Condensed Matter Theory Seminar

Topotronics with Magnetic Topological Materials

Speaker: Prof. Oleg Tretiakov

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Tuesday, June 10, 2025

Lecture Room, Collaboration Bldg.(3F)

2025年 6月10日（火）16:00–17:00

コラボレーション棟 講義室（3F）

I will discuss topological magnetic textures, such as skyrmions, half-skyrmions (merons), and bimerons, which constitute tiny whirls in the magnetic order. They are promising candidates as information carriers for next generation electronics, as they can be efficiently propelled at very high velocities employing current-induced spin torques [1]. First, I will talk about bimerons [2] and antibimerons [3] in ferromagnetic systems coupled to heavy metals and topological materials. Then I will show that antiferromagnets can also host a variety of these textures, which have gained significant attention because of their potential for terahertz dynamics, deflection free motion [4], and improved size scaling due to the absence of stray fields. Finally, I will demonstrate that topological spin textures, merons and antimerons, can be generated at room temperature and reversibly moved using electrical pulses in thin film CuMnAs, a semimetallic antiferromagnet that is a test-bed system for spintronic applications [5].

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References:

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[2] B. Göbel, A. Mook, I. Mertig, and O. A. Tretiakov, Phys. Rev. B **99**, 060407(R) (2019); K. Ohara, Y. Chen, J. Xia, M. Ezawa, O. A. Tretiakov, et al., Nano Lett. **22**, 8559 (2022).
[3] P. A. Vorobyev, D. Kurebayashi, and O. A. Tretiakov, ArXiv:2410.10557 (2024).
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[5] O. J. Amin, O. A. Tretiakov, K. W. Edmonds, and P. Wadley et al., Nature Nano. **18**, 849 (2023).