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Role of Thickness in Magnon Propagation Across Antiferromagnetic Insulators

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The diffusion of spin-waves or magnons in magnetic insulators is a promising candidate for sending signals in spintronic-based logical units that can outperform classical electronic current-based devices.
We present numerical simulations of magnon transport at finite temperature and its dependence on the material thickness in antiferromagnetic (AFM) insulators with material parameters from hematite. We consider magnon transport in both magnetic phases of hematite: i. easy-axis phase and ii. easy-plane phase.
Magnons are injected and detected electrically through the Spin Hall effect and the inverse Spin Hall effect, respectively.
We observe a distinct transition from effective 2D to 3D transport, occurring at a thickness comparable to the system's domain-wall length scale. The results indicate that ultrathin materials support better spin transport and thus could be the better candidate for implementation in spintronic devices.

Authors: Prof. QAIUMZADEH, Alireza (NTNU); MYHRE, Mathias (NTNU); Dr BREHM, Verena Johanna (NTNU)

Presenter: MYHRE, Mathias (NTNU)

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