

SEMINAR PLAN: THEORETICAL AND NUMERICAL ASPECTS OF CELESTIAL MECHANICS

1. BASIC INFORMATION

Seminar:

Name: Theoretical and Numerical aspects of Celestial Mechanics
2022

Leader:

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2. OBJECTIVES

The main goal of this seminar is to provide or improve the background in Hamiltonian Systems and present applications of numerical tools to exciting problems in Celestial Mechanics. In this order, we would like to introduce the audience to some key concepts in Celestial Mechanics as the N-body problem, Central Configurations, Choreographies, Collision and Final motions.

The seminar will start with introductory classes and discussions about the problems and methodology. After that, the students should present some of the topics.

In an advanced seminar stage, we intend to discuss the result of published papers in the field and invite some specialists to talk about their results.

3. CONTENT

- Introduction to N-body problem. Mathematical aspects of 2-body problem and Kepler problem.
- The restricted three body problem. Stilnikov Problem. Hill's Problem.
- Computation of some special trajectories.
- Lagrangian Points and their neighborhoods: a study about Poincaré maps, stability of solutions and computation of Invariant objects
- Special solutions of N-body problem: Central configurations, choreographies.
- Collision and final motions.
- Perturbation theory.

4. SUGGESTED TEXT BOOKS

- **Introduction to Hamiltonian Dynamical Systems and the N-body problem**
Meyer, K.R. , Hall, G.R., Offin, D.

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- **Classical and Celestial Mechanics**
Cabral, H. and Diacu, F.
- **Solar Systems Dynamics**
Murray, C.D. and Dermott, S.F.
- **Practical Numerical Algorithms for Chaotic Systems**
Parker, T.S. and Chua, L.O.
- **Theory of Orbit- The Restricted Problem of Three Bodies**
Szebehely, V.
- **Mathematical Methods of Classical Mechanics**
Arnold, V.I.
- **Mathematical Aspects of Classical and Celestial Mechanics**
Arnold, V.I., Kozlov, V.V. and Neishtadt, A. I.

5. BACKGROUND REQUIRED

Ordinary of Differential Equations, notions of Dynamical Systems and Differential Geometry.