Fyzikální ústav
Akademie věd ČR, v. v. i.

ÚSTAVNÍ SEMINÁŘ

proběhne ve středu dne 4. 4. 2018 v 15:00
v přednáškovém sále Fyzikálního ústavu AV ČR Na Slovance

Program:

prof. Mauro Fernandes Pereira

GHz-THz-MIR Sources and Nonlinearities

This talk starts with a general Nonequilibrium Green's Functions (NEGF) approach suitable for both interband and intersubband optics. Intersubband lasers, such as Quantum Cascade Lasers (QCLs), are the prime sources for coherent radiation in the Mid-Infrared (MIR). The α-factor of intersubband lasers was initially expected to be zero. However, values ranging from -0.5 to 3 have been found experimentally. The NEGF approach and an intuitive simplification of it is used to explain the nonzero α-factor. Next, a very efficient analytical set of equations is applied to explain optical properties of dilute semiconductor materials, with an emphasis on the evolution of peak luminescence gain with temperature and its relation to sample quality. and it will be explained here and presented as a numerical characterization tools, notably useful for materials for the MIR and NIR ranges. Evolving from the MIR to the THz and GHz ranges, the talk introduces a concept to study nonlinear optics through controllable nonlinearities in semiconductor superlattices. A fully predictive microscopic Nonequilibrium Green's Functions approach is used to deliver input to a relaxation-rate approximation approach leading to fully analytical expressions for the nonlinear polarization at arbitrary orders. These results open the possibility of extending the whole field of nonlinear optics to the GHZ-THz range and the possibility of designing materials and devices for a large number of applications, including spectroscopy of biomolecules, which typically have strong GHz-THz resonances.

Short Biography: Prof. Mauro Fernandes Pereira obtained his PhD at the Optical Sciences Center, University of Arizona and has given important contributions to Nonequlibrium Greens Functions many body theory of transport and optics of semiconductor materials. He has been named SPIE Fellow in 2011 for his contributions to the theory of semiconductor materials and optics. After taking several research positions at University of Rostock, Technische Universität Berlin, Tyndall Institute and Sheffield Hallam University, he has become the head of the Department of Condensed Matter Theory at the Institute of Physics of the Czech Academy of Sciences since 2017.

Seminář proběhne v anglickém jazyce.

RNDr. Michael Prouza, Ph.D.
ředitel