Department of Physics and Astronomy presents:

Exploring Condensed Matter Physics with Quantum Diamond Sensors

PRESENTED BY
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Refreshments will be served in the JH 1st Floor Vending Area at 3:30

ABSTRACT

Nitrogen vacancy (NV) center in diamond is a solid-state atomic qubit that serves as an excellent magnetic field sensor. Because it is capable of nanoscale resolution and operation over a wide range of temperature, quantum sensing with NV center has emerged as a versatile probe to explore condensed matter phenomena that are inaccessible with other techniques. In this talk, I discuss two topics we have explored with NV centers at Harvard. In the first work, we have developed a novel probe using NV to study autonomous oscillation of spin-torque oscillator (STO). We resolve multiple spin-wave modes in a microbar of ferromagnetic insulator yittrium-iron-garnet, quantify their damping modified by spin injection, and detect auto-oscillation of the modes. These results open the way for quantitative, nanoscale mapping of the microwave signals generated by STOs. In another work, we reveal the viscous flow of strongly-correlated electron fluid in graphene at room temperature. Optical magnetic resonance imaging and scanning probe magnetometry reveals a parabolic current profile in graphene channels corresponding to a viscous flow, in contrast to the conventional uniform flow imaged in a metallic wire. This finding has implications for understanding mesoscopic graphene devices and opens way to study electronic turbulence, while the technique developed here can be used to study other novel electronic phenomena such as topological transport.