Field:
Materials Science/Biomaterials

Session Topic:
Advances in Graphene-Based Science and Application

Speaker:
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Title: What's so interesting about graphene?

The 2010 Nobel Prize in Physics was awarded to Andre Geim and Kostya Novoselov for their experiments, conducted only six years earlier, which isolated and electrically probed graphene, a single atom-thick plane of graphite. In this talk I will try to give a sense of why graphene sparked such excitement in the physics community. In graphene, a two-dimensional hexagonal lattice of carbon atoms, electrons behave as if they have no mass – they move at constant velocity regardless of their energy, and can never be stopped. Their motion is described not by the Schrodinger equation familiar to physics undergraduates, but rather the Dirac equation for massless particles, making graphene electrons more akin to neutrinos. As a consequence of the Dirac nature of electrons in graphene, the quantized Hall effect – a quantum-coherent phenomenon - can be observed up to room temperature. Graphene is different, yet it is also strikingly simple, and is often a testbed to demonstrate the most fundamental of condensed matter physics phenomena. In contrast with other major fronts in condensed matter physics, theory and experiment on graphene show strikingly good agreement. Graphene is an extraordinary conductor of electricity, and graphene transistors working up to several hundred gigahertz have already been demonstrated. Graphene is exquisitely sensitive to changes on its surface, which could lead to new sensor technologies. Graphene is exceedingly tough and flexible, and almost completely transparent, leading to new possibilities for transparent, flexible electronic devices.