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Phase-filling singularities in femtosecond transient dielectric spectra of Germanium

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By exciting semiconductors with ultra-short laser pulses and studying the non-equilibrium material, information about the band structure and the dynamics of the generation and relaxation of carriers can be obtained.

Time-resolved ellipsometry allows the measurements of changes in the dielectric function of solid state materials in the femtosecond time-scale. In semiconductors, these changes can be assigned to different ultrafast processes such as carrier generation, band gap renormalization, Burstein-Moss shift, carrier-phonon scattering, carrier-carrier scattering, and phase filling singularities.

This work will present recent results on femtosecond transient dielectric spectra of undoped Germanium at room temperature. The carriers were generated by the excitation with a 1.55 eV laser beam. The predicted band-filling singularity (Fermi singularity) [1] was observed at around 2.6 eV lasting a few picoseconds.

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References

[1] C. Xu, N.S. Fernando, S. Zollner, J. Kouvetakis, J. Menéndez, Observation of Phase-Filling Singularities in the Optical Dielectric Function of Highly Doped n-Type Ge, Phys. Rev. Lett. 118 (2017) 267402.

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