CNAM Condensed Matter Colloquium

2 p.m., Thursday, October 28, 2010

Room PHYS1201

Refreshments will be served at 1:30 p.m. in Room 1305F – Behind the IT Help Desk.

Spin pumping in magnetic tunnel junctions and topological insulators:

Theory and experiments

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Abstract:
The pursuit of the second-generation spintronics has been largely focused on harnessing coherent spin states and their dynamics in metals and semiconductors. The salient examples of phenomena involving both coherent spins and their time evolution is the spin-transfer torque and its Onsager reciprocal effect, termed spin pumping because it occurs in the absence on any bias voltage, where microwave driven precessing magnetization of a single ferromagnetic (FM) layer emits pure spin current into adjacent normal metal (N) layers. While it has been long considered that low transparent interfaces would completely screen the interfacial spin pumping effect, the recent surprising measurements of large voltage signals of the order of 1 μV in microwave driven FM|I|N and FM|I|FM tunnel junctions have attracted considerable attention. In this talk, I review these experimental results together with the nonequilibrium Green function- based approach to spin pumping we developed to explain the large pumping voltage while taking into account strong interfacial spin-orbit couplings. In addition, this approach allows us to examine spin pumping into chiral spin-filtered edge states of recently discovered two-dimensional topological insulators (TI), where the two FM|TI heterostructures we propose can either substantially enhance the pumped pure spin current even at very small input microwave power or convert it into quantized charge current as electrically measurable signature of the quantum spin Hall phase.

Host: Ian Appelbaum