CNST offers insights into metallic ferromagnetism using spin polarized electron probes

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The Center for Nanoscale Science and Technology's Daniel Pierce has provided an overview of three decades of applications of spin-polarized measurement techniques to understanding metallic ferromagnetism.

His insights were published in the Journal of Applied Physics in an invited paper for the Magnetism and Magnetic Materials Conference.

The ferromagnetic metals, Fe, Co, Ni, and their alloys dominate technological applications, particularly in electronics and information storage.

Because the ordering of electron spins is at the heart of ferromagnetism, probes that give information about electron spin states have proven particularly useful.

For example, spin polarized photoemission and inverse photoemission spectroscopy have revealed spin-dependent electronic structure, providing excellent tests of spin-dependent band structure calculations.

Measurements of the spin dependence of the electron mean free path have demonstrated the spin filtering effect of ferromagnetic layers used in solid state spintronic devices designed to manipulate spin-polarized currents.

The development of new electron spin detectors has facilitated the development of powerful techniques such as Scanning Electron Microscopy with Polarization Analysis (SEMPA), which measures the properties of magnetic nanostructures and has greatly enhanced the understanding of coupling between magnetic multilayers.

Pierce, a NIST Fellow, Emeritus who has worked at NIST (then NBS) since 1975, remains actively engaged in SEMPA measurements in the CNST Electron Physics Group.

More information: Perspective on probing metallic ferromagnetism with electrons, D. T. Pierce, Journal of Applied Physics 109, 07E106 (2011). doi:10.1063/1.3537960

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