

# Celestial mechanics on the microscopic scale

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## Resumen

Sensitive dependence on initial conditions is a feature of the motion of three or more bodies which interact gravitationally. In the solar system, objects such as asteroids and comets, can follow chaotic trajectories. Intriguingly, the same sort of trajectories are encountered in atomic and molecular systems, particularly for the motion of electrons that have been excited to very high energies. In effect, these so-called Rydberg electrons 'orbit' at large distances from their parent atoms. The mathematics describing the motion of gravitationally interacting bodies in space closely parallels the mathematics describing the motion of electrons. The special case of the celestial restricted three-body problem is mathematically analogous to the situation when a hydrogen atom loses its electron (through ionization) in crossed electric and magnetic fields. After presenting this remarkable analogy, I will explain how this connection is being used for mission design and for understanding the way chemical reactions take place.