Study programmes: Bachelor studies – Astronomy and Astrophysics

Course name: Radio astrophysics

Lecturers: Dejan Urošević

Status: Compulsory

ECTS: 6

Attendance prerequisites: passed exam – radio astronomy

Course aims: Acquiring advanced knowledge in radio astrophysics

Course outcome: At the end of the course student has enough knowledge for advanced courses with topics in studying interstellar medium on PhD level. Student is capable to enrol into scientific work.

Course content:

LAWS THAT GOVERN PRODUCTION OF RADIO CONTINUUM

Bremsstrahlung radiation. Radiation of accelerated electron. Bremsstrahlung frequency distribution for single collision. Radiation of ionized gas cloud.

Synchrotron radiation. Review of Lorentz transformation. Synchrotron radiation of single electron. Total radiation power. Angular radiation distribution. Radiation frequency distribution – simplified representation. Radiation frequency distribution and polarization - detailed representation. Spectral distribution of synchrotron radiation from ensemble of electrons. Homogeneous magnetic field and polarization. Non-homogeneous magnetic field. Differential spectral index. Equipartition calculation. Supernova remnants. Hydrodynamic evolution of supernova remnants (free expansion phase, adiabatic phase, isothermal phase and dissipation phase). Radio evolution of supernova remnants in adiabatic phase.

Inverse Compton scattering. Sunyaev-Zel'dovich effect. Loss of energy from high brightness sources.

Black-body radiation. Radiation of black-body – dust in molecular clouds. Separating thermal and non-thermal component of radiation.

PLASMA EFFECTS IDENTIFIED IN RADIO CONTINUUM OBSERVATIONS

Emission measure.

Dispersion measure. Plane waves in non-conductive medium. Wave packet and group velocity. Plane waves in dispersive medium. Dispersion measure of diluted plasma.

Rotation measure. Wave polarization. Poincare sphere and Stokes parameters. Quasi-monochromatic plane waves. Stokes parameters for quasi-monochromatic waves. Faraday's rotation.

LINE RADIATION IN RADIO DOMAIN. Recombination lines. Lines of neutral hydrogen (HI). Molecular lines.

Literature:

Д. Урошевић, Ј. Милорадов-Турин: Теоријске основе радио-астрономије, Математички факултет, Београд, 2007

Exercises: T. L. Wilson, S. Huttemeister: Tools of Radio-Astronomy (Problems and Solutions), Springer-Verlag, Berlin, Heidelberg, 2000.

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

Teaching and learning methods: Frontal, Group work, Exercises

Assessment (maximal 100 points)

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