COSOM lecture INTERFACES
by Hubert Motschmann

The states of matter gas, liquid, solid, pair correlation function. Retrieve macroscopic properties from the model, such as why is a wet floor slippery? Which noble gas is the best choice for building a heat protection glass? Understand macroscopic properties as an average of the corresponding molecular quantities averaged about meso length scales. Understand isotropic and anisotropic properties, understand tensors, understand unusual phases: supercritical fluids, liquid crystals, nematic and smectic phases

Condensed phases are the consequence of intermolecular forces Can we liquefy an ideal gas? Discussion of ion-ion, ion -dipole, dipole-dipole, dipole induced dipole, induced dipole -induced dipole, H-bonding. Discussion of the potentials, relate the interaction energy to the thermal energy $k_B T$

Surface tension Estimate the surface tension of a simple liquid from the pair interaction energy w_{AA}, Techniques for the determination of the surface tension: drop shape analysis, Wilhelmy system. Minimal surfaces and soap lamella, surface pressure, the escape mechanism of the Stenus, Langmuir Blodgett films

Thermodynamics at interfaces Repeat the key findings of phenomenological thermodynamics, the thermodynamic potentials, Maxwell relations, Boltzmann equation, Adsorption of soluble surfactants, Gibbs equation and excess, Laplace equation, Ion distribution at a charged interface, Poisson-Boltzmann equation.

Adsorption Adsorption , Langmuir equation, Brunauer-Emmett-Teller (BET)model, Frumkin-Fowler-Guggenheim model, Irreversible adsorption, Random Sequential Adsorption model

Nucleation and growth Undercooled liquids, Homogenous and heterogeneous nucleation, Ostwald ripening, Kelvins law, Understand phase separation by spinodal decomposition. How does the heat pad work? Understand the mechanism of clouding, Why is a rain cloud dark and a heap cloud white? Understand the experiment Menthos in Cola,

Colloidal interactions Van der Waals interactions . Electrical double layer forces DLVO Potential Stabilization of colloidal particle with end-adsorbed polymers in good solvent conditions. Molecular cooking : Lets look on some recipes, what is happening on a molecular scale? Link taste to the interfaces, novel cuisine parsley foam.

Wetting, adhesion, friction and lubrication Young's equation, work of adhesion and cohesion, Hamakers law, Contact angle advancing and receding, contact angle hysteresis, Lotus e ect, Fundamentals of friction, Why can the gecko hang single toed on a vertical wall?

Surface rheology Nonequlibrium states, Surface dilational modulus, relation to foam stability, oscillating bubble technique