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Rashba Spin-Orbit Anisotropy and the Electric Field Control of Magnetism JUN'ICHI IEDA, Advanced Science Research Center, Japan Atomic Energy Agency; CREST, Japan Science and Technology Agency, STEWART E. BARNES, Advanced Science Research Center, Japan Atomic Energy Agency; Physics Department, University of Miami, SADAMICHI MAEKAWA, Advanced Science Research Center, Japan Atomic Energy Agency; CREST, Japan Science and Technology Agency — The control of the magnetism of ultra-thin ferromagnetic layers using an electric field would lead to many technologically important applications. To date, while it is usually assumed the changes in the magnetic anisotropy, leading to such a control, arises from surface charge doping of the magnetic layer, a number of key experiments cannot be understood within such a scenario. Much studied is the fact that, for non-magnetic metals or semi-conductors, a large surface electric field gives rise to a Rashba spin-orbit coupling which leads to a spin-splitting of the conduction electrons. Here we develop a simple analytic theory for the existence and electrical control of the magnetic anisotropy based upon the Rashba spin-orbit interaction and the Stoner model of magnetism. We show that the competition between the Rashba spin-orbit fields and the exchange interaction leads to a very large magnetic anisotropy arising from the internal electric fields which exist at, e.g., ferromagnetic/metal and ferromagnetic/oxide insulator interfaces but modified by the addition of an applied electric field. This different path to an electrically induced anisotropy energy can explain the electric field, thickness, and material dependence reported in many experiments.

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