

Topics

I) Kinetics

- i) Boltzmann Equation from BBGKY truncation, via diluteness
- ii) H-Theorem via Detailed Balance and Molecular Chaos; Macroscopic Irreversibility from microscopic chaos and reversibility
- iii) Fluid Equations as moments of Boltzmann equation expressing conservation laws
- iv) Computing Transport Coefficients via Chapman–Enskog expansions
- v) Onsager Symmetry from microscopic reversibility

II) Linear Response Theory

- i) Kubo formulae: transport coefficient \leftrightarrow equilibrium correlation
- ii) Diffusion from cumulant expansion
- iii) Hydrodynamics, diffusion, dynamic response and susceptibility, relation to correlations
- iv) Quantum and Classical Fluctuation–Dissipation Theory

III) Statistical Dynamics

- i) Langevin Equation, Noise, Brownian Motion
- ii) Fluctuation–Dissipation Theorem Revisited
- iii) Fokker–Planck Equation and Theory
- iv) Basic Applications
 - Brownian particle
 - Logistic system (multiplicative noise)
 - Sedimentation
- v) Reaction Rate Problems: Kramers, First Passage
- vi) Emergence by Aggregation
 - Colloidal Coagulation
 - General Theory of Aggregation
 - Gelation, Finite Time Singularity

vii) Master Equation

- Formulation, relation to Chapman–Kolmogorov, Fokker–Planck
- Simple examples: Radioactive Decay, Diffusion
- Bimolecular Chemical Reactions
- Quantum Master Equation
- Dynamical Model of a Heat Bath, ‘Canonical’ Master Equation

viii) D-o-f Thinning, Zwanzig-Mori Method

IV) Special Topics — Coarsening