Potential of oxide-based 2DEG for spin-charge interconversion

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Spintronics traditionally relied on ferromagnetic metals as spin generators and detectors. A new approach, spin-orbitronics, exploits the interplay between charge and spin currents enabled by the spin-orbit coupling in non-magnetic systems. We studied the potential of bidimensional electron gases (2DEG) that form at the interface between LaAlO3 and SrTiO3 [1] or by deposition of Al, Ta or Y on SrTiO3 [2], Ca:SrTiO3 [3] or KTaO3 [4] for spin-current to charge-current conversion [2, 3, 4, 5]. The sizeable Rashba spin-orbit coupling of the gas [6] allows to obtain very efficient conversions, larger than those of the topological insulator Sn or the Bi/Ag interface [7]. This conversion efficiency can be highly modulated by a gate voltage and linked to the band structure [2]. We also studied the charge to spin conversion, detected through simple magnetotransport experiments [8, 4]. Moreover, we exploited the electric-field induced ferroelectricity in SrTiO3 to manipulate the spin-orbit properties of a 2DEG and convert spin currents into either positive or negative charge currents in a non-volatile manner [9]. This suggest that oxide interfaces [10] have a strong potential for spin-based information readout in novel memory [11] or for a new generation of spin-based devices, in which non-volatility would be provided by ferroelectricity rather than by ferromagnetism.

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