

Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910



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“Optics in the GIGA-TERA-MIR Range”

This talk summarizes recent results on the application of Nonequilibrium Green's Functions Theory to transport and optics in the GHz-THz-MIR range. It starts with a study of intersubband lasers linewidth, for which the linewidth enhancement (α -)factor was initially expected to be zero, but THz-MIR values ranging from -0.5 to 3 have been found experimentally. Starting from a NEGF approach and going through a step by step simplification to a limit that resembles the usual two-level atom approach, the nonzero α -factor is explained in simple terms. Evolving from linewidth to luminescence in dilute nitrides, an efficient set of equations is applied to explain the evolution of peak luminescence gain with temperature and its relation to sample quality notably useful for materials for the MIR and NIR ranges. To conclude, extending the analysis to the GHz range, the talk introduces a concept to study nonlinear optics through controllable nonlinearities in semiconductor superlattices. A predictive microscopic NEGF approach is used to deliver input to a relaxation-rate approximation approach leading to analytical expressions for the nonlinear polarization at arbitrary orders.

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