Stuttgarter Physikalisches Kolloquium

Fachbereich Physik, Universität Stuttgart
Max-Planck-Institut für Festkörperforschung
Max-Planck-Institut für Intelligente Systeme

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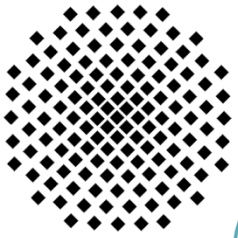

Dienstag, 17. Juni 2014	17:15 Uhr	Hörsaal V 57.01

Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart-Vaihingen

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Ultrafast Carrier Dynamics in Graphene and Graphene Nanostructures

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Abstract

Graphene is an attractive candidate for many optoelectronic applications because of its vanishing bandgap and high carrier mobility. Anessential process for such applicationsis the dissipation of the energy of photoexcited charge carriers in the material. Two competing energy relaxation mechanisms for optically excited carriers exist: They can (i) thermalize with intrinsic carriers near the Fermi level, heating them to higher energy statesthrough the process of ‘hot carrier multiplication’; or (ii) the excessenergy of the optically excited carrier can be lost via emission of phonons. With optical excitation-THz probe spectroscopy, an optical method for probing photoconductivities on ultrafast timescales, we reveal highly efficientenergy transfer from an optically excited carrierto multiple heated charge carriers (relaxation path (i)).

While presenting an advantage for some applications, the vanishing bandgap of graphene can also be a disadvantage in applications such as photovoltaics. A chemical synthesis approach was recently shown for making well defined, narrow graphene nanoribbons (GNRs) with widths as small as ~1 nm. In these structures, carrier confinement in the lateral dimension induces a bandgap corresponding to absorption of visible wavelength. Similarly, carbon nanotubes (CNTs) are one dimensional graphene nanostructures which can exhibit bandgaps. We present a study of the complex photoconductivity of GNRs and semiconducting CNTs, and show that while the mechanism of photoconductivity is very similar in the two materials, the charge mobility is very different between the two nanostructures.