

Bringing Astronomy Back to its Roots

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Astronomy is the oldest natural science, the very foundation of physics and attempts to understand the Universe. Its premise, all along, has been to understand Observations with simple rules, facts and – eventually – theory which could predict more complicated observations. How and where did it begin? In large part, in Egypt, with its glorious ancient culture and skies; and with the Greek astronomer and geometer, Eratosthenes and his profound measurement that in Syene (Aswan) vs. Alexandria the Sun on summer solstice had a difference in maximum elevation of 7.2 degrees, leading to his remarkably accurate inference for the Earth's circumference and thus diameter and inference that the Sun and Earth must be in "circular" motion. Observations by the Roman astronomer, Ptolemy, led to carefully crafted models of the Universe as "crystalline spheres" and epicycles which could model the Universe, still within a (perfect) spherical and geometric framework. Why was it to be overturned ~1.5 millennia later by Copernicus, and the more exhaustive observations of Tycho that followed? Because these in turn enabled the systematic synthesis and "Laws" of Kepler to later culminate in the genius of Newton and provide the very foundation of physics.

The modern teaching of science and even physics has, by and large, lost its observational anchor. Instead of actual observation, students of the Universe for the past half century (and more) have increasingly "observed" from the printed, or now video, page rather than the celestial sphere – either visually or ultimately with high powered instruments. Most modern astronomers do not "know" the sky, and many of us as astrophysicists cannot even point to more than a few constellations beyond Orion or Ursa Major. In Egypt, and in fact the entire mid-East region, the power of observation of the rising of the seasonal constellations, the march of the planets, and the natural order inherent in observation could be taught in rural areas where generally flat horizons and relatively dark skies make this possible. The lessons of observation and inference are deep, and not only cultivate an enlightened world view of the natural order, but might even transfer to the human condition. Observation brings understanding, and understanding brings curiosity, where it may not have flourished before. Astronomy brought home will allow new stars to shine.

I teach an undergraduate course at Harvard called "Observing the Sun and Stars". It is not for future astrophysicists. Instead it is aimed at students of the arts, economics, languages, all but those doing natural science. Why? Because the power of observation in one academic sphere, may (often) stimulate very different inference and "observation" in a totally different domain. It might encourage innovation, to be able to design or develop a better instrument (either literal or figurative) with which to "observe". It might lead to a new understanding of the virtues of patience, usually required to actually conduct an observation or experiment (whether purely visual or, usually today, highly automated or secondary). Observation and understanding are fundamental to not only disentangling the natural world, but to improving (through observation and reflection) the human condition.