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Spin Transport by Collective Spin Excitations[1]

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We report studies of angular momentum transport in insulating materials. Our measurements reveal efficient spin pumping from high wavevector k spin waves in thin film $Y_3Fe_5O_{12}$ (YIG): spin pumping is independent of wavevector up to $k \sim 20\,\mu m^{-1}$ [1]. Optical detection of YIG FMR by NV centers in diamond reveals a role for spin waves in this insulator-to-insulator spin transfer process [2]. Spin transport is typically suppressed by insulating barriers, but we find that fluctuating antiferromagnetic correlations enable efficient spin transport at nm-scale thicknesses in insulating antiferromagnets, even in the absence of long-range order, and that the spin decay length increases with the strength of the antiferromagnetic correlations [3,4]. [1] S.A. Manuilov, C.H. Du, R. Adur, H.L. Wang, V.P. Bhallamudi, F.Y. Yang and P.C. Hammel, Applied Physics Letters 107 042405 (2015); [2] C.S. Wolfe, V.P. Bhallamudi, H.L. Wang, C.H. Du, S. Manuilov, R.M. Teeling-Smith, A.J. Berger, R. Adur, F.Y. Yang and P.C. Hammel, Physical Review B Rapid Communication 89 180406 (2014); [3] H.L.Wang, C.H. Du, P.C. Hammel and F.Y. Yang, Physical Review Letters 113 097202 (2014); [4] H.L.Wang, C.H. Du, P.C. Hammel and F.Y. Yang, Physical Review B 91 220410 (2015).

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