Study programmes: Bachelor studies – Astronomy and Astrophysics

Course name: Theory of stellar spectra

Lecturers: Olga Atanacković

Status: Compulsory

ECTS: 7

Attendance prerequisites: none

Course aims: Acquiring knowledge in theory of stellar atmosphere and formation of stellar spectra.

Course outcome: At the end of the course student knows basic quantities, ideas and concepts in the theory of stellar atmospheres. Student knows and understands physical processes that are fundamental for the formation of stellar spectra – continuum and spectral lines.

Course content:

Radiative transfer. Basic quantities related to the radiation field. Interaction of radiation with matter. Absorption and emission coefficients. Approximation of local thermodynamic equilibrium (LTE). The equation of radiative transfer. Boundary conditions. Formal solution. The Schwarzschild-Milne equations. Eddington-Barbier relation. Limb darkening law. Radiative equilibrium.

Formation of continuum energy distribution. Grey atmosphere. Mean opacities. Milne's equation. The method of discrete ordinates. Hopf's solution. Approximate solutions of the grey problem (Schwarzschild-Schuster method, Eddington method). Opacity in continuum. LTE radiative-equilibrium model atmospheres for the continuum. Temperature correction procedure. Convection.

Formation of spectral lines. Chemical composition and physical conditions in stellar atmospheres. Characteristics of line profile. Spectral line formation. Classical treatments of the line transfer. Non-LTE line transfer. The equations of statistical equilibrium. Two-level model atom. Line absorption coefficient. Broadening of spectral lines (natural, Doppler, collision, rotation, due to magnetic field, due to strong gravitational field).

Curve of growth. Theoretical curve of growth. Empirical curve of growth. Determination of chemical element abundances.

Literature:

М. Вукићевић-Карабин: 1994, *Теоријска астрофизика*, Научна књига, Београд

О.Атанацковић: *Теорија звезданих спектара* (скрипта: http://poincare.matf.bg.ac.rs/~olga/tzs/)

D. Mihalas: 1978, *Stellar atmospheres*, 2nd ed., San Francisco: W.H.Freeman&Comp.

Exercises: М. Вукићевић-Карабин: 1994, *Теоријска астрофизика*, Научна књига, Београд

D. Mihalas: 1978, *Stellar atmospheres*, 2nd ed., San Francisco: W.H.Freeman&Comp.

http://poincare.matf.bg.ac.rs/~olga/tzs/

http://nikolavitas.blogspot.com/p/old-course-materials-in-serbo-croatian.html

http://poincare.matf.bg.ac.rs/~donic/vezbe.html

Number of hours: 5	**Lectures**: 3	**Tutorials**: 2

Teaching method: Frontal / Group / Practical

Assessment (maximal 100 points)

Course assignments	points	Final exam	points
Lectures	10	Written exam	30
Practical work	10	Oral exam	40
Colloquia	10		
Essay / Project			