

NEW DIRECTIONS IN SPINTRONICS

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While applications of GMR and TMR are already on the market, spintronics is now developing in interesting new directions. I will review some recent developments:

1. **SPIN TRANSFER:** The magnetic moment of a ferromagnetic element can be re-oriented **WITHOUT APPLYING A MAGNETIC FIELD** but only by **TRANSFUSING SPINS** carried by an electrical current. This is the concept of spin transfer. I will describe experiments in which the magnetization is coherently reversed by spin transfer and others in which the spin transfer is used to move back and forth a magnetic domain wall. Spin transfer is very promising for the switching of sub-micronic devices like MRAM.
2. **SPINTRONICS WITH SEMICONDUCTORS:** Fusion between traditional electronics and spintronics in semiconductor/ferromagnetic heterostructures is a very attractive goal (for MRAM, for example, or for re-configurable devices). I will summarize the advances in this field.
3. **NANO-SPINTRONICS:** Spin polarized currents can be injected into a nanoparticle to combine Coulomb and spin blockade. This probes the spin coherence time in small particles (2-3 nm), which is the relevant information to asses the potential of spin-based qubits .