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**Ferromagnetic resonance (FMR) spin-pumping in FM/I/NM heterostructures** YONG PU, C. DU, H. WANG, R. ADUR, A. BERGER, J. BEARDSLEY, A. HAUSER, The Ohio State University, P. ODENTHAL, A. SWARTZ, R. KAWAKAMI, University of California-Riverside, J. PELZ, E. JOHNSTON-HALPERIN, F. YANG, P.C. HAMMEL, The Ohio State University — The recent demonstration of the injection of a pure spin current via ferromagnetic resonance (FMR) in the FM electrode, spin-pumping, with no need for an accompanying charge current, promises low-power high-efficiency spin injection in a wide variety of materials. Here we report the demonstration of FMR spin-pumping in Ferromagnet/Insulator/Non-magnetic materials heterostructures via different spin detection techniques, and characterizations of the dynamically injected spin. Our investigation proves the possibility that one can both utilize the advantages of FMR spin-pumping, and simultaneously overcome the well-known resistance mismatch problem, which usually happens for spin injection through a FM/NM direct contact and drastically suppresses the efficiency of spin injection into NM. Furthermore, by individually and systematically varying the magnetic, electrical and mechanical properties of each element of the FM/I/NM heterostructures, we are able to study the fundamental mechanisms for FMR spin-pumping, e.g. coupling range and strength, and role of and interplay between spin, charge, lattice, magnon and phonon degree of freedoms.

Yong Pu
The Ohio State University

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