Study programmes: Astronomy and Astrophysics - PhD Studies
Course name: Astronomical Spectroscopy
Lecturers: Luka Popović
Status: Optional
ECTS: 9
Attendance prerequisites: none
Course aims: Obtaining advanced and specific knowledge in the field of astronomical spectroscopy.
Course outcome: After completing the course, student has advanced knowledge in the field of astronomical spectroscopy. First of all, student has the knowledge of the theory of radiation and radiation transfer, the properties of continuum and line spectra, different spectroscopic methods for probing the emission regions, and is capable to do independant scientific research in these fileds.
Course content: Kinematics in the central symmetric field. The energy levels of the atom. LS coupling, JJ coupling, JL coupling, line transitions, and selection rules. Transition probabilities, absorption coefficient and oscillator strength. Optical depth and equivalent width of the line. Radiative transfer. The theory of spectral line profiles. Spectral lines broadening; natural, Doppler, van der Waals, resonant and Stark broadening. General approximations of the line broadening theory: semiclassical approximation, adiabatic approximation, quasi-static approximation, collisional approximation. Continuum radiation. Natural continuum absorption. Neutral hydrogen. The negative ion of hydrogen. Other mechanisms of continuum absorption. Electron scattering. The total absorption coefficient. The stellar continuum emission. Quantitative chemical analysis of stellar atmospheres. The differential analysis of the abundances of chemical elements. Stellar line strengths. Mean curve of growth of the observed star. Spectral synthesis. The chemical composition of the Sun and stars. Determination of the stellar temperature and radius. Determination of the radius and the stellar absolute temperature by the absolute flux. Determination of the temperature from the continuum and line spectrum. Measuring the pressure in stellar atmospheres. Electronic pressure and gas pressure in stellar atmospheres. Continuum spectrum as an indicator of pressure. Pressure measurements using spectral lines. Diagram of the temperature and gravity acceleration. The stellar rotation and turbulent motion. Line profiles and stellar rotation. Microturbulence and macroturbulence and calculation of spectral lines. Radio lines of the hydrogen in interstellar medium. Special spectral methods. Atomic and molecular emission spectroscopy. Absorption and emission continuum spectroscopy. Nuclear magnetic resonance. Raman spectroscopy. Phosphorescent spectroscopy. Fluorescence spectroscopy. Mesbauer spectroscopy. Critical factors in the experimental study of the spectral line shapes. Plasma sourcec. Determination of the electron density. Measuring temperature. Self-absorption. The spectra of active galaxies.
Литература: 1. Милан С. Димитријевић, Астрономска спектроскопија, Публикације Астрономске опсерваторије у Београду, бр. 62, 1998. 2. H. R. Griem, Spectral Line Broadenig by Plasmas, Academic Press, New York, 1974. 3. A. Thorn, Spectrophysics, Chapman and Hall & Science, Paperbacks, London. 4. I. I. Sobel'man, Atomic spectra and radiative transitions, Springer Verlag, Berlin, 1979. 5. H. R. Griem, Plasma Spectroscopy, Mc Graw Hill Inc., New York 6. Gray, D. F., The observation and analysis of stellar atmospheres, Willey, Interscience, 1980. 7. Mihalas, Theory of stellar atmospheres 8. C. R. Cowley, The theory of stellar spectra, Gordon and Breach, New York, 1970.

Number of hours: 10	**Lectures: 4**	**Tutorials: 6**

Методе извођења наставе:
Frontal, group

Assessment (maximal 100 points)			
Course assignments	**points**	**Final exam**	**points**

Lectures	-	Written exam	-
Exercises / Tutorials	-	Oral exam	70
Colloquia	-	Written-oral exam	-
Essay / Project	30		