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Ultrafast dynamics in semiconductor nanowires ROHIT PRASANKUMAR, SUKGEUN CHOI, Center for Integrated Nanotechnologies, Los Alamos National Laboratory, GEORGE WANG, Sandia National Laboratories, SAMUEL PICRAUX, ANTOINETTE TAYLOR, Center for Integrated Nanotechnologies, Los Alamos National Laboratory — Semiconductor nanowires (NW) have recently attracted much interest due to their novel electronic and optical properties along with their potential for device applications in areas including nanoscale lasers and thermoelectrics. However, the further development and optimization of NW-based devices will depend critically on an understanding of carrier relaxation in these unique nanostructures. Here, we present the first all-optical time-resolved measurements of carrier dynamics in free standing semiconductor nanowires. Optical pump-probe measurements on GaN NW reveal a rapid transfer (<500 fs) of photoexcited carriers into states responsible for deleterious yellow luminescence, which can be modified by varying the growth and annealing temperatures. Polarization, angle, and wavelength-resolved measurements on vertically aligned Ge NW allow us to independently measure electron and hole dynamics parallel and perpendicular to the NW axis. Carriers propagating parallel to the NW axis have significantly longer lifetimes, clearly demonstrating the influence of two dimensional confinement on carrier dynamics in semiconductor nanowires.

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