Katori-Group Seminar
with Prof. Piotr Graczyk

Date and Time: Thursday 16 March 2023, 16:30-17:30

Venue: Room 3507, 5th floor, Building No.3, Korakuen Campus, Department of Physics, Chuo University

Program: (15 min. talk + 5 min. discussion for each)

16:30-16:50 Yuya TANAKA
Rings-to-Disk Transitions in Complex Eigenvalue Processes

16:50-17:10 Ayana EZOE
Switching Interacting Particle Systems Modeling Foraging Path Selection by Ants

17:10-17:30 Saori MORIMOTO
Classifications and Generalizations of Traffic Flow Models in Statistical Mechanics

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Abstracts

Yuya TANAKA

Rings-to-Disk Transitions in Complex Eigenvalue Processes

First I show two movies of complex eigenvalue processes of the non-Hermitian matrix-valued Brownian motions starting from two different initial matrices. The first one shows a simple growing of a disk starting from a point source. The second one shows a transition from a single ring to a disk. I am interested in the latter case and studying its generalization as explained in this talk. I briefly review the hydrodynamic equations of eigenvalue processes following the paper by Burda et al. (Nucl. Phys. **B 897** (2015) 421). The solutions of the hydrodynamic equations describe both cases well. We found the initial matrices showing transitions from double rings to a disk of eigenvalue distributions. I report the double-ring solutions of the hydrodynamic equations. Finally I discuss the general case starting from m-multiple rings with an arbitrary integer m.

Anaya EZOE

Switching Interacting Particle Systems Modeling Foraging Path Selection by Ants

Collective behaviors and swarm intelligence of ants have been extensively studied experimentally, and mathematical modelling is a challenging subject. Recently Nishimori's group experimentally showed that ants perform a situation-dependent switching of the primarily relied cues from the recruit pheromones to the visual ones in the foraging path selection. I use the notion of switching interacting particle systems introduced by den Hollander's group in probability theory in which slow particles and fast particles are switching randomly with a given transition rate. Here I propose a stochastic model on a plane lattice, where the hopping of particles has two modes, slow and fast. The slow mode represents the pheromone-mediated-walk and the fast model represents the visual-cues-mediated-walk of ants. I will show the simulation results of my model.

Saori Morimoto

Classifications and Generalizations of Traffic Flow Models in Statistical Mechanics

One of the most serious issues in modern society is a traffic jam. Starting from a simple cellular automaton (CA) model named Rule-184, a series of improvements of traffic flow models have been reported in statistical mechanics. The main purpose of the improvements was to reproduce the fundamental diagram (the density-flow diagram) obtained by empirical data. Following 'a general stochastic traffic CA model' proposed by Sakai et al. (J. Phys. A: Math. Gen. **39** (2006) 15327), I have programmed in Python my own 'generalized CA model' which includes the quick-start model and the slow-to-start model. In the preset talk, I will explain a variety of models and demonstrate the numerical simulations showing dependence of the obtained fundamental diagrams on the parameters of my model. I expect that the traffic flow models studied so far can be classified into two categories by the following two factors: drivers' individual factor and the eivironmental factor.