Gravitation of extended bodies and galaxies

ECTS : 4

Volume horaire : 30

Description du contenu de l'enseignement :

Dynamics of extended bodies and point-mass N-body systems (1/3)
Extended body :
angular velocity, kinetic moment, inertia tensor.
Euler-Liouville equation, application to the free rotation of the Earth principle of the gyroscope , solid body potential librations of a body, application to the Moon
Point-mass N-body system :
Restricted three body problem, lagrangian points perturbation theory, mean motion resonances and secular resonances stability criteria, chaos introduction to numerical integration
Milky Way and galaxies (2/3)
Morphological and kinematical properties of star clusters, galaxies, and galaxy clusters
Virial theorem, Boltzmann equation, Poisson equation, Jeans theorem, relaxation, characteristic times
Spherical potentials, axial potentials, epicyclic motion, Lindblad and other resonances spiral structures, density waves, instabilities
Galaxy interactions : tidal streams, introduction to N-body simulations

Compétence à acquérir :

Gravity is involved in one way or another in all astrophysical fields. It is therefore necessary to go beyond the 2 point body system, as seen in the first semester. The understanding of the dynamics of an extended body and an N-body system allows to deepen the understanding of classical gravitation up to the study of the dynamics of a galaxy.
This lecture is a natural extension of the gravity course of the first semester. The primary objective is to understand in more detail the dynamics of an extended body and a multi-particle system. This will provide the physical and mathematical basis for studying the dynamics of a galaxy and begin to lay the foundations for the study of extragalactic objects.