Study programmes: Master Studies - Astronomy and Astrophysics

Course name: Interpreting astronomical spectra

Lecturers: Olga Atanacković

Status: Optional

ECTS: 8

Attendance prerequisites: None

Course aims: Acquiring specific knowledge of spectrum formation theory of various astrophysical objects / environments

Course outcome: At the end of the course, student has a good knowledge of the theory and interpretation of astronomical spectra – spectra of various astrophysical objects /environments (from stars and interstellar medium to active galactic nuclei)

Course content:

The behaviour of spectral lines: The line transfer equation. Level populations. Line formation in LTE and non-LTE. Contribution functions and depths of line formation. Dependence of line strength on temperature, pressure and chemical abundance of the absorber.
Methods for inferring stellar parameters: Measurements of temperature, radius, pressure, rotation velocity, turbulence.
Measurement of spectral lines: Instrumental profile. Reconstruction process and removal of the noise. Scattered light and corrections. Line measurements with low resolution.
Chemical analysis: Curve of growth. Derivation of abundances via the curve of growth. Differential analysis. Synthesis method. Chemical composition of the Sun and stars.
Emission nebulae: Photoionization in gaseous nebulae. Continuum. Forbidden lines. Recombination lines. Resonance fluorescence.
Active galactic nuclei: Introduction and classification. Continuous spectra. Emission lines.
Spectrum of the cold interstellar medium: Atoms and molecules in the cold interstellar medium. Molecular hydrogen. Dust.
Expanding atmospheres. Winds and circumstellar shells: Moving astrophysical environments. Expanding stellar atmospheres. P Cygni line profiles. Supernovae and their remnants. Stellar winds.
Very hot thin gases and coronae: Very hot thin gases. The Solar corona.

Literature:

D. Emerson: 1996, *Interpreting Astronomical Spectra,* John Wiley & Sons
D. Gray: 2005, *The Observation and Analysis of Stellar Photospheres,* 3rd ed., Cambridge Univ. Press
D. Mihalas: 1978*, Stellar Atmospheres,* 2nd ed., San Francisco: W.H. Freeman & Co.
D.E. Osterbrock, G.J. Ferland: 2006, *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei*, 2nd ed., Sausalito, CA: Univ. Science Books
О.Атанацковић (скрипте: http://poincare.matf.bg.ac.rs/~olga/ias/)

Exercises: *D. Gray: 2005, The Observation and Analysis of Stellar Photospheres, 3rd ed., Cambridge Univ. Press*

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

Teaching and learning methods: Frontal, group work

Assessment (maximal 100 points)

Course assignments	points	Final exam	points
Lectures	-	Written exam	-
Exercises / Tutorials	20	Oral exam	60
Colloquia	-		
Essay / Project	20		