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Title:Carrier dynamics in semiconductors studied with time-resolved terahertz spectroscopy
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Abstract:Time-resolved, pulsed terahertz spectroscopy has developed into a powerful tool to study charge carrier dynamics in semiconductors and semiconductor structures over the past decades. Covering the energy range from a few to about 100 meV, terahertz radiation is sensitive to the response of charge quasiparticles, e.g., free carriers, polarons, and excitons. The distinct spectral signatures of these different quasiparticles in the THz range allow their discrimination and characterization using pulsed THz radiation. This frequency region is also well suited for the study of phonon resonances and intraband transitions in low-dimensional systems. Moreover, using a pump-probe scheme, it is possible to monitor the nonequilibrium time evolution of carriers and low-energy excitations with sub-ps time resolution. Being an all-optical technique, terahertz time-domain spectroscopy is contact-free and noninvasive and hence suited to probe the conductivity of, particularly, nanostructured materials that are difficult or impossible to access with other methods. The latest developments in the application of terahertz time-domain spectroscopy to bulk and nanostructured semiconductors are reviewed.
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