



IFMP Seminar

Date Tuesday, December 06, 2022, at 14:50

REC/C213

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Speaker **Kotaro Shimizu**

University of Tokyo

Title **Phase degree of freedom and topological properties in multiple-Q spin textures**

Abstract Topological spin textures, such as two-dimensional skyrmion lattices (SkLs) and three-dimensional hedgehog lattices (HLs) are approximately represented by superpositions of multiple spin-density waves, and hence, called multiple-Q spin textures. In such spin structures, the phase degree of freedom of the superposed waves plays an important role in the topological properties as well as the symmetry of the magnetic textures [1,2], but no systematic investigation has been performed thus far.

In this study, we theoretically investigate the evolution of magnetic and topological properties in SkLs composed of three spin density waves (3Q-SkL) and HLs composed of four spin density waves (4Q-HL) while changing the phases as well as the magnetization [3]. By introducing a hyperspace to deal with the phase degree of freedom systematically, we find that the 3Q-SkLs change their skyrmion number among -2 , -1 , 0 , 1 , and 2 depending on the phase and magnetization. In the case of the 4Q-HLs, we obtain richer phase diagrams where the density and configuration of topological objects called hedgehogs and antihedgehogs change in a wide range. Our results of the complete phase diagrams for the phase shift provide good references to discuss how the actual systems experience magnetic and topological transitions in an applied magnetic field.

[1] T. Kurumaji *et al.*, *Science* **365**, 914 (2019).

[2] S. Hayami, T. Okubo, and Y. Motome, *Nat. Commun.* **12**, 6927 (2021).

[3] K. Shimizu *et al.*, *Phys. Rev. B* **105**, 224405 (2022).

Host: D. Peets