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Oliver E. Buckley Prize Talk: Discovery and exploration of spin-dependent tunneling[1]

PAUL TEDROW[2], Francis Bitter Magnet Laboratory, MIT

Experiments on thin-film superconductors in intense magnetic fields by R. Meservey and P. M. Tedrow led to the discovery of spin-polarized tunneling. Measurements of the critical magnetic of very thin aluminum films for temperatures down to 0.45K verified that spin-orbit scattering had to be included in the BCS description of the critical field. Theory predicted a first order transition at low temperature, and, although measurements of the shape of the resistive transition of the films strongly implied the existence of such a transition, magnetic field-dependent tunneling measurements of the energy gap of the aluminum were undertaken to observe directly the first-order nature of the transition. Splitting of the superconducting density of states by the applied magnetic field, i.e., spin-dependent tunneling, was observed in these measurements. Subsequent tunneling experiments demonstrated the spin polarization of tunnel currents from ferromagnets. The extension of these tunneling studies to include a wide range of superconductors and magnetic materials produced new qualitative and quantitative information about the behavior of conduction electron spins in such materials. Although experimental technique and theory have improved from these early times, there remain unanswered questions concerning electron tunneling into ferromagnets. An overview of these early experiments will be presented.[3]

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[2]Buckley Prize

[3]A review can be found in R. Meservey and P. M. Tedrow, Physics Reports **238**, 175 (1994).