



量子物理学・ナノサイエンス第 281 回セミナー

Antiferromagnetic Spintronics with Topological Solitons

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概要

Magnetic skyrmions are topologically protected spin solitons, which may be used in spintronic devices for information storage and processing. However, skyrmions in ferromagnets have some intrinsic difficulties, which must be overcome to use them for spintronic applications, such as the inability to move along electric current due to skyrmion Hall effect [1]. I will discuss how to work around this problem by using instead of skyrmions different anisotropic topological solitons? antiskyrmions, recently observed in systems with anisotropic Dzyaloshinskii-Moriya interaction [2]. I will explain their current-driven dynamics in both ferromagnets and antiferromagnets based on the transformation between skyrmion and antiskyrmion. Yet as another solution to eliminate the skyrmion Hall effect, I will also talk about skyrmions in antiferromagnetic materials [3]. We demonstrate how they can be stabilized [4] and manipulated at finite temperatures [3]. An antiferromagnetic skyrmion is a composite topological object with a similar but of opposite sign spin texture on each sublattice, which results in a complete cancellation of the Magnus force and as a result absence of skyrmion Hall effect. I will show that this effect is universal for any topological solitons. However, the topological spin Hall effect of antiferromagnetic skyrmion texture is nonzero and enhances the spin transfer torques acting on skyrmions [5].

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[2] A. K. Nayak, et al., *Nature* **548**, 561 (2017).

[3] J. Barker and O. A. Tretiakov, *Phys. Rev. Lett.* **116**, 147203 (2016).

[4] P. F. Bessarab, D. Yudin, D. R. Gulevich, P. Wadley, M. Titov, and O. A. Tretiakov, *Phys. Rev. B* **99**, 140411(R) (2019).

[5] C. A. Akosa, O. A. Tretiakov, G. Tatara, and A. Manchon, *Phys. Rev. Lett.* **121**, 097204 (2018).

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