Study programmes: Bachelor studies – Astronomy and Astrophysics

Course name: Dynamics of cosmic plasma

Lecturers: Dušan Onić

Status: Compulsory

ECTS: 5

Attendance prerequisites: None

Course aims: Acquiring general and specific knowledge of physics and dynamics of comic plasma.

Course outcome: At the end of the course student has acquired basic characteristics of cosmic plasma and understands physical process in it. Student is familiar with specifics of different methods which are applied for studying dynamic of cosmic plasma, as well as mechanisms for formation of different types of waves in plasma.

Course content:

Introduction. Plasma characteristics. Plasma parameters. Collective and binary interactions in plasma. Criteria of plasma state. Methods for studying cosmic plasma dynamics.
Orbital method in plasma dynamics. Characteristic motion of charged particles in electric and magnetic fields. Drift of charged particles. Magnetic mirrors. Accelerating mechanism of charged particles. Fermis' acceleration. Alfens' acceleration.
Plasma radiation. Bremsstrahlung radiation. Non-thermal (cyclotron and synchrotron) radiation.
Hydrodynamic method in plasma dynamics. Magnetohydrodynamics application on cosmic plasma. MHD – approximation. Magnetic pressure in plasma. Equation of magnetic induction. Diffusion of magnetic field. Frozen magnetic field in plasma. Alfen's theorem and consequences.
Kinetic theory. Distribution function. Kinetic equation. Relation between kinetic and hydrodynamic equations.
Waves in cosmic plasma. Origin and characteristics of oscillations and waves in stellar plasma. Electrostatic oscillations and waves. Internal gravitational waves. MHD waves. Incompressible electro-conductive fluid. Alfen's waves. Compressible electro-conductive fluid. Magneto-acoustic waves. Shock waves. Shock waves in incompressible fluid. Shock waves in plasma. Heating stellar chromospheres and corona. Electromagnetic waves in inhomogeneous collisionless plasma without magnetic field. Electromagnetic waves in collisional plasma with magnetic field.

Literature:

М. Вукићевић-Карабин: 1994, *Теоријска астрофизика*, Научна књига, Београд;
Б. Милић: 1977, *Основе физике гасне плазме*, Научна књига, Београд

Exercises: М. Вукићевић-Карабин: 1994, *Теоријска астрофизика,* Научна књига, Београд
J. A. Bittencourt: 2004, *Fundamentals of Plasma Physics*, 3rd Ed.,Springer-Verlag, New York, Inc.;
M. Goossens: 2003, *An introduction to plasma astrophysics and magnetohydrodynamics*, Kluwer Acad. Publ.; http://poincare.matf.bg.ac.rs/~donic/vezbe.html

Number of hours: 4	**Lectures: 2**	**Tutorials: 2**

Teaching and learning methods: Frontal, Group work

Assessment (maximal 100 points)

Course assignments	points	Final exam	points
Lectures	10	Written exam	30
Exercises / Tutorials		Oral exam	40
Colloquia	20		
Essay / Project			