Large Scale Chaos and Marginal Stability in the Solar System

Jacques Laskar
Astronomie et Systèmes Dynamiques,
Bureau des Longitudes, 3 rue Mazarine, 75006 Paris, France
E-mail: laskar@bdl.fr

Large scale chaos is present everywhere in the solar system. All the inner planets probably experienced large scale chaotic behavior for their obliquities during their history. The Earth obliquity is presently stable only because of the presence of the Moon, and the tilt of Mars undergoes large chaotic variations from 0° to about 60°. On billion years time scale, the orbits of the planets themselves present strong chaotic variations which can lead to the escape of Mercury or collision with Venus in less than 3.5 Gyr. The organization of the planets in the solar system thus seems to be strongly related to this chaotic evolution, reaching at all time a state of marginal stability, that is practical stability on a time-scale comparable to its age.