

Astro I: Introductory Astronomy







J.J. Losada

facing east: Moon rising



facing west: Moon setting



Jupiter and Saturn move from night-to-night against the stars looking south



images taken at (nearly) the same time of night, two weeks apart

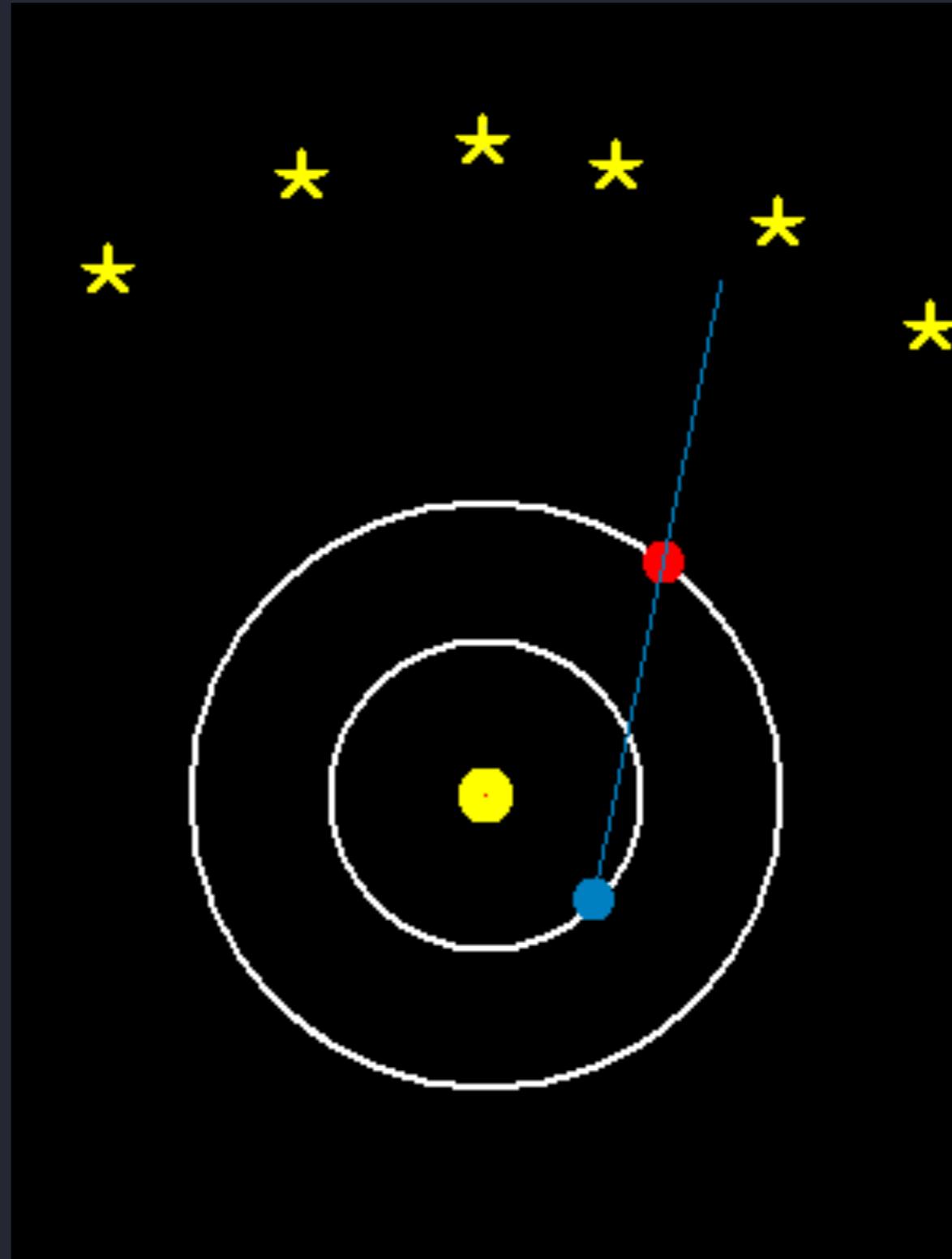
Mars
looking south

East

West



In the Copernican model, retrograde motion arises naturally from the dual motion of Earth and Mars.



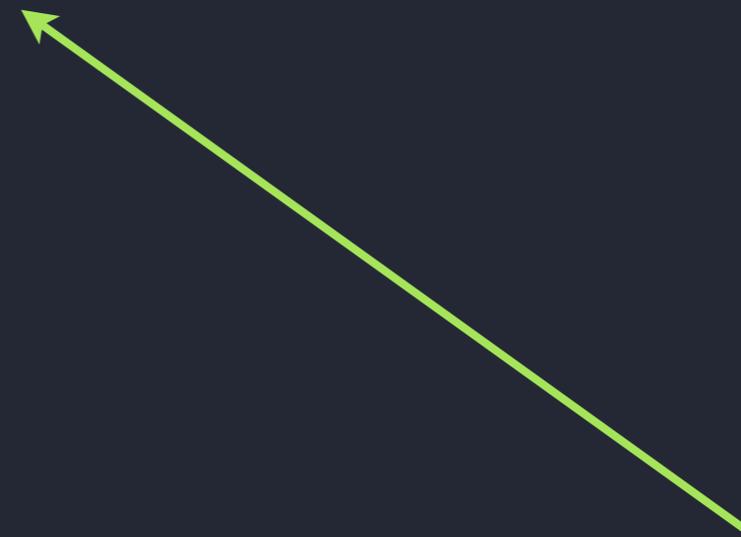
“The ancient mystery of the planets drove much of the historical debate over Earth’s place in the universe. In many ways the modern technological society we take for granted today can be traced directly to the scientific revolution that began in the quest to explain the strange wanderings of the planets...” (pp. 50-51)





Tycho Brahe's large sextant (late 1500's)

unprecedented accuracy of star and planet positions (about 1 arc minute)



understanding and *predicting* the cyclical patterns in the sky was key to the survival of pre-modern, agricultural societies

Early astronomy: marks the cycles of nature...and represents power



Limbourg brothers, early 15th Cen.

Ancient people built astronomical observatories to mark the passage of the seasons...and perhaps for more spiritual reasons as well.



Stonehenge in England.
4000 years old!







Xunantunich (Maya, 9th Cen.)

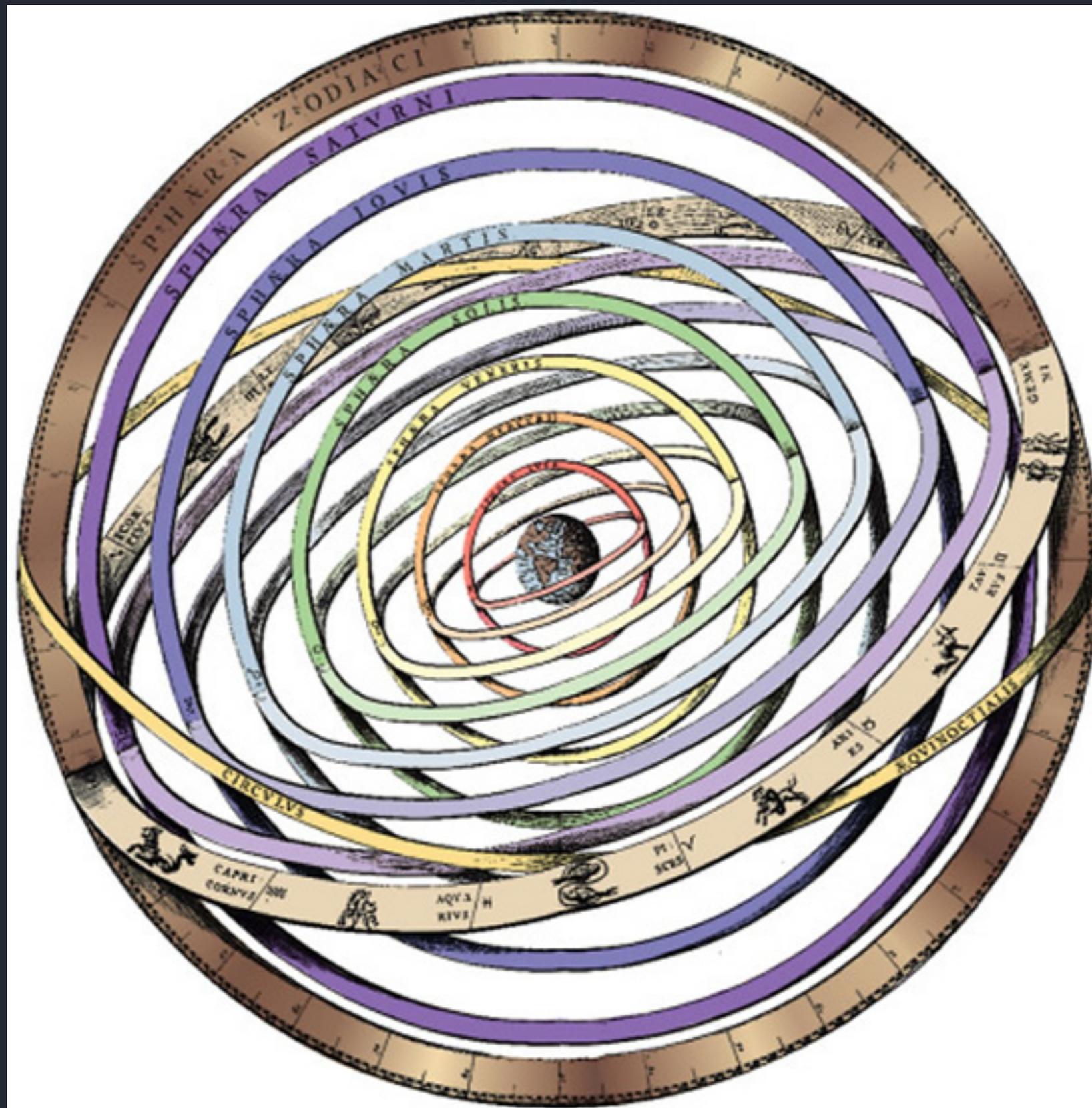


Ancient Greece (6th Cen. BC to 1st Cen. AD) is the primary source of modern astronomy

though many of their ideas were wrong, many others were right or at least valuable

Starting in the later part of the European renaissance (16th Century), the need to update the Greek astronomical knowledge led to a revolution in astronomy and indeed to the birth of modern science itself

Ancient Greeks developed the geocentric model...a series of nested celestial spheres, with the Earth at the center



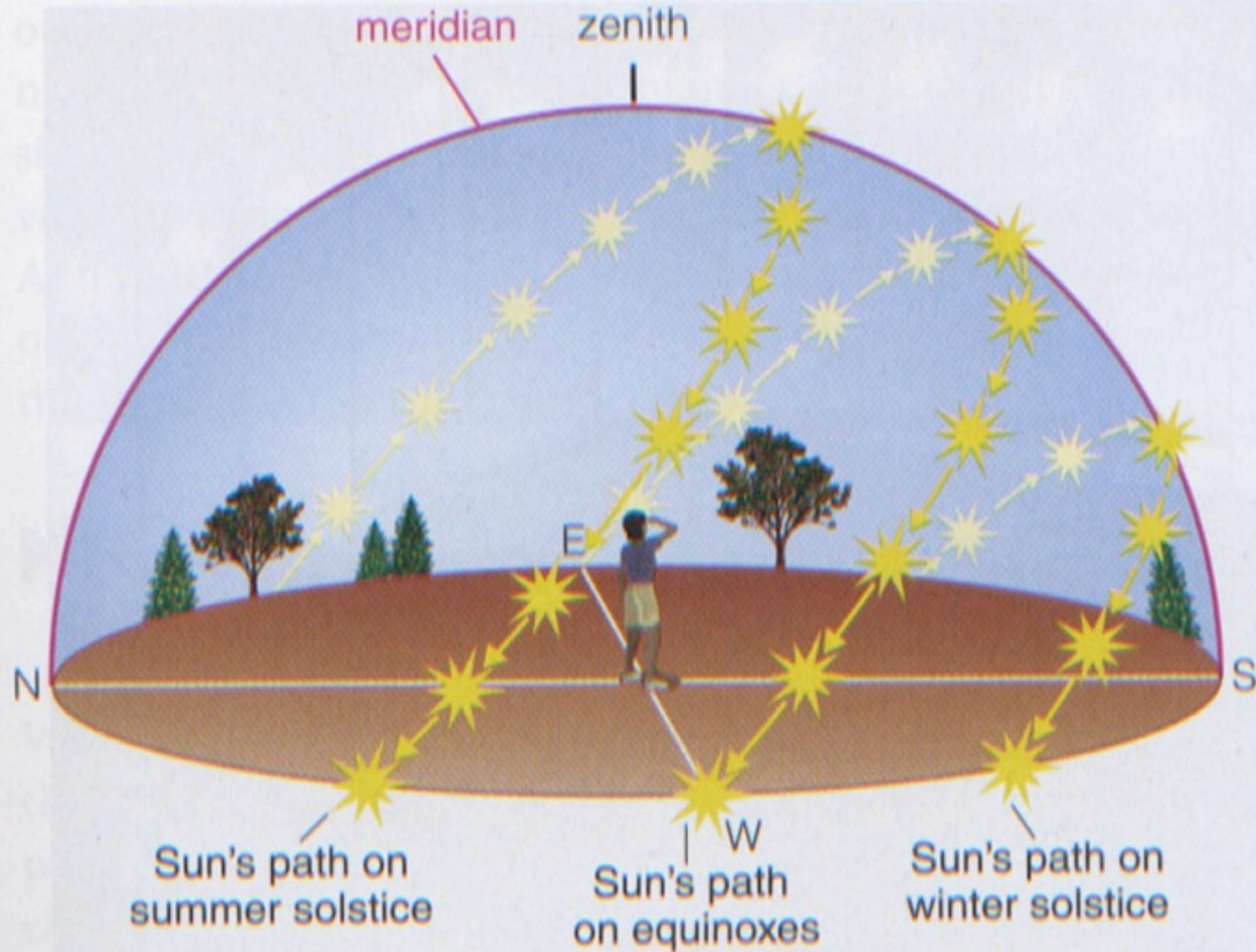
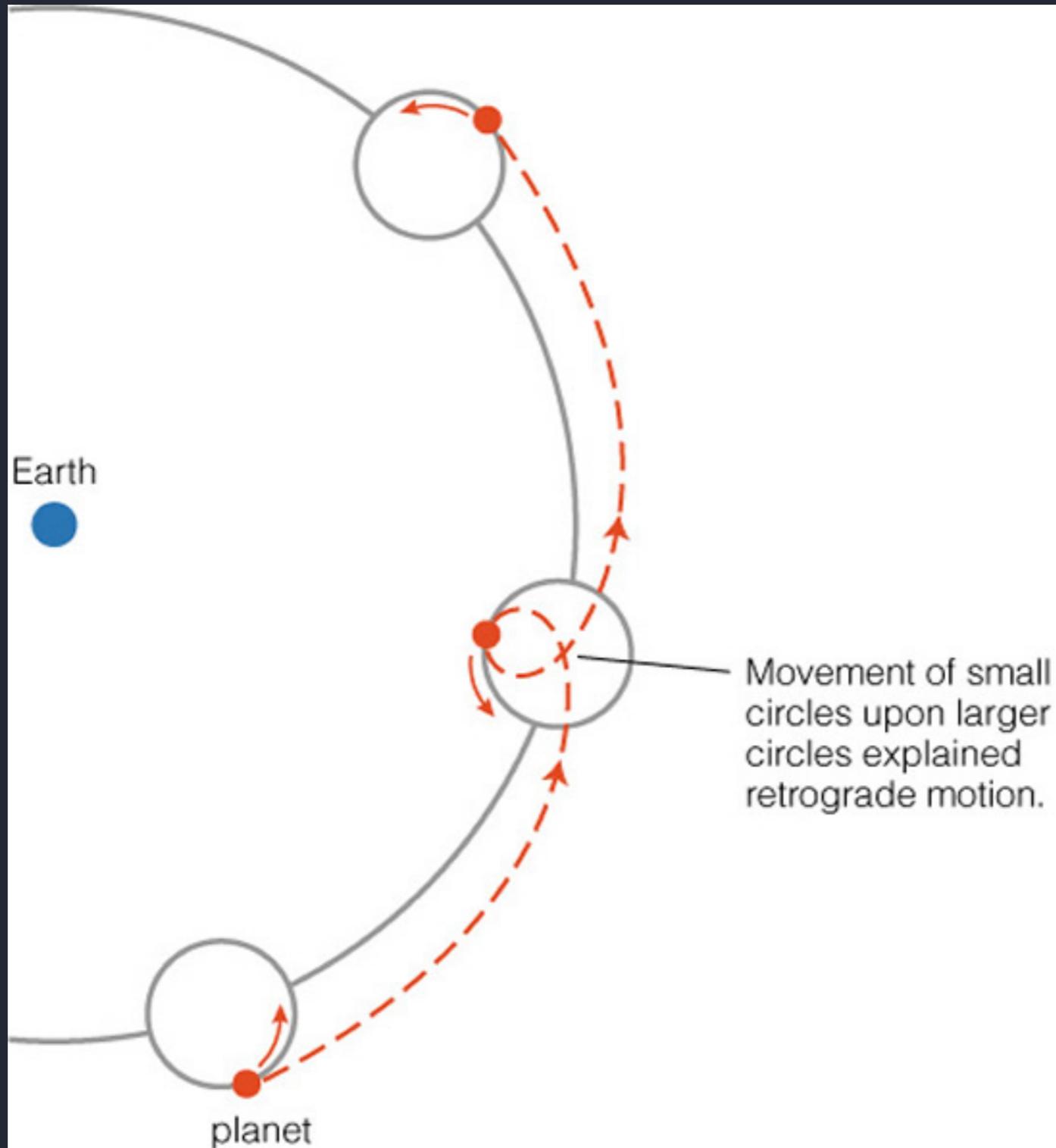


Figure 2.17 *Interactive Figure* This diagram shows the Sun's path on the solstices and equinoxes for the Northern Hemisphere sky (latitude 40°N). Notice that the Sun rises exactly due east and sets exactly due west only on the equinoxes. The summer solstice occurs on the day that the Sun rises and sets farthest to the north and reaches its highest point in the sky. The winter solstice occurs on the day that the Sun rises and sets farthest to the south and traces its lowest path through the sky.



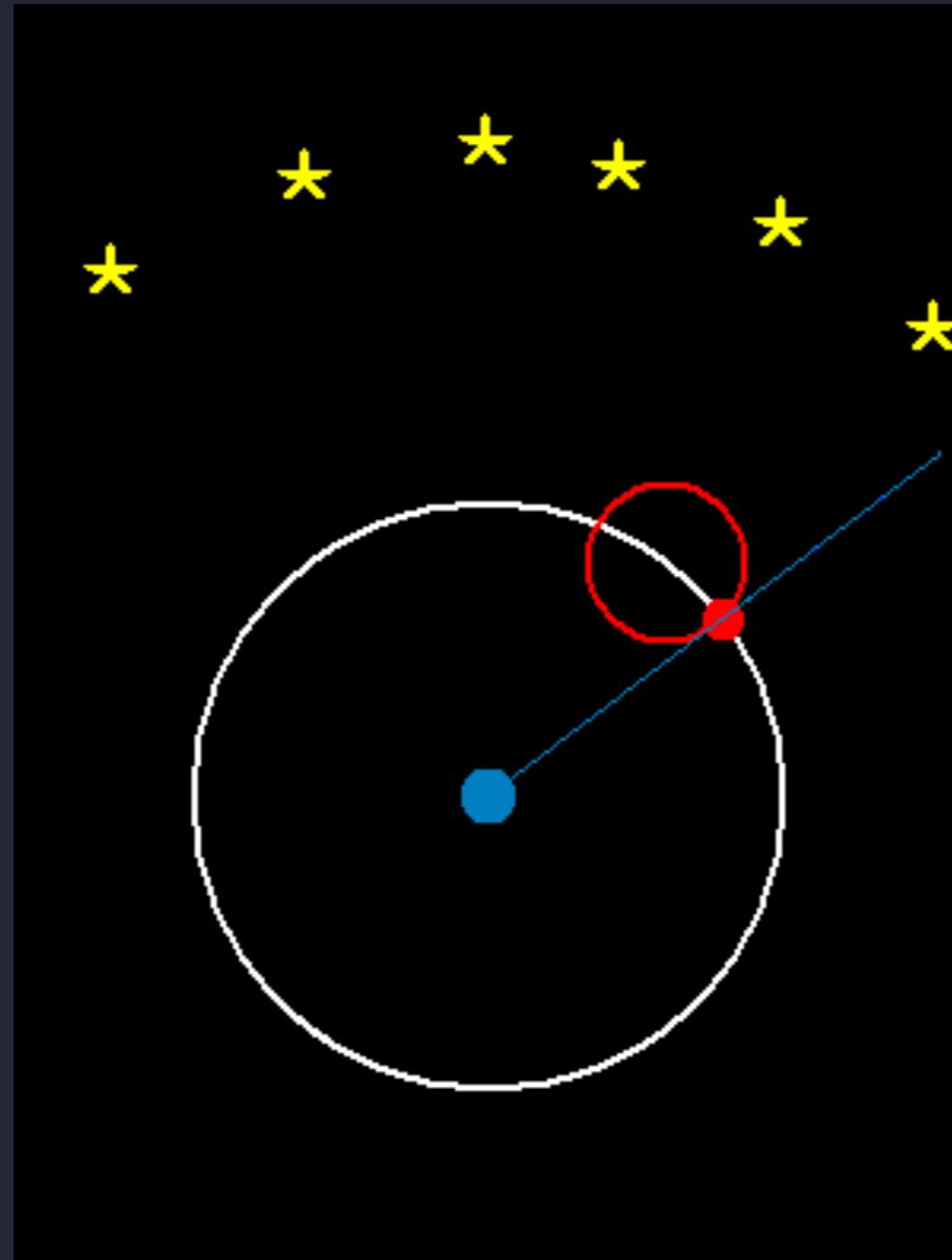
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Greek astronomy tries to meet the challenge of planetary motion

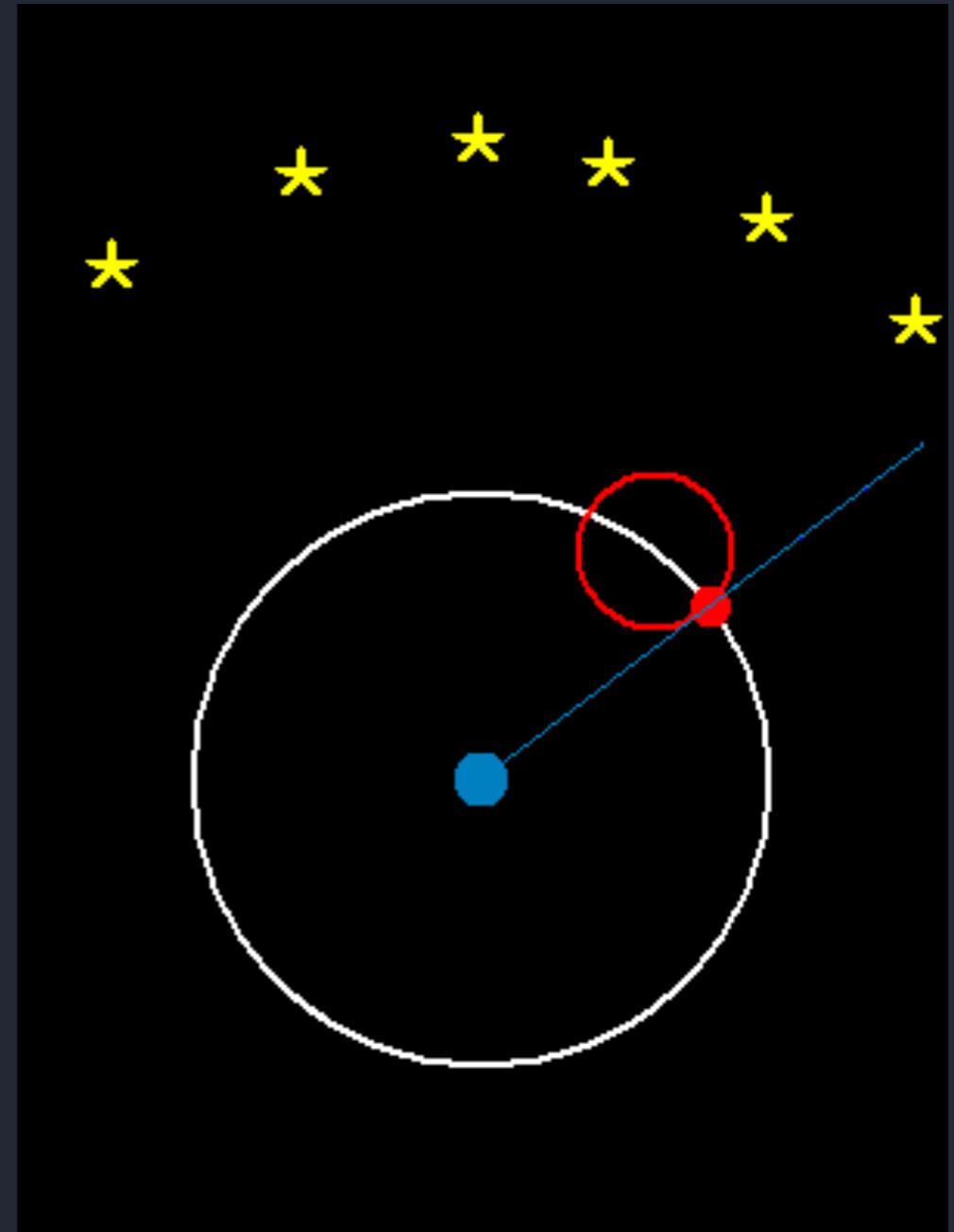
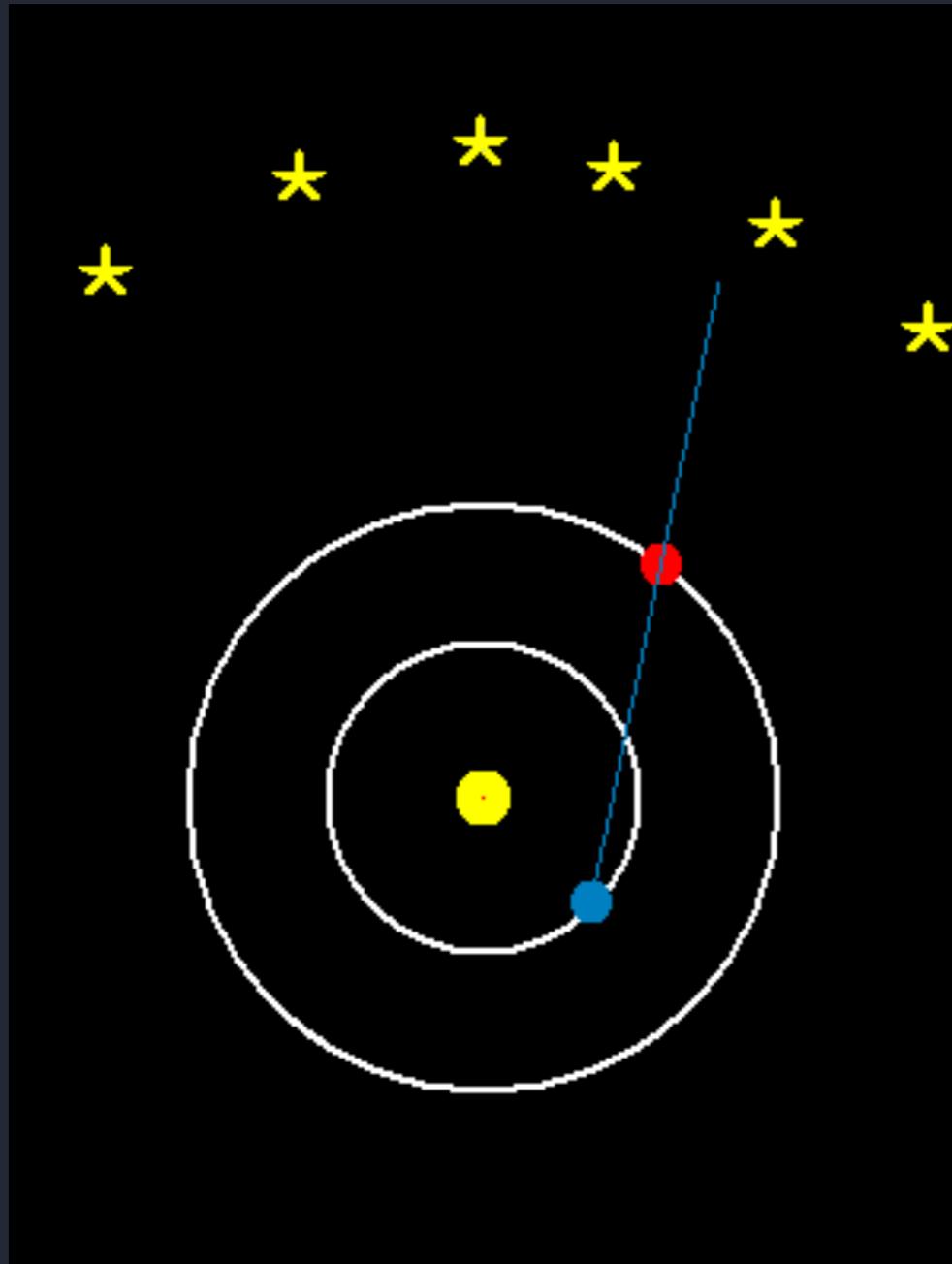


Epicycles – small circles on large circles – allowed for the model to explain complex, non-uniform and non-circular motion...by using “perfect” circles

In Ptolemy's model, the epicycle moving along the deferent causes retrograde motion (here of Mars)



The Copernican system's and Ptolemaic system's explanations of retrograde motion are mathematically equivalent. But the physical causes are very different.



see separate powerpoint document with the animations