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Mesoscopic fluctuations in the spin-electric susceptibility due to Rashba spin-orbit interaction MATHIAS DUCKHEIM, DANIEL LOSS, Department of physics, University of Basel — Spin-orbit interaction enables the control of the spin with electric fields in non-magnetic semiconductors. The orbital transport processes generating the internal fields that are necessary for this control are typically described as classical diffusive drift. In contrast, when this orbital motion is phase coherent, typical mesoscopic effects occur not only in transport but also in the spin dynamics. We investigate mesoscopic fluctuations in the spin polarization generated by a static electric field and by Rashba spin-orbit interaction in a disordered 2D electron gas. In a diagrammatic approach we find that the out-of-plane polarization - while being zero for self-averaging systems - exhibits large sample-to-sample fluctuations which are shown to be within experimental reach. We evaluate the disorder-averaged variance of the susceptibility and find its dependence on magnetic field, spin-orbit interaction, dephasing, and chemical potential difference. [M. Duckheim and D. Loss, Phys. Rev. Lett.(in print), arXiv:0805.4143v1].

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