



SACRAMENTO STATE

Department of Physics & Astronomy Fall 2007

# *Physics Colloquium Series*

## *"Giant Magnetoresistance and Related Phenomena"*

*The Nobel Prize in physics this year was awarded for the discovery of giant magnetoresistance (GMR). GMR is a part of a large class of phenomena which involve the change of the electrical resistance of a material in magnetic field i.e. magnetoresistance (MR). I will discuss my involvement in the development of the theory of GMR and related phenomena. The goal of these investigations has been to understand magnetoresistance from the electronic structure of the material by studying the electronic transport. In particular, I will discuss the discovery and calculations of GMR in layered heterostructures consisting of interchanging slabs of magnetic and nonmagnetic metals, in which the phenomenon was originally discovered. Tunneling magnetoresistance (TMR) is a related phenomenon observed in heterostructures in which the magnetic slabs are separated by an insulator. Another set of MR phenomena involves atomic size contacts between two wires. Ballistic magnetoresistance (BMR) is related to the trapping of a magnetic domain wall in the contact area. Electronic transport in ferromagnetic ballistic conductors is predicted to exhibit ballistic anisotropic magnetoresistance (BAMR) – a change in the ballistic conductance with the direction of magnetization. This phenomenon originates from the effect of the spin-orbit interaction on the electronic band structure which leads to a change in the number of bands crossing the Fermi energy when the magnetization direction changes. Finally, tunneling anisotropic magnetoresistance (TAMR) is observed in magnetic break junctions. These phenomena form a research field with rich physics and tremendous practical impact.*

**Julian P. Velez**

*(Candidate for Faculty Position)*

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**Thursday, December 20, 2007**

**\*3:30-4:50PM MND 1015**

**Open & Free to all Students, Faculty & Public**