

Current subject area:**Physics**

Status	Course code / number in the book: B.1 <i>Physics of Bose-systems</i> Taught by: Andrij Rovenchak			
Acad. cycle	ECTS credits	Duration	Semester	Contact hours
Master	4	1 semester	Autumn	32
Year of study	Weekly lectures/seminars		Prerequisites	
1st	1 / 1		Statistical physics; Quantum statistics	
Languages	Examination		Assessment	
English	Written exam		100-point scale	

Aims and objectives: provide with knowledge of physical phenomena in quantum liquids and gases as well as with relevant mathematical techniques. Main objectives are to analyze processes in Bose-systems and to learn the methods for studies of ideal bosons and diluted systems of laser-cooled atoms of alkali metals. These issues are of particular interest due to recent experimental advances in this area.

Intended capabilities: to know basic physical properties of Bose-systems and theoretical methods for studying them; to be capable of obtaining main relations for an ideal Bose-gas and using techniques of quantum field theory for studies of bosonic systems with interactions.

Description. The course covers the following topics: History of Bose-system studies; Ideal quantum gases (derivation of the distribution functions, thermodynamics of the ideal Bose-gas, ideal Bose-gas in an external field); Bose-systems with a finite number of particles; Gross–Pitaevskii equation; Bogoliubov’s method of approximate second quantization; Bose-systems with strong interactions; Physical grounds of experimental techniques for cooling and trapping atoms.

Reading list:

1. N. N. Bogoliubov. *Lectures on Quantum Statistics. Problems of Statistical Mechanics of Quantum Systems*. New York: Gordon and Breach, 1967.
2. *Bose–Einstein Condensation*, ed. by A. Griffin, D. W. Snoke, S. Stringari. Cambridge University Press, 1995.
3. C. J. Foot. *Atomic Physics*. Oxford University Press, 2005.
4. A. Griffin. *Excitations in a Bose-condensed liquid*. Cambridge University Press, 1993.
5. L. D. Landau & E. M. Lifshitz. *Statistical Physics*. Oxford: Pergamon Press, 1980.
6. C. Pethick & H. Smith. *Bose–Einstein Condensation in Dilute Gases*. Cambridge University Press, 2002.

Online resources:

BEC Homepage, <http://www.colorado.edu/physics/2000/bec/>
Bose-Einstein Condensation at NIST, <http://www.bec.nist.gov/>