Study programmes: BACHELOR STUDIES – Astronomy and Astrophysics

Course name: Fundamentals of Statistical Physics

Lecturers: Milan Knežević and other lecturers

Status: Optional

ECTS: 5

Attendance prerequisites: Mathematics 2

Course aims: Learn the main concepts, laws and methods of equilibrium thermodynamics and statistical physics.

Course outcome: Students will be able to apply the acquired knowledge and methods in studies of simple equilibrium many-body systems.

Course content:

Fundamental concepts and laws of equilibrium phenomenological thermodynamics; applications to simple systems. Legendre transformations and thermodynamic potentials. Response functions. Equilibrium and stability conditions. Phases and phase transitions. First and second order phase transitions. Central limit theorem of probability theory. Shannon entropy. Foundation of classical statistical physics; Liouville's equation; ergodic hypothesis. Gibbs concept of statistical enesemble. Microcanonical ensemble; Gibbs paradox. Canonical ensemble; partition function for idel gas; Maxwell-Boltzmann distribution; fluctuation of energy. Grand canonical enesemble; fluctuations of energy and number of particles. Quantum statistics of identical particles; average occupation numbers for idel bose and fermi particles; applicability of classical statistics. Thermodynamic properties of ideal fermions. Bose-Einstein condensation. Statistics and thermodynamics of photon gas.

Literature:

1. H. Callen, Thermodynamics and introduction to thermostatistics 2nd ed. John Wiley (1985)
2. S. Milošević, Osnovi fenomenološke termodinamike, PFV (1979)
3. R. Patria, Statistical mechanics, 2nd ed. Butterworth-Heinemann (1996)
4. I. Živić, Statistička mehanika, PMF Kragujevac (2006)
5. R. Kubo, Statistical physics, North-Holland (1965)

Number of hours: 4	**Lectures**: 2	**Tutorials**: 2	**Laboratory**: -	**Research**: -

Teaching and learning methods:

Lectures, example exercises, consultations, homework assignments.

Assessment (maximal 100 points)

Course assignments	**points**	**Final exam**	**points**
Lectures	-	Written exam	30
Exercises / Tutorials	10	Oral exam	50
Colloquia	-	Written-oral exam	-
Essay / Project	10		