Name: Makiko Sasada

Research field: Probability and Statistics

Keywords: statistical physics, hydrodynamic limit, anomalous diffusion

Present research: My main research area is probability theory. I have been working on problems motivated by the statistical physics. The most fundamental problem in the non-equilibrium statistical physics is to derive the evolution equations of macroscopic parameters such as the temperature, the density and the pressure from microscopic systems, which consist of a large number of particles such as atoms or molecules. Under the assumption that the evolution of the microscopic system to be stochastic, the derivation can be justified rigorously, as the law of large numbers for empirical distribution of the microscopic system through a space-time scaling limit. This procedure is called the hydrodynamic limit.

Recently, I am working on the hydrodynamic limit for non-gradient systems via topological approach, and also on the derivation of anomalous and normal diffusion of energy from a microscopic Hamiltonian dynamics with stochastic noise.

The derivation of the macroscopic behavior from the fundamental law of the microscopic system is strongly required not only in the physics but also in the various fields such as the biology, the chemistry, the economics and so on. I am also interested in the applications of the mathematical methods to them.

Notice for the students:
Basic knowledge of the measure theory and the probability theory is required. Besides, I recommend to read textbooks about the stochastic processes, statistical physics, or partial differential equations according to your interest.

Also, I would like the students wishing to work with me to keep thinking with patience, study slow and steady, and discuss with other people a lot.