# On-line SPICE-SPIN+X Seminars

**Wednesday, 15th June 2022, 15:00 (CET)**

**The seminar will be via Zoom (**Meeting ID: 833 5270 5239**) and live streamed in the SPICE YouTube Channel.**


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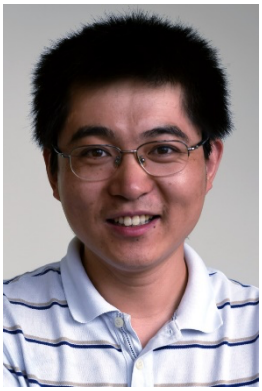

## Nonreciprocal transport and topological band structure through interactions of magnonic multilayers

Dipolar interaction, one of the most classical interaction mechanisms among magnetic moments, acts as a 'spin-orbit-coupling' like mechanism on magnons, by coupling their precession handedness with the propagation direction. This has given rise to the well-known surface magnetostatic wave (Damon-Eshbach mode) in thin film ferromagnet with chiral surface states. Recently, dipolar interaction induced magnon couplings between different magnetic layers have drawn interests, for realizing non-reciprocal transmission of microwave signals and non-Hermitian Hamiltonian systems. In a recent work, via the coupling of magnons between a ferrimagnetic insulator Y3Fe5O12 (YIG) and a magnetic alloy NiFe, we showed that tunable, nonreciprocal propagation can be realized in spin Hall effect-excited incoherent magnons, whose frequencies cover the spectrum from a few gigahertz up to terahertz [1]. In the diffusion transport, the nonreciprocity is reflected as asymmetric magnon diffusion lengths, which are unequal along opposite transmission directions. The diffusive nonreciprocity is closely related to the change of the magnon damping through the chiral dipolar coupling. Extending this bi-layer structure into an antiparallelly aligned magnetic multilayer, we show theoretically that the interlayer dipolar interaction generates bulk bands with non-zero Chern integers and magnonic surface states carrying chiral spin currents [2]. The surface states are highly localized and can be easily toggled between non-trivial and trivial phases through an external magnetic field. Our experimental and theoretical findings enrich knowledge on diffusive transport of magnons and provide an easy-to-implement system for topological magnonic states, which can be used for the design of passive signal isolation devices.


[1] J. Han, Y. Fan, B. C. McGoldrick, J. Finley, J. T. Hou, P. Zhang, and L. Liu, Nano Letters, 21, 7037 (2021)
[2] Z. Hu, L. Fu, L. Liu, "Tunable Magnonic Chern Bands and Chiral Spin Currents in Magnetic Multilayers," arXiv:2201.00312 (2022)