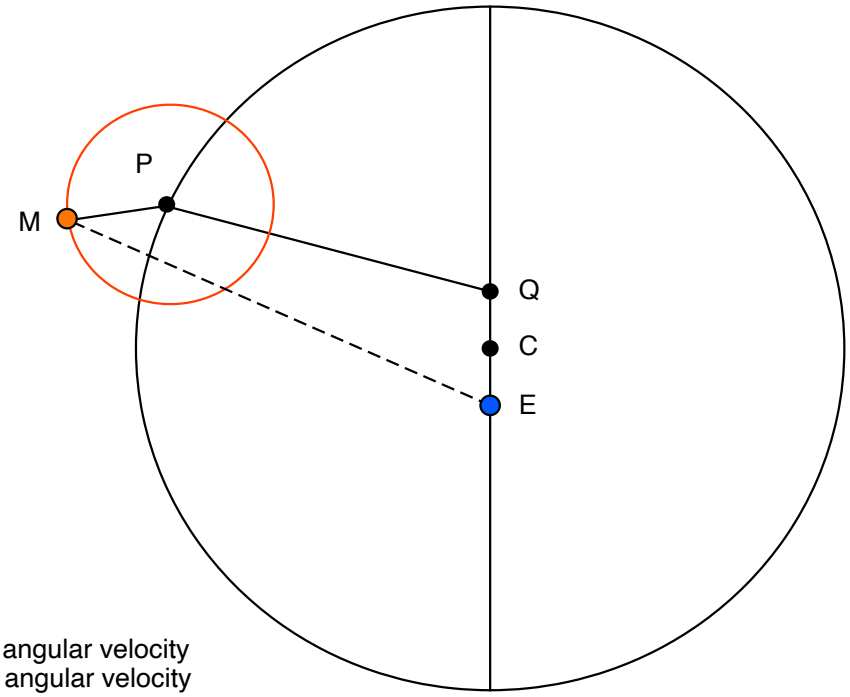
Basic Ptolemaic System

Apollonius produced a large volume of work on conic sections, and proved several theorems used by later astronomers. Though he never actually applied his math to astronomical calculations, he made several important discoveries relating the motion of an epicycle on a deferent. Epicycles were applied to astronomy by Hipparchus, who also introduced the idea of the eccentric to explain the difference in the length of the seasons. (He applied the eccentric to the motion of the sun around the earth.)

Of the planets easily observable to the naked eye, Mars has the most eccentric orbit. Building a model that could predict the position of Mars was the most difficult, and it was Mars that caused the most problems for the principle of uniform circular motion. (Actually, Mercury has a more eccentric orbit, but there was much less data for Mercury due to its closeness to the sun.)

This is a more detailed example of the Ptolemaic model for Mars. In the diagram below, the dashed line segment EM is the line of sight from the earth to mars.



Q is equant point
C is deferent center
E is earth
P is epicycle center
M is mars

EC = CQ
QP sweeps with constant angular velocity
PM sweeps with constant angular velocity

The epicycle rotates at a constant angular speed. At the same time, the center of the epicycle, P, is moving on the deferent such that the line segment PQ rotates with a constant angular speed. The equant was an invention of Ptolemy. He devised this so that he could accurately predict the positions of the planets while retaining some semblance of the principle of uniform circular motion. (The motion of Mars around the deferent was now non-uniform with respect to the center of the deferent, however.)

This model was used to calculate the longitudinal position of Mars. To calculate the latitude, a different set of calculations was done.

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This is NOT to scale at all – it is just to show the order of the planets in the Ptolemaic system.