Contribution ID: **97** Type: **poster**

Nonequilibrium Kosterlitz-Thouless transition in a three-dimensional driven disordered system

Two dimensional (2D) systems with global $U(1)$ symmetry such as liquid Helium films and superconducting arrays of Josephson junctions exhibit a topologically ordered phase, which is characterized by power-law decay of the correlation function. The transition from such a quasi-long-range order (QLRO) phase to a disordered phase is called the Kosterlitz-Thouless (KT) transition. The peculiarity of this transition comes from the fact that it is caused by the structural changes in topological defects. Since the geometries and interactions of the topological defects crucially depend on the spatial dimensions, it is intriguing to understand the role of spatial dimensionality in the realization of the KT transition. In the first step toward clarifying this problem, we ask whether there exists a topologically ordered phase and a KT transition in higher dimensions.

It is well known that a quenched disorder can significantly change the large-scale physics of phase ordering systems. One might expect the possibility that the disorder leads to a novel type of KT transition. In fact, some 2D disordered systems are known to exhibit a disorder-induced KT transition at zero temperature. However, to the best of our knowledge, there is no example of a higher-dimensional disordered system which exhibits a KT transition in equilibrium.

In this study, we show that the three-dimensional random field XY model exhibits a topologically ordered phase and a KT transition when it is driven at a uniform velocity. In the first part of this study, we consider the spin-wave model in which the vortices are ignored. By applying the non-perturbative renormalization group approach, we show that the spin-wave model exhibits a QLRO phase, wherein the correlation function shows power-law decay with an exponent that depends on the disorder strength and the driving velocity. This QLRO phase resembles the topologically ordered phase in the 2D pure XY model. In the second part, we develop a phenomenological theory of the KT transition by taking into account the effect of the vortices. The change in the vortex structure at the transition point is also discussed.

Primary author: HAGA, Taiki (Kyoto University)

Presenter: HAGA, Taiki (Kyoto University)