Science Program presents

Optimized Design of Semiconductor Quantum Nanostructures

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Thursday, December 2, 2010 12-1 p.m.
LH 143
(Light lunch will be served)

LECTURE SUMMARY: Optimization techniques play a significant role in the field of investigating electronic and optical properties of semiconductor nanostructures, as they provide the tools for calculating the best structural parameters for a particular application. We have developed a host of techniques within the last few years, based on methods of quantum mechanics which have been successfully transplanted into the more applied research areas (i.e. modeling of various semiconductor devices) and combined with modern optimization methods (simulated annealing algorithm, genetic algorithm, procedures based on applying the optimal control theory). This enables us to perform a global optimization (with no unnecessary constraints) of QW structures realized with III-V's and nitride semiconductors, considering a predefined set of goals. Part of our research efforts has been directed towards modeling and optimization of quantum cascade lasers and their application in very strong magnetic field. This includes obtaining gain-maximized structures, designed to emit radiation at specified wavelengths, as well as analyzing the possibilities for constructing novel (active) metamaterials with the arrangement of structural layers as in quantum cascade laser. Within the field of spintronics, we have applied similar optimization principles to maximize particular spin-dependent properties in nanostructures based on semimagnetic and nonmagnetic semiconductors. Our research also includes modelling of time-related parameters for tunneling of particles in QW structures (delay times), together with considering analogous problem in electromagnetics, i.e. tunneling times that occur while electromagnetic waves travel through barriers placed inside the waveguide with different index of refraction.

FOR MORE INFORMATION:

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