Examination topics

Each person will draw two problems from the set of "Basic questions". Answers to these questions will determine the initial grade. In case the student is not satisfied with the proposed grade, he or she can try to improve it by drawing one question from the set of Ądvanced topics".

Basic questions

1. Fock space formalism and second quantization.
2. Reduced density matrices.
3. BEC in an ideal Bose gas.
4. Definition of Bose–Einstein Condensation and the concept of Off-Diagonal Long-Range Order.
5. From mean-field to Gross–Pitaevskii: scaling regimes and their meaning.
6. Hartree theory: ground state energy and condensation (without proofs).
7. Landau's criterion for superfluidity.
8. Bogoliubov approximation for the Bose gas - non-rigorous (Bogoliubov's idea and computation).
9. Rigorous formulation of Bogoliubov theory.
10. Time-dependent Hartree and Bogoliubov theory.

Advanced topics

1. Ground state energy asymptotics in the mean-field limit: proof.
2. BEC in the mean-field limit: proof.
3. Justification of the Bogoliubov approximation - sketch of the proof.