

Date: 2023 Jan 21

Title: Vulcan: The planet that wasn't

Event: Lecture Series in Theoretical Physics.

Venue: Sphira Science Center

① Credit: Isaac Asimov (1920-1992)

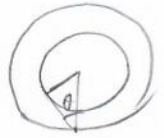
②	<u>Greek god</u>	<u>Roman god</u>	<u>Week day</u>
	Helios	Sun	Sunday
	Selene	Moon	Monday
	Ares	Mars	Tuesday
	Hermes	Mercury	Wednesday
	Zeus	Jupiter	Thursday
	Aphrodite	Venus	Friday
	Kronos	Saturn	Saturday
	Ouranos	Uranus	-
	Poseidon	Neptune	-

③ 1 AD : Ptolemy

- * Geocentric model
- * Stars have simple motion
- * Sun → star lag due to motion of Earth
- * Moon's phases.
- * Planets (wanderers) — 5 planets
— movement not simple.

④ 1543 : Copernicus.

- * Heliocentric model.
- * circular orbits
- * calculated orbital radii of planets
(in terms of Earth's orbital radius)
- * Phases of Venus.



⑤ 1610 - 1619 Kepler

- * elliptic orbits
 - * $mvr = \text{constant}$. speed not constant.
 - * $R^3 \propto T^2$
 - * 1619 — transit of mercury
- Transit
 - Occultation
 - Eclipse.

⑥ 1610 - Galileo
* telescope.

⑦ 1687 - Newton
* Newton's law of Gravitation $m\omega^2 R = \frac{GmM}{R^2}$.
* Mass of a planet can be calculated precisely if it has a moon/satellite. Note that mercury and venus have no moons.

⑧ 1781 - Herschel
* Realized that Uranus is a planet. (size changes with power.)
* Uranus was thought to be a star, (visible with naked eye,) before Ptolemy's time.

⑨ 1843 - Leverrier
* carefully accounted for the contributions to the perihelion shift of mercury.

⑩ 1846 - Leverrier

* carefully accounted for all the disturbances to Uranus.

* Predicted the planet Neptune.

(observed within a couple of hours of search by Galle.)

⑪ 1859 - Leverrier

* hypothesized Vulcan.

* Mass of Venus not accurately determined because it has no moon. However suggest of an extra mass for Venus would disturb Earth. So, Vulcan must be on the other side of Mercury.

* 1845 observation associated to Vulcan. (Lescarbault)

* Controversy begin.

- (12) 1877 - Leverrier dies.
1878 - Solar eclipse in US, controversy prolonged.
1900, 1909 - bounds on Vulcan shrink.
1915 - Einstein