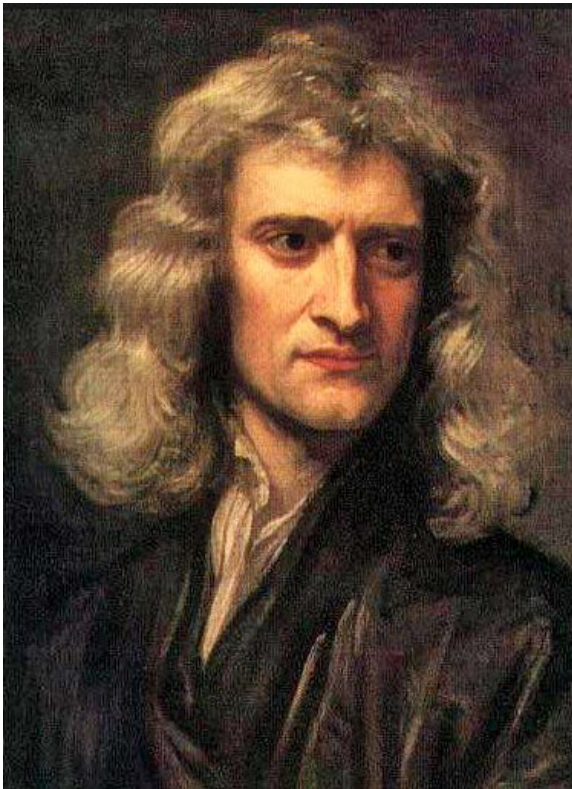
According to Me





# How science progresses IV

“Einstein showed that Newton was wrong”



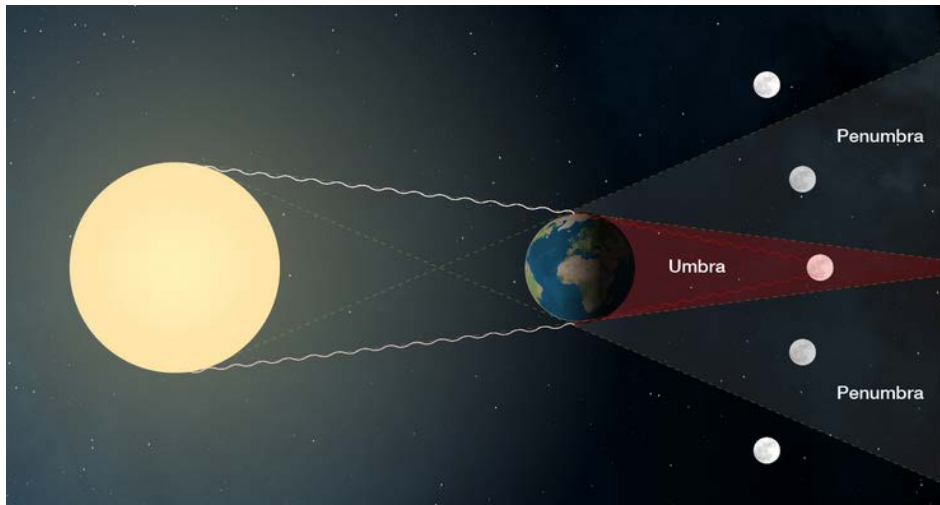
# How an ancient Greek viewed the cosmos I

- Heavens rotated once/24 hours. Appeared as though we were at the center of a “starry vault”

[http://astro.unl.edu/naap/motion2/animations/ce\\_hc.html](http://astro.unl.edu/naap/motion2/animations/ce_hc.html)

- We live at the center, since heavens move around us  
Arguments against alternate view (Earth rotating)?

- Earth is round (educated people)  
Lunar eclipse (curved edge)



# How an ancient Greek viewed the cosmos II

- Heavens were a “rational” system: simple, perfect  
“Rationality” = perfection  $\Rightarrow$  heavenly objects exhibit
  - 1) uniform motion (constant speed)
  - 2) perfect circles
- Heavens were *unchangeable*
  - stars always in the same place every night
  - $\Rightarrow$  *define* what you see that doesn't change as heavenly!
  - $\Rightarrow$  anything that changes must be “below the orb of the moon”