Abstract:
Consider the planar 3 Body Problem with masses $m_0, m_1, m_2 > 0$. In this paper we address two fundamental questions: the existence of oscillatory motions and chaotic hyperbolic sets.

In 1922, Chazy classified the possible final motions of the three bodies, that is, the behaviors the bodies may have when time tends to infinity. One of the possible behaviors are oscillatory motions: solutions of the 3 Body Problem such that the positions of the bodies $q_0, q_1, q_2$ satisfy 
\[
\liminf_{t \to \pm \infty} \sup_{i,j=0,1,2, i \neq j} \|q_i - q_j\| < +\infty \quad \text{and} \quad \limsup_{t \to \pm \infty} \sup_{i,j=0,1,2, i \neq j} \|q_i - q_j\| = +\infty.
\]
Assume that all three masses $m_0, m_1, m_2 > 0$ are not equal. Then, we prove that such motions exist. We also prove that one can construct solutions of the 3 Body Problem whose forward and backward final motions are of different type.

This result relies on constructing invariant sets whose dynamics is conjugated to the (infinite symbols) Bernouilli shift. These sets are hyperbolic for the symplectically reduced planar 3 Body Problem. As a consequence, we obtain the existence of chaotic motions, an infinite number of periodic orbits and positive topological entropy for the 3 Body Problem.

This a joint work with M. Guardia, J. Paradela and T. M. Seara