

Kepler's 3rd Law

On how he discovered his Third law: " ... and if you want the exact moment in time, it was conceived mentally on 8th March in this year one thousand six hundred an eighteen, but submitted to calculation in an unlucky way, and therefore rejected as false, and finally returning on the 15th of May and adopting a new line of attack, stormed the darkness of my mind. So strong was the support from the combination of my labor of seventeen years on the observations of Brahe and the present study, which conspired together, that at first I believed I was dreaming, and assuming my conclusion among my basic premises. But it is absolutely certain and exact that the proportion between the periodic times of any two planets is precisely the sesquialterate proportion of their mean distances ... "

- Johannes Kepler (1571 - 1630)

[Source: "Harmony of the World": *Harmonices mundi* (Linz, 1619) Book 5, Chapter 3, trans. Aiton, Duncan and Field, p. 411, from School of Mathematics and Statistics, University of St Andrews, Scotland]

Kepler's 3rd Law (Harmonic Law):

The square of a planet's orbital period is directly proportional to the cube of the planet's mean distance (semi - major axis of the planet's elliptical orbit) from the sun.

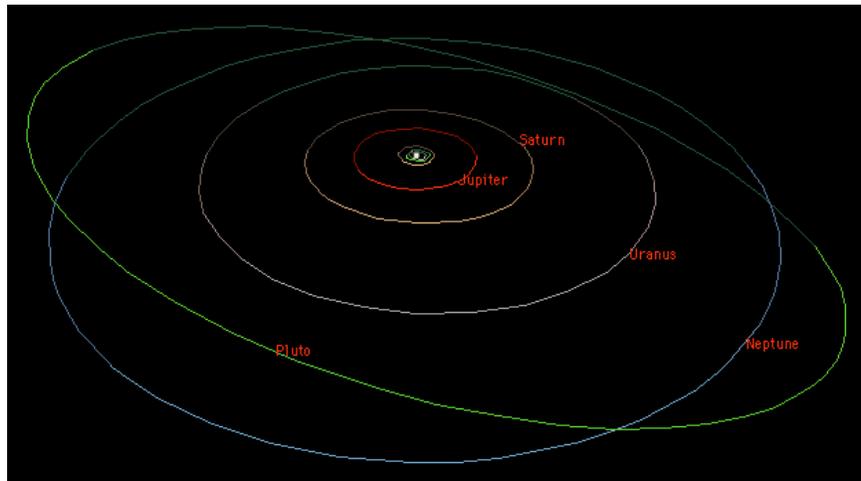
That is,

$$\begin{aligned} T^2 &\propto a^3 \\ T^2 &= k \cdot a^3, \\ T^2 \cdot a^{-3} &= k, \text{ universal planetary constant} \end{aligned}$$

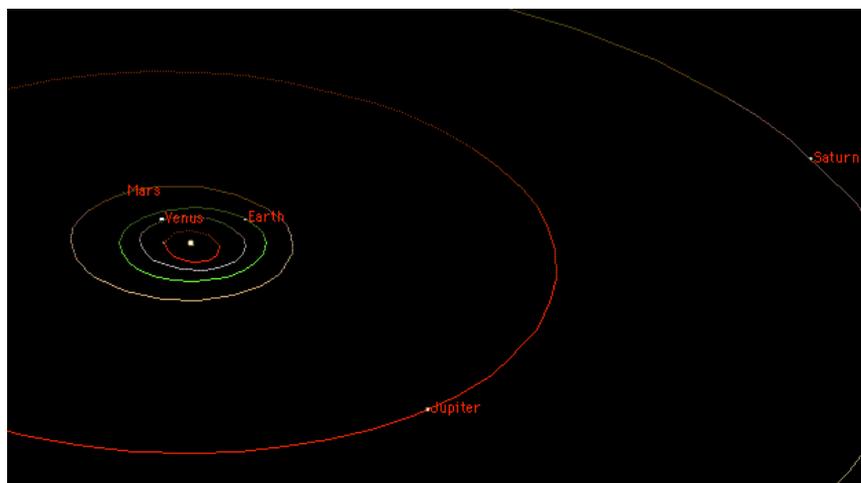
T = orbital period of planet

a = semi-major axis of orbit

k = constant value for all planets including Earth



Outer Solar Planets



Inner Solar Planets

source: <http://www.cab.u-szeged.hu/WWW/tnp/nineplanets/overview.html>

§ See the pdf on the Proof for [Kepler's 3rd Law](#).

§ References:

1. Kepler's 3rd Law (Harmonic Law) "[Astronomia Nova](#)", by Johannes Kepler (1571 - 1630)
2. Kepler's 3rd Law (Harmonic Law) "[Harmonices Mundi](#)", by Johannes Kepler (1571 - 1630)