Spin-to-charge conversion through Rashba coupling in $LaAlO_3/SrTiO_3$

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A charge current running through a material with strong spin–orbit coupling generates a transverse spin current (spin Hall effect, SHE) and vice versa (inverse spin Hall effect, ISHE). The emergence of SHE and ISHE as charge-to-spin interconversion mechanisms offers a variety of novel spintronic functionalities and devices. However, the interconversion efficiency of SHE and ISHE (spin Hall angle) is a bulk property that rarely exceeds ten percent, and does not take advantage of interfacial and low-dimensional effects otherwise ubiquitous in spintronic hetero- and mesostructures. Here, we make use of an interface-driven spin–orbit coupling mechanism—the Rashba effect—in the oxide two-dimensional electron system (2DES) $LaAlO_3/SrTiO_3$ to achieve spin-to-charge conversion with unprecedented efficiency. As shown in Fig. 1, a spin current generated at NiFe film by spin pumping technique was injected into the oxide 2DES. The detect the resulting charge current, which could be strongly modulated by a gate voltage. We propose the gate dependence on the basis of the electronic structure of the 2DES, and highlight the importance of a long scattering time to achieve efficient spin-to-charge interconversion.

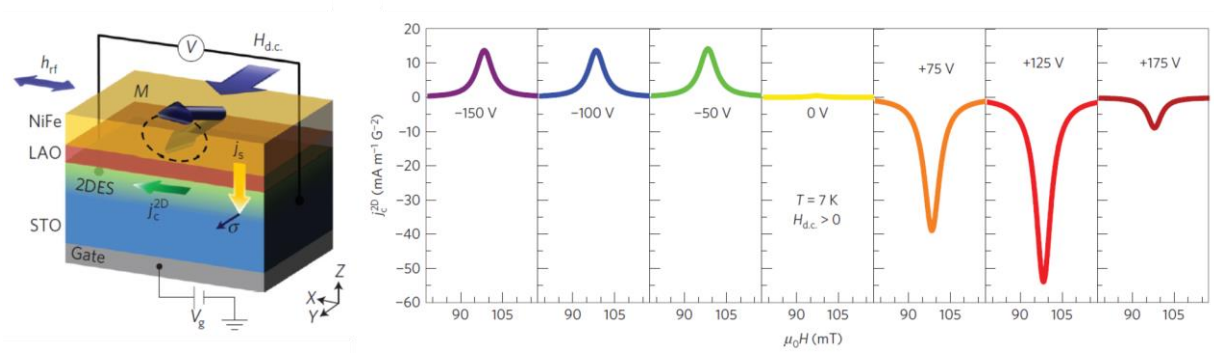

Figure 1 Sketch of spin-pumping experimental configuration and symmetric component of the detected signal for different gate voltages.

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