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Ultrafast dynamics of the mid-infrared response of carbon nanotubes CHRISTIAN FRISCHKORN, Physics Department, Freie Universitat Berlin, Germany, TOBIAS KAMPFRATH, LUCA PERFETTI, MARTIN WOLF — We report on time-resolved measurements of low-energy excitations in carbon nanotubes and compare these with results obtained for graphite. The systems mid-infrared response has been obtained from time-resolved THz spectroscopy data in the 10 - 30 THz spectral range. We find essentially two processes governing an electronic current dynamics in carbon nanotubes. First, strongly bound excitons are the main photoproduct in large-band gap tubes and thus prevent a typical free-carrier response, while in small-gap and metallic tubes carrier localization due to defects is observed as manifested in a substantial dichroism. In these measurements, the reduced polarizability perpendicular to the tube axis is exploited. In the case of graphite, our results show that strongly coupled optical phonons in the graphite layer dominate the ultrafast energy and transport relaxation dynamics after optical excitation [1]. These phonon modes heat up on a femtosecond time scale and cool down with a time constant of several picoseconds. Moreover, the observed pronounced increase in the Drude relaxation rate significantly originates from these few active lattice vibrations. - [1] PRL 95, 187403 (2005).

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