NUSOD 2008 Short Course Description SC 802

Intersubband Semiconductor Optics

SCOPE: This course introduces the basic physics of intersubband transitions in semiconductor heterostructures. Mechanisms for intersubband absorption are presented and relevant selection rules are derived. Analytical results are presented for simple structures and numerical results are discussed for realistic structures. The relevance of many body and nonequilibrium effects is compared and contrasted for simple quantum wells and complex superlattices and state of the art algorithm developments are discussed and applied to quantum cascade laser (QCL) structures. Novel QCL device concepts and applications, especially in the THz domain are summarized.

BENEFITS AND LEARNING OBJECTIVES

This course will enable you to

- understand the basic principles of interusbband optics
- develop insight for intersubband optics device design
- understand the role of many body effects and how to control them
- understand the relevance of nonequlibrium effects in contrast to interband optics
- have an overview of recent device applications and development

COURSE LEVEL

Introductory/Intermediate
Knowledge of basic quantum mechanics concepts and equations is necessary

INTENDED AUDIENCE

Students, postdocs, device engineers and researchers who are interested in understanding the differences and peculiarities of the less explored and expanding field of intersubband optics.

INSTRUCTOR

Mauro F. Pereira, Professor at the Materials and Engineering Research Institute of Sheffeld Hallam University in the United Kingdom, is an active researcher in theory of semiconductor materials and optics. His expertise includes Nonlinear and quantum optics, exciton and polariton effects, band structure engineering, many-body effects, semiconductor lasers including quantum cascade structures, nonequilibrium Greens functions and numerical methods. His research is aimed at fundamental understanding and as input for the design and simulation of novel optical and electrooptical devices.