The “orbit” of the Sun: Kepler was Right

Elliptical orbit can be mimicked with Ptolemaic circle + equant

However direct measurement of variation in solar image diameter across the year indicated Kepler was right

At apogee: 31’ 8” (Cassini) 31’ 0” (Riccioli & Grimaldi)
At perigee: 32’ 10” (C) and 32’ 4” (R & G)
How to combine circular orbits and uniform speeds in order to platonically “save the phenomena” [and make your life difficult...]

A planet moving at uniform speed on a circular but eccentric orbit is seen by Earth as moving at variable angular speed. A non-eccentric deferent

A planet moving at uniform speed on an epicycle, the center of which orbits at uniform speed on a circular deferent, itself eccentric, can be seen by Earth to temporarily invert its motion.
The **Equant Point**, opposite Earth w.r.t. the center of the deferent.

In order to better describe the motions of superior planets, **Ptolemy** proposed that the center of the planet’s epicycle move at constant angular speed *as seen from the Equant point*, rather than from the center of its deferent.

A number of astronomers later found fault with idea, a breach with the platonic postulate of uniform circular motion of a planet w.r.t. to the center of its orbit. Among those was **Copernicus**.
"Knowledge comes from generalizing from what is observed"
[Francis Bacon 1561-1626]

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Classic Greek approach of deduction with logical rigor from first postulates:

Observe, generalize, distill basic rules; then push them to their extreme logical power. If predictions are confirmed, theory lives. If they are not, theory is rejected \( \Rightarrow \) a new, broader theory is needed: one that explains correctly the results the old one explained, plus those the old one did not explain:

\( \Rightarrow \) we then have a "paradigm shift"
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The variety of the scientific experience is broad, but scientists speak the same language, albeit in different “dialects”:

- Some disciplines are quite formal, their basic axioms are very mathematical, e.g. Physics
- Some are “data rich”, requiring attention to sifting the fundamental from the circumstantial, e.g. Meteorology and Geology
- Some are “data poor”, and a theory’s worth is evaluated by its ability to extrapolate to currently unobserved phenomena, e.g. Early Universe Cosmology

They all agree on being empirical, open-minded, skeptical, sensitive to the need of theory to be vulnerable, i.e. open to the possibility of being proved wrong

The language of science is the same across borders, races and gender; the glue of the scientific community is its method
A scientific theory not only describes known facts; it also predicts the outcome of new experiments or observations.

“The problem with communication is the illusion that it has been accomplished.”
G. B. Shaw