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Spin current valve effect in normal metal/magnetic insulator/normal metal sandwiches[1] JUNXUE LI, YADONG XU[2], MOHAMMED ALDOSARY, CHI TANG, ZHISHENG LIN, UC Riverside, SHUFENG ZHANG, University of Arizona, ROGER LAKE, JING SHI, UC Riverside, SHINES COLLABORATION — Pure spin current is generated in two common ways. One makes use of the spin Hall effect in normal metals (NM), the other utilizes spin waves with the quasi-particle excitations called magnons. A popular material for the latter is yttrium iron garnet (YIG), a magnetic insulator (MI). Here we demonstrate in NM/MI/NM sandwiches that these two types of spin current are interconvertible, which allows transmitting an electrical signal across the MI, predicted as the magnon-mediated current drag phenomenon. We show experimentally that the spin current can be switched on or off by controlling the magnetization orientation of MI, analogous to conventional spin valves for spin-polarized charge current. The transmitted current drag signal scales linearly with the driving current without any threshold and follows the power-law T^n with n ranging from 1.5 to 2.5. Our results indicate that the NM/MI/NM sandwich structure can serve as a scalable pure spin current valve device which is an essential ingredient in spintronics.

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