Abstract for an Invited Paper
for the OSF10 Meeting of
The American Physical Society

Wonder Material Graphene and its Application as a Nanoscale Magnetic Sensor

JANICE WYNN GUIKEMA, Johns Hopkins University

Since its experimental realization in 2004, graphene has ignited great interest in physics, material science, chemistry and engineering. Thousands of papers have been published on graphene in these past six years with the publication rate greatly increasing each year. Graphene is a two-dimensional sheet of carbon atoms arranged in a hexagonal lattice, which is only one-atom thick. This elegantly simple material has excellent electronic and mechanical properties, as well as remarkable physics resulting from its relativistic electrons. In this talk I will discuss graphene's properties and mention promising applications for graphene such as flexible transparent electrodes, next-generation transistors, energy applications and sensors. I will also describe how graphene is made, and what challenges the community still faces in producing graphene and in understanding the basic science. Finally, I will tell you about my work utilizing graphene to make sensitive magnetic field sensors just several hundred nanometers in size. In these sensors the graphene is fabricated into a cross geometry in which the Hall effect is used to measure a magnetic field. Such sensors could be used to measure small magnetic particles or be made into a scanning probe to map out magnetic fields. My present results show that these graphene Hall crosses have magnetic field sensitivity at room temperature on par with similar crosses made from other materials. Plus, because they are made from graphene, these sensors have further advantages such as being tunable with a gate, being extremely thin, and the potential to make them very small. Indeed, graphene is a "wonder material" which we can expect to advance the state of the art in many applications and to contribute to science and technology in ways not yet even envisioned.