IEEE Magnetics Society Lecture

Spin transport, condensation, and superfluidity in magnetic insulators

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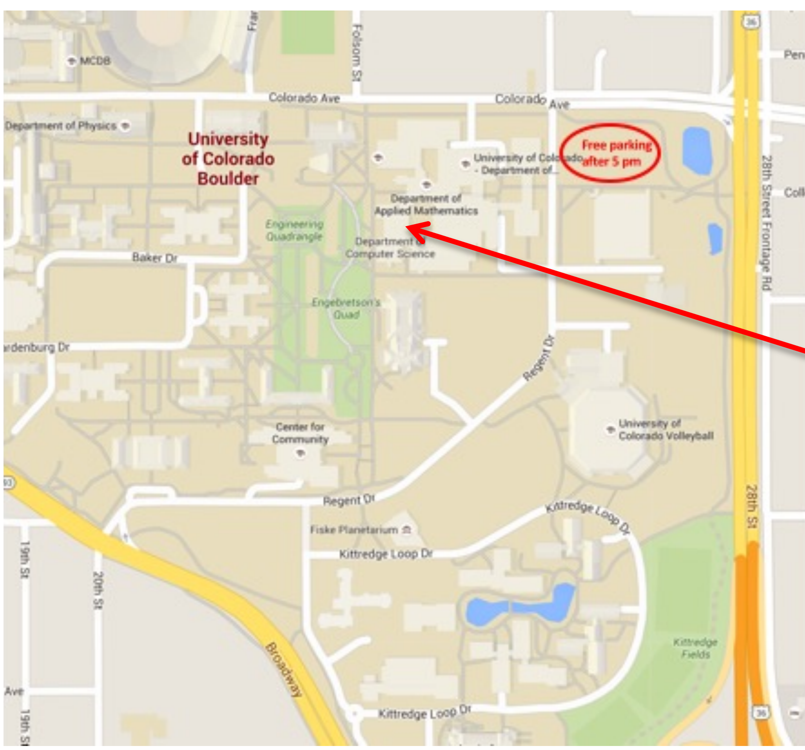
The nature of spin transport through insulating magnetic heterostructures is intricately tied to heat flows. In this talk, I will discuss several scenarios that illustrate the resultant interplay between the macroscopic and microscopic magnetic dynamics engendered by thermal gradients. (1) At normal-metal/insulating-ferromagnet interfaces, thermal magnons carry both heat and spin currents, with the latter having components along and transverse to the magnetic order parameter. The longitudinal component is responsible for the spin Seebeck and spin Peltier effects, while the transverse component for the spin torque and spin pumping associated with the coherent dynamics of the magnetic order parameter. This sets the stage for an interplay between the incoherent transport of thermal magnons, on the one hand, and coherent (macroscopic) magnetic dynamics, on the other. (2) A highly nonlinear limit of this physics leads to bosonic condensation of thermal magnons and ensuing spin superfluidity. In this regime, both spin and heat can be carried collectively, in close analogy to two-fluid hydrodynamics of superfluid helium. (3) Finally, I will address the problem of thermally-induced magnetic domain wall motion, another example of the coupling between coherent and incoherent degrees of freedom triggered by thermal gradients.

Prof. Tserkovnyak earned a Ph.D. in physics at Harvard University in 2003. He has been on the faculty at the University of California, Los Angeles since 2006 (tenured in 2009, full professor 2013). His interests are theory of quantum transport and nonequilibrium dynamics in spintronic and low-dimensional electron systems.



Tuesday, January 26th

Talk begins at 2:30 pm
Refreshments at 2:15 pm

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