

**Spin polarization via interferences and decoherence in a spin orbit active interferometer coupled to an electron reservoir**

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We study the spin polarization of mixed and entangled electron states in a probe/beam splitter sitting on the arm of an interferometer with local Rashba and Dresselhaus interactions. A pair of maximally entangled electrons collides the beam splitter and enters a Mach Zehnder interferometer pierced by a perpendicular magnetic flux. Spin-polarization effects are caused by both the presence of the reservoir and the combination of the gauge field and spin-orbit interaction.