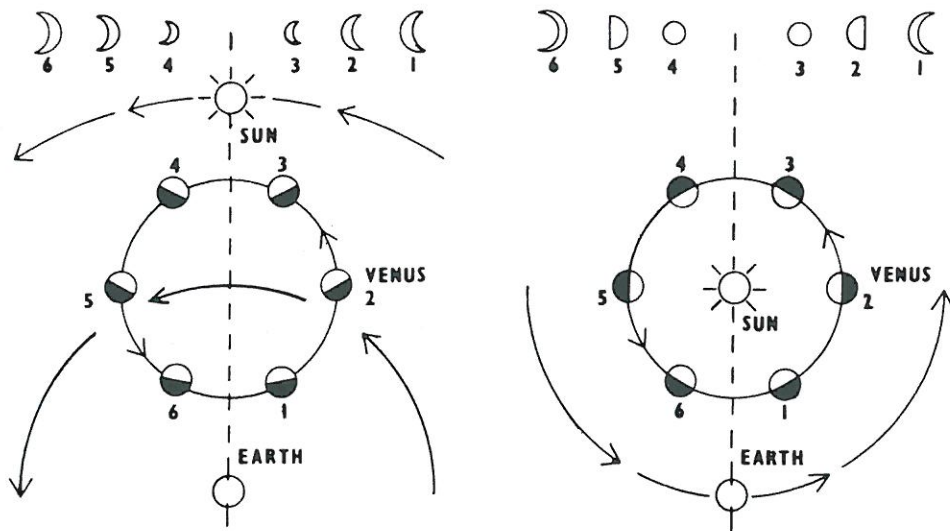


Next Apelles suggests that sunspot observations afford a method by which he can determine whether Venus and Mercury revolve about the sun or between the earth and the sun. I am astonished that nothing has reached his ears—or if anything has, that he has not capitalized upon it—of a very elegant, palpable, and convenient method of determining this, discovered by me about two years ago and communicated to so many people that by now it has become notorious. This is the fact that Venus changes shape precisely as does the moon; and if Apelles will now look through his telescope he will see Venus to be perfectly circular in shape and very small (though indeed it was smaller yet when it [recently] emerged as evening star). He may then go on observing it, and he will see that as it reaches its maximum departure from the sun it will be semicircular. Thence it will pass into a horned shape, gradually becoming thinner as it once more approaches the sun. Around conjunction it will appear as does the moon when two or three days old, but the size of its visible circle will have much increased. Indeed, when Venus emerges [from behind the sun] to appear as evening star, its apparent diameter is only one-sixth as great as at its evening disappearance [in front of the sun] or its emergence as morning star [several days thereafter], and hence its disk appears forty times as large on the latter occasions.

These things leave no room for doubt about the orbit of Venus. With absolute necessity we shall conclude, in agreement with the theories of the Pythagoreans and of Copernicus, that Venus revolves about the sun just as do all the other planets. Hence it is not necessary to wait for transits and occultations¹ of Venus to make certain of so obvious a conclusion. No longer need we employ arguments that allow any answer, however feeble, from persons whose philosophy is badly upset by this new arrangement of the universe. For these opponents, unless constrained by some stronger argument, would say that Venus either shines with its own light or is of a substance that may be penetrated by the sun's rays, so that it may be lighted not only on its surface but also throughout its depth. They take heart to shield themselves with this argument because there have not been wanting philosophers and mathematicians who have actually believed this—meaning no offense to Apelles, who says otherwise. Indeed, Copernicus himself was forced to admit the possibility and even the necessity of one of these two ideas, as otherwise he could give no reason for Venus failing to appear horned when beneath the sun.² As a matter of fact nothing else could be said before the telescope came along to show us that Venus is naturally and actually dark like the moon, and like the moon has phases.



The appearance of Venus predicted by the Ptolemaic and Copernican systems

Galileo's Telescopic Discoveries

Announced in *Siderius Nuncius*

- Surface of the Moon irregular, including mountains 4 miles high
- “Earth shine”: reflected light from the Earth lights the Moon
- Fixed stars do not appear as disks when viewed in telescopes
- Planets do appear as disks when viewed in telescopes
- Fixed stars are “so numerous as almost to surpass belief”
- Milky way consists of congeries of innumerable stars grouped in clusters
- So too for the celestial objects theretofore called nebulae
- Four “planets” are in orbit around Jupiter, lending support to Copernicanism

Announced in “Letters on Sunspots”

- Venus exhibits phases, akin to those exhibited by the Moon
- The Sun's surface displays spots, persisting in relation to one another
- As inferred from the spots, the Sun rotates on its axis (roughly 25 days)
- Saturn exhibits two “small stars” tied to it on opposite sides