固体物理セミナー（令和元年度　第５回）

（インタラクティブ物質科学カデットプログラム講演会後援）

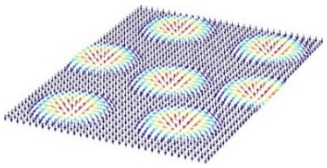
Date: 9:20-10:20,Wednesday 9th October, 2019

Place: G215-221 Seminar Room

Speaker: Dr. Anjan Soumyanarayanan (A*STAR and NUS, Singapore)

Contents: Magnetic Skyrmions: Creation, Stability and Dynamics

Abstract: The discovery of room temperature (RT) magnetic skyrmions in multilayer films has spawned a fascinating research field witnessing rapid progress in fundamental science and device applications [1]. A magnetic skyrmion is defined by the topological character of its spin structure, which emerges from the interplay of atomic-scale magnetic interactions. Skyrmions are expected to scale to sub-10 nm sizes, with individual addressability in devices.



Schematic array of

Here we describe our efforts to unravel the relationship between the properties of magnetic skyrmions, their parent magnetic interactions, and their stability and dynamics in multilayer thin films and devices.

We begin by introducing our material platform – Ir/Fe(x)/Co(y)/Pt multilayers – wherein skyrmion properties (e.g. size, density) can be systematically tailored by varying magnetic interactions [2]. Next, we show how interfacial chiral interactions can progressively lead to the emergence of Néel helicity [3, 4], and the evolution of chiral bubbles into skyrmions [4]. Crucially, we clarify that skyrmions and chiral bubbles have distinct creation and annihilation mechanisms, which manifest in contrasting thermodynamic signatures [5].

We then turn to skyrmions in nanodots – wherein zero field stability is achieved by confinement [6]. Ongoing efforts are exploring their potential for realizing tunnel junction devices. Finally, we examine skyrmion dynamics in nanowire devices [7]. Here, we identify distinct skyrmion dynamic regimes, and distinguish intrinsic electrodynamics from geometric and disorder-related effects. We will conclude by outlining the promise of skyrmions towards next-generation electronic technologies.

References

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[2] A. Soumyanarayanan et al., Nature Materials (2017) 16, p898–904.
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[5] A.K.C. Tan et al., Submitted (2019).
[6] P. Ho et al., Physical Review Applied (2019) 11, 024064.
[7] A.K.C. Tan, P. Ho et al., In Prep (2019)

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＊　固体物理セミナーは、物性・未来（物性系）Ｍ２必修科目「ゼミナール III」に該当します。