Plenary Talk PV X Wed 9:00 Audimax 1

Revealing the topological nature of transport at mesoscopic scales with quantum interferences — •Helene Bouchiat, A. Bernard, A. Murani, B. Dassonneville, A. Kasumov, M. Ferrier, R. Deblock, and S. Guéron — Laboratoire de Physique des Solides, University Paris Saclay, 91405 Orsay, France

A mesoscopic conductor is characterized by its size smaller than the phase coherence length of electronic wave-functions (typically one micrometer at low temperature). Mesoscopic electronic transport depends strongly on the nature of interferences between these wave functions determined by the scattering disorder potential which tends to localize electronic states at low dimension. Moreover, these interferences can be modulated by a magnetic flux through the Aharonov-Bohm effect giving rise to orbital persistent currents in ring geometries. These interferences also determine the Josephson supercurrent of a mesoscopic normal conductor when connected to superconducting electrodes. We show that these basic fundamental properties of mesoscopic quantum interferences can be used to reveal the existence and the physical location of 1d protected states in topological insulators. This method is illustrated in the case of crystalline bismuth nanowires which were found to belong to a class of newly discovered higher order topological insulators with helical ballistic hinge states coexisting with trivial bulk and surface diffusive states. In particular we discuss SQUID like periodic magnetic oscillations observed in Bi based Josephson junctions.