Exotic Statistics (lecturer: Dr. Andrij Rovenchak)

[2 ECTS credits]

Lectures

1. Introduction: Grand canonical ensemble. Notion of statistics. Energy level occupation. Statistical-mechanical approaches

2. Gentile statistics. Derivation of the Gentile distribution function. Polychronakos statistics. Haldane–Wu statistics.

3. Nonextensive Tsallis statistics and it modifications.

4. q-deformations and statistics

5. Quantum-mechanical approaches to statistics generalization. Anyons.

6. Basics of the group theory. Lie groups. SU(n), braid group.

7. Establishing links between different statistics types. Virial and cluster expansions.

8. Parabosons and parafermions. Operator realizations of fractional statistics.

Seminars

1. Thermodynamic properties of systems obeying the Gentile statistics.

2. Derivation of the distribution functions in the Polychronakos and Haldane–Wu statistics.

3. Polychronakos statistics with a complex parameter: a 1D oscillator system.

4. Nonextensive statistics. Canonical and grand-canonical formulation in various generalizations of the Tsallis statistics.

5. Basics of the q-calculus.

6. Elements of the group theory.

7. Anyon statistics. Integer and fractional quantum Hall effects.

8. Anyon statistics. Second virial coefficient. Links between various statistics types.

Grading plan:

Work during seminars: 20%

Seminar reports (average):   40%

Mid-term and final tests $(2 \times 20\%) =$ 40%

Total: **100%**

Grading scale: 90–100 = A; 81–90 = B; 71–80 = C; 61–70 = D; 51–60 = E