

Topic Page: [celestial mechanics](#)

Definition: **celestial mechanics** from *The Penguin Dictionary of Science*

The study of the motion of stars and other celestial bodies.



Image from:

[volcanism The ASTER instrument aboard NASA's... in Astronomy Encyclopedia](#)

Summary Article: **celestial mechanics**

From *The Columbia Encyclopedia*

the study of the motions of astronomical bodies as they move under the influence of their mutual gravitation. Celestial mechanics analyzes the orbital motions of planets, dwarf planets, comets, asteroids, and natural and artificial satellites within the solar system as well as the motions of stars and galaxies. Newton's laws of motion and his theory of universal gravitation are the basis for celestial mechanics; for some objects, general relativity is also important. Calculating the motions of astronomical bodies is a complicated procedure because many separate forces are acting at once, and all the bodies are simultaneously in motion. The only problem that can be solved exactly is that of two bodies moving under the influence of their mutual gravitational attraction (see ephemeris). Since the sun is the dominant influence in the solar system, an application of the two-body problem leads to the simple elliptical orbits as described by Kepler's laws; these laws give a close approximation of planetary motion. More exact solutions, which consider the effects of the planets on each other, cannot be found in a straightforward way. However, methods accounting for these other influences, or perturbations, have been devised; they allow successive refinements of an approximate solution to be made to almost any degree of precision. In computing the motions of stars and the rotations of galaxies, statistical methods are often used. Columbia astronomer Wallace Eckert was the first to use a computer for orbit calculations; now computers are used for this work almost exclusively.

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