Spring term 2015/16

week		Statistical Physics/L		Statistical Physics/T
1.	26. 2.	Thermodynamics: System in thermostat, ideal gas, Gibbs paradox. Ensemble theory: Phase space, Liouville theorem, microcanonical ensemble.	22. 2.	Molecular dynamics and Monte Carlo simulations: Lennard-Jones fluid.
2.	4. 3.	Canonical ensemble: Ideal gas. Equipartition and virial theorems. Paramagnetism. Grand canonical ensemble.	29. 2.	Macroscopic quantities: probability distribution width. Hard spheres: equation of state. Ultrarelativistic gas: adiabatic expansion. Physical pendulum: Liouville equation and trajectories.
3.	11. 3.	Quantum statistical physics: Density matrix. Microcanonical and canonical ensemble. Particle in a box. Systems of indistinguishable particles.	7. 3.	Isobaric canonical ensemble. Tonks gas: equation of state. Classical rotor: phase space and partition function.
4.	18. 3.	Noninteracting systems I: Ideal Bose gas. Bose-Einstein condensation. Blackbody radiation.	14. 3.	Equipartition theorem: ultrarelativistic gas. Density matrix; different representations: electron in magnetic field. *Orto- and para-hydrogen.*
5.	25. 3.	Noninteracting systems II: Ideal Fermi gas, white dwarfs.	21. 3.	*Density matrix: system of free particles.* Superfluid helium: roton specific heat. Bose-Einstein condensation in 2D?
6.	1. 4.	Interacting systems I: Cluster expansion, virial equation of state.	28. 3.	*(holiday)*
7.	8. 4.	Interacting systems II: Second virial coefficient of hard-core bosons. Interating systems.	4. 4.	*Superfluid helium: two-fluid model. Mie-Grüneisen equation of state for a solid. Thomas-Fermi model of the atom.*
8.	15. 4.	Density-functional theory: grand potential as a functional, intrinsic free energy, Ornstein-Zernike equation.	11. 4.	Virial theorem. *Thermionic emission from metals.* N-particle correlation functions. Tonks gas: pair correlation function.
9.	22. 4.	Phase transitions I: Critical exponents, Landau theory, thermodynamic inequalities, Ginzburg criterion.	18. 4.	Structure factor and pair correlation function. Total and direct correlation function. Ornstein-Zernike equation. Potential of mean force. Percus-Yevick approximation. Tonks gas: direct correlation function.
10.	29. 4.	*(holiday)*	25. 4.	*(no class)*
11.	6. 5.	Phase transitions II: Exactly solvable models: Tonks gas, 1D Ising model, 2D ising model. Kosterlitz-Thouless transition.	2. 5.	*(holiday)*
12.	13. 5.	Phase transitions III: Renormalization group: 1D Ising model, flow in parameter space, fixed points.	9. 5.	*Density functional theory: melting of colloidal crystals, Binary mixtures and Ising model, Liquid crystals: Maier-Saupe theory.*
13.	20. 5.	Fluctuations I: Brownian motion: Einstein theory, Smoluchowski theory, Langevin theory.	16. 5.	XY-model: pair correlation function in 3D, *Free energy concavity and Griffiths inequality, Ising model (1D): transfer matrix approach.*
14.	27. 5.	Fluctuations II: Fokker-Planck equation, fluctuation-dissipation theorem, Onsager relations.	23. 5.	*Landau model: tricritical point, Ising model: Bethe approximation,* Thermodynamic stability of matter.
15.	3. 6.	Fluctuations III: Nematodynamics, Kubo formula, time-dependent Ginzburg-Landau theory.	30. 5.	*Ising model (2D): renormalization group, Brownian motion of free particles: Langevin approach, Brownian harmonic oscillator: linear response and fluctuation-dissipation theorem.*
16.	10. 6.	Stochastic thermodynamics.	6. 6., 10. 6.	*Master equations: Spruce budworm model, Curvature fluctuations of long molecules, Boltzmann equation: DC and thermal conductivity, thermoelectric effects.*