

# Warm-Up, September 12th, 2024 (INTD262)

Dr. Jordan Hanson - Whittier College Dept. of Physics and Astronomy

September 12, 2024

## 1 Chapter 2 of *The Scientific Attitude*

1. In Chapter 2 of *The Scientific Attitude*, we encounter the following quote:

Samir Okasha recounts the example of John Couch Adams and Urbain Le Verrier ... they were working (independently) within the Newtonian paradigm and noticed a slight perturbation in the orbit of the planet Uranus.

Newton's Law of Gravity predicts perfectly elliptical orbits for the planets, with no perturbations. Was the law of gravity therefore *falsified*? What solved the problem in the end?

2. Compare this story to the anomalous perihelion advance of the planet Mercury. (a) How long did scientists know about this anomaly with respect to Newtonian gravity before it was finally solved? (b) Who solved it, and how? (c) What challenge does this present for science, given that *falsifiability* is so important to trusting scientific theories?
3. Suppose you encounter someone who claims human evolution is "just a theory." Even though there is ample evidence that human evolution occurred, (a) can we ever truly say that it is a theory that has been proven absolutely true? (b) Does your answer change, knowing that Mendelian genetics, and later modern genetics, arrived *after* Charles Darwin published *On the Origin of Species*?
4. **Bode's Law** was an attempted mathematical explanation of the planetary orbits. Bode's sequence was the pattern 0, 3, 6, 12, 24, ..., plus 4 to each, then divide the sequence by 10. The result is 0.4, 0.7, 1.0, 1.6, 2.8, 5.2, 10.0, 19.6, 38.8, 77.2, ... . At the time (1772), the radii of the planets from the Sun were 0.387, 0.723, 1.0, 1.524, 5.203, 9.539. Nine years later, Uranus was discovered at 19.18. Twenty years later, the asteroid belt between Mars and Jupiter was discovered at 2.77. Did Bode's Law become a scientific fact because it fit the data?
5. One last question: is the example of family medical treatment we contemplated *falsifiable*? Is it *warranted*?