

# Chaos in the Three body problem

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## Abstract

Since the works of Johannes Kepler (1571-1630), and later the works of Isaac Newton (1642-1727) about the universal laws of gravitation, it is well known that the possible motion of two bodies moving under their mutual Newtonian gravitational forces can be on ellipses, parabolas or hyperbolas.

In this talk we will recall Kepler results about the motion of two bodies and we will talk about the possible motions when one considers the more realistic model of three bodies.

This problem, already considered by Henri Poincaré (1854-1912), is still far from being understood, and one can find many works proving the existence of different type of solutions for the three body problem like periodic orbits, asymptotic orbits to them, among others.

In this talk we will give some light about the possible motions that three bodies can have if we wait enough time and we will try to answer questions like: will the orbits be bounded or can the bodies fall apart (and therefore going to “infinity”)?

Can one find chaotic motion in the three body problem and therefore unpredictability?

These and related questions will be the main goals of this talk, where we will see how the mathematical tools coming from Dynamical Systems can be used to deal with this complex problem.

In particular, we will prove the existence of oscillatory motions, that is, orbits which leave every bounded region but which return infinitely often to some fixed bounded region.