Statistical Mechanics (Physics 219), Spring 2019

Date and time: Mondays and Wednesdays, 9:20–10:55am

Webpage: https://syzranov.physics.ucsc.edu/teaching/Course219spring2018/StatMech.html

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Location: ISB 231

Office hours: Friday, 11:00am-12:00pm or by appointment

Syllabus

- Reminder of main thermodynamic potentials and relations between them.
- Reminder of the concept of entropy, its statistical meaning, the concept of distribution function.
- Thermalisation. Ergodic and non-ergodic dynamics.
- Classical ideal gas and its thermodynamic functions. Maxwell distribution.
- Fermi and Bose distributions. Quantum ideal gases. Bose condensation.
- Magnetism of ideal quantum gases. Landau diamagnetism. Pauli paramagnetism.
- Systems with variable numbers of particles. Canonical and grand-canonical ensembles.
- Non-ideal gases. Virial expansion. Van der Waals' equation.
- Landau theory of phase transitions. Mean-field theories. Critical indices.
- Fluctuations. Small fluctuations in ideal gases. Fluctuation-dissipation theorem.
- Ising model. Mean-field solution. The method of transfer matrices in 1D.
- Second quantisation. Bosonic and fermionic Hubbard models.
- Phenomenological facts about superconductivity. Magnetic properties of superconductors.
- BCS microscopic theory of superconductivity.
- Solids. Heat capacity of crystals at high and low temperatures. Phonons.

Mark: 40% Homework + 30% Midterm + 30% Final exam

Recommended literature

- L.D. Landau and E.M. Lifshitz, v.5 "Statistical Physics"
- K. Huang, "Statistical Mechanics"
- M. Kardar, "Statistical Physics of Particles"

See and learn by heart the **most important formulas** at
https://syzranov.physics.ucsc.edu/teaching/Course219spring2019/Notes/Formulas.pdf