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 "Advanced topics".

Basic questions

- 1. Concept of stability of matter of first kind. Uncertainty principle. Kinetic Lieb-Thirring inequality (with proof).
- 2. Proof of stability of matter of first kind.
- 3. The CLR bound and Lieb-Thirring inequality (statement and proof).
- 4. Semiclassical interpretation of Lieb-Thirring inequality.
- 5. Many-body QM, reduced density matrices.
- 6. Pauli's exclusion principle.
- 7. Ideal Fermi gas.
- 8. Kinetic Lieb-Thirring inequality for many-body wave functions.
- 9. Stability of matter of second kind (statement and proof).
- 10. Thermodynamic limit and grand canonical stability (sketch of proof).
- 11. Ionization conjecture.
- 12. Formal derivation of Thomas-Fermi theory. Scaling properties of TF functional. Validity of TF theory.
- 13. Other effective theories: TFW, TFDW, Hartree-Fock.

Advanced topics

- 1. Levy-Lieb density functional and its Gamma convergence to TF theory (sketch of proof).
- 2. Bosonic instability (sketch of proof).
- 3. Baxter's electrostatic inequality (sketch of proof).