Electric and Magnetic Gating of Rashba-Active Weak Links

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In a one-dimensional weak-link wire the spin-orbit interaction (SOI) alone cannot generate a nonzero spin current. We show that a Zeeman field acting in the wire in conjunction with the Rashba SOI there does yield such a current, whose magnitude and direction depend on the direction of the field. When this field is not parallel to the effective field due to the SOI, both the charge and the spin currents oscillate with the length of the wire. Measuring the oscillating anisotropic magnetoresistance can thus yield information on the SOI strength. These features are tuned by applying a magnetic and/or an electric field, with possible applications to spintronics .