

Ultrafast high THz-field driven carrier dynamics and transport in semiconductors

Christos Flytzanis

Laboratoire Pierre Aigrain, Ecole Normale Supérieure, 75231 Paris Cedex 05, France

We briefly review the main regimes of carrier dynamics and transport in semiconductors. We present an experimental and theoretical study of ultrafast high THz-field driven transport in bulk GaAs and compare the case of electron and hole plasma and photo-generated electron-hole plasma. We discuss the transition from ballistic to diffusive regime in the latter case and the role played by the quantum coherences and quantum-kinetic scattering processes in conjunction with induced carrier-carrier interactions. We extend the analysis to the nonlinear regime and briefly discuss the case of the photo-galvanic effect.

1. K. Seeger, *Semiconductor Physics*, Springer Verlag, Wien N.Y. 1973; K.F. Brennan & A.S. Brown, *Theory of Modern Electronic Devices*, John Wiley, N.Y. 2010.
2. M. Woerner & T. Elsaesser in *Dynamics at Solid State Surfaces and Interfaces Vol 1*, eds. U. Bovensiepen *et al* (Wiley-VCH, Weinheim, 2010) pp 3-32.
3. R. Ulbricht *et al*, *Rev. Mod. Phys.* **83**, 543 (2011).
4. P. Bownan *et al*, *Phys. Rev. Lett.* **107**, 256602(2011); *Phys. Rev.* **B85**, 165206 (2012).
5. W. Kuehn *et al*, *Phys. Rev. Lett.* **104**, 146602 (2010).