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Spin-orbit edge states in semiconductor two-dimensional systems
L.L. XU, SHAOLA REN, J.J. HEREMANS, DJORDJE MINIC, Virginia Tech, C.K. GASPE, S. VIJEYARAGUNATHAN, T.D. MISHIMA, M.B. SANTOS, University of Oklahoma — The electromagnetic duality between the Aharonov-Casher and the Aharonov-Bohm topological phases can lead to magnetoelectronic edge effects in two-dimensional systems. Based on this duality, we propose and experimentally explore a quantized Hall effect in which magnetization transport may be quantized analogously to charge transport. When the magnetic moment is fully projected, the edge effect is a magnetization dual to the integer quantum Hall effect. An analogy also exists between this dual and the bosonic quantum Hall effect currently under investigation. In experiments we search for edge states induced by the equivalent vector potential from Rashba-type spin-orbit interaction. We use mesoscopic side-gated channel structures on InGaAs/InAlAs heterostructures where backscattering between edge states can experimentally form evidence for edge states. The side-gate voltage varies the effective gauge field and resistance as function of side-gate voltage is measured across the mesoscopic structures at either low applied magnetic field or at fixed magnetic filling factors to obtain states of defined spin (DOE DE-FG02-08ER46532, NSF DMR-0520550).

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