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Pure Spin Current in a broad range of materials generated by YIG-based spin pumping[1]

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Spintronics relies on the generation, manipulation, and detection of spin current mediated by itinerant charges or magnetic excitations. FMR spin pumping is a powerful technique in understanding pure spin current. Building on our high-quality $Y_3Fe_5O_{12}$ (YIG) films and the large inverse spin Hall effect (ISHE) signals enabled by these films [1-10], we have characterized spin currents in several classes of materials with different magnetic structures, including: nonmagnetic and ferromagnetic metals, nonmagnetic insulators, and antiferromagnetic (AF) insulators. The spin Hall angles determined for a series of 3d, 4d, and 5d metals show that both atomic number and d-electron count play important roles in spin Hall physics [1, 6]. Strikingly, we achieved robust spin transport from YIG to Pt across AF insulators, which initially enhances the ISHE signals and can transmit spin currents up to 100 nm thickness, demonstrating highly efficient spin transport through an AF insulator carried by magnetic excitations [3].

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[2] Adur, et al. PRL 113, 176601 (2014).
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[4] Wang, et al. APL 104, 202405 (2014).
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[6] Wang, et al. PRB 112, 197201 (2014).
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