



Physics Colloquium

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Friday, 23 October 2009

4:00pm, PSC 3046

Making Semiconductors Ferromagnetic: Opportunities and Challenges

Introducing ferromagnetism into a semiconductor holds out the promise of using the spin of the electron, alongside its charge, for the purpose of increasing the functionality of semiconductor devices. This is the focus of the emerging technology referred to as “spintronics”. It has already been demonstrated that III-V semiconductor compounds (e.g., GaAs) can be made ferromagnetic by replacing a fraction of the group-III ions of the III-V lattice by Mn ions to form $\text{III}_{1-x}\text{Mn}_x\text{V}$ alloys (e.g., $\text{Ga}_{1-x}\text{Mn}_x\text{As}$). The Mn atoms enter the III-V lattice as divalent Mn^{++} ions, and thus act both as magnetic moments and as acceptors. The presence of holes generated by these acceptors then constitutes the mechanism facilitating long-range ferromagnetic coupling between the Mn spins. In this talk I will describe the methods used to prepare such $\text{III}_{1-x}\text{Mn}_x\text{V}$ alloys; their representative ferromagnetic properties (the Curie temperature, magnetic domains, magnetic anisotropy, etc.); the methods of controlling these properties; and I will present several examples of prototype spintronic devices based on these materials. Finally, I will give special emphasis to the challenges that still remain to be overcome in order to bring these applications to practical reality.

For further information on Physics colloquia visit <http://physics.stfx.ca>
Doughnuts and coffee will be served at 3:45 pm