Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Sorting Category: 10.1.5 (E)

Spin-orbit or Aharonov-Casher edge states in semiconductor two-dimensional systems L.L. XU, J.J. HEREMANS, Virginia Tech, C.K. GASPE, S. VIJEYARAGUNATHAN, T.D. MISHIMA, M.B. SANTOS, University of Oklahoma — In semiconductors with spin-orbit interaction we experimentally search for edge states induced by the Aharonov-Casher vector potential or Rashba-type spin-orbit interaction. The Aharonov-Casher effect is electromagnetically dual to the Aharonov-Bohm effect and is predicted to lead to a possibly helical edge state structure at two-dimensional sample edges. We use InGaAs/InAlAs heterostructures patterned into mesoscopic side-gated channel structures, where the edge states can be induced, and where backscattering between edge states can be experimentally measured in the resistance. Sweeping side-gate voltage, low temperature resistances are measured across such mesoscopic closed-path structures at either low applied magnetic field, in-plane or normal to the plane, or at fixed magnetic filling factors of 5, 6, 7, and 8 to obtain states of defined spin. Resistance oscillations are observed at low magnetic fields and around filling factor 6 as function of side-gate voltage, and we analyze the oscillations in the light of the search for the edge states (DOE DE-FG02-08ER46532, NSF DMR-0520550).

[X] Prefer Oral Session
[ ] Prefer Poster Session

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Date submitted: 16 Dec 2011 Electronic form version 1.4