秋元琢磨（慶応大）

細胞膜近傍の水の異常ダイナミクス

(Anomalous water dynamics near the surface of a cell membrane)

Water molecules play an important role in providing an environment for biological reactions on cell membranes. In fact, water molecules form bridges that connect lipid molecules and stabilize cell membranes. Using all-atom molecular dynamics simulations, we show that translational and rotational diffusion of water molecules on lipid membrane surfaces exhibit subdiffusion (sublinear growth of the mean square displacement) and aging (decrease of diffusivity according to the measurement time). Moreover, we provide an evidence that both divergent mean trapping time (continuous-time random walk) and long-correlated noise (fractional Brownian motion) contribute to this subdiffusion. These results suggest that the water retardation, resulting in an enhancement of cell membrane stability and a higher reaction efficiency, is brought by subdiffusion on cell membranes.

池田昌司（京都大）

粒子のランダム最密充填における臨界性

(Criticality at the random close packing of spheres)

When spherical balls are thrown into a box and the box is shaken, a random packing of spheres is obtained. While different random packings are obtained in each attempt, surprisingly the densities are always about 64 %. This is called the random close packing of spheres. We use molecular dynamics simulation to discuss the vibrational and mechanical properties of densely packed spheres, showing that various dynamical anomalies appear at the random close packing. These anomalies are reminiscent of critical phenomena, though the critical point seems to be at zero temperature.

宮元展義（福岡工大）

Swelling and exfoliation of layered materials into liquid crystalline colloids of inorganic nanosheets

中川尚子（茨城大）

非平衡定常系への操作的仕事と線形応答関係の破れ

1993年にゆらぎの定理が発見され、非平衡系の微視的ゆらぎの一端が明らかにされた。これにより、非平衡系の巨視的性質を微視的レベルから積み上げて研究するための門戸が一つ開かれた。本講演では、熱伝導系に代表される非平衡定常系に焦点をあて、ゆらぎの定理を利用して熱力学関数や熱力学関係式を拡張した結果について報告する。とくに非平衡定常系に外部操作を施すために要する仕事が、平衡系への操作によるポンピング効果や線形応答関係の破れに結びつけられること、さらにJarzynski等式および第2法則の非平衡定常系への拡張などを報告する予定である。

大政義典（関西大）

Surface waves on complex liquids

Liquid surfaces are always fluctuating due to the thermal motions. The spectra of the fluctuations can be studied experimentally by using the surface dynamic light scattering (SDLS) technique. The spectra reflect the surface tension and viscoelastic properties of both the surface and the underlying bulk liquid.

We studied two examples of the dynamics of thermally excited fluctuations on the surface of complex liquids from a theoretical point of view. First, we studied the case where the underlying bulk liquid is a non-Newtonian viscoelastic liquid. In this case, the surface waves show complex behaviors such as crossover between the capillary wave and the elastic wave, and the coexistence of several modes. We show that the power spectrum is separated into surface localized modes and the bulk shear modes. In addition, they are decomposed further into several modes using the partial fraction expansion. We discuss evolution of the constituent peaks with liquid parameters.

Next, we studied the case where some kind of order parameter exists on the Newtonian liquid surface. In this case, effective surface dilational elasticity ε appears, and the relaxation process of the order parameter induces the surface viscosity. Especially, when the order parameter represents the concentration of the soluble surfactant on the surface layer, the relaxation process mainly governed by the exchange of the surfactant molecules between the surface and the bulk liquid. In this case, coupling between the surface wave mode and the fluctuation of the solute concentration in the bulk liquid plays important role. We discuss the influence of this effect on the SDLS spectra.

迫田憲治（九州大）

温度応答性高分子のランダムコイル–グロビュール転移に対する巨大分子の混み合いと塩添加の複合効果

(Combined effects of macromolecular crowding and salt-addition on the ramdom coil-globule transition of a thermoresponsive polymer)

Poly(N-isopropylacrylamide) (PNIPAM) is a thermoresponsive polymer that shows the coil-globule transition at ~31˚C. We have studied the combined effect of macromolecular crowding and salt-addition on the coil-globule transition of PNIPAM in aqueous solution. The transition temperature as a function of salt concentration drastically changes with or without macromolecular crowders in solutions. The addition of the macromolecular crowders modulates the adsorption property of salt (SCN-) onto PNIPAM, causing the drastic change of the transition temperature. Hence, the macromolecular crowding and salt-addition show the combined effects on the coil-globule transition of PNIPAM in aqueous solution.