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Berry Phase Measurements of Topological Surface States[1] KENJIRO K. GOMES, WONHEE KO, WARREN MAR, YULIN CHEN, ZHI-XUN SHEN, HARI C. MANOHARAN, Department of Physics and SIMES, Stanford University — In special two-dimensional systems, such as graphene and topological insulators, electrons can mimic the behavior of relativistic Dirac particles and exhibit a quantized Berry's phase of π. In this experiment we harness the power of complimentary interferometry methods to quantify the quantum phase present in pure antimony, a topological insulator parent matrix. We extract the Berry's phase from the quantum magneto-oscillations measured in low-temperature transport (Shubnikov-de Haas effect) and in local tunneling conductance (TMCO). We also combine scanning tunneling spectroscopy (STS) with band structure determined by angle-resolved photoemission spectroscopy (ARPES) to develop a novel technique for quantifying the Berry's phase of surface electrons. These techniques enable robust determination of the Berry's phase that can remarkably be extended to high magnetic fields, providing a new window on the dynamics of these unique spin-polarized carriers.

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