

to whom it may concern,

Report by Florin Garoi

The Institute for Atomic Physics Chapter had Prof. Mauro F Pereira, from the University of Sheffield Hallam UK, as an invited lecturer on March 2, 2009. His lecture, entitled *21st century optical engineering: manipulating nonequilibrium many body effects to create new THz devices*, was of great interest and actuality.

SPIE Student Chapter
Institute for Atomic Physics

SPIE Romanian Student Chapter presents:
<http://studentrospie.inflpr.ro/news.html>

Invited Lecture

“ 21st Century Optical Engineering: Manipulating Nonequilibrium Many Body Effects to Create new THz Devices by Professor Mauro F Pereira from Sheffield Hallam University, UK ”

March 02, 2009 at 14:00h in the Seminar Room within The National Institute for Laser, Plasma and Radiation Physics / Laser Department

abstract
In this talk I will start with the basic principles of operation of semiconductor lasers and then describe in simple terms how laser light can be generated in a semiconductor device. Applications of THz and MIR devices will be briefly highlighted.

I will then compare and contrast conventional interband optics with intersubband optics and the frontier of microscopic design of semiconductor lasers: the quantum cascade laser. These are the most complex structures ever grown in a laboratory and some of them already have commercial applications. The need for advanced quantum statistical mechanics, many particle and nonequilibrium Physics to describe these devices will be explained. Results of our state of the art device simulator will be presented and the difficulties to create new mid infrared and THz devices will be explained. Both technological and mathematical/simulations issues will be addressed and the role of complex scattering mechanisms will be explained. It will be further demonstrated how we can now visually study the nonequilibrium charge distribution in the structure and use it to analyse potential design failures and re-design the lasers based on those studies. A possible solution for intervalence THz gain without inversion is discussed.

I will close the lecture with a highlight on fundamental physic and demonstrate that the coupling between light and intersubband excitations in semiconductors is fundamentally different from the well understood coupling to interband transitions that leads to excitonic polaritons and a more general intersubband antipolariton concept is introduced.

about Professor Mauro F Pereira

Theory of Semiconductor Materials and Optics

Expertise: Nonlinear and quantum optics, exciton and polariton effects, band structure engineering, many-body effects, semiconductor lasers including quantum cascade structures, nonequilibrium Green's functions and numerical methods. The results are aimed at fundamental understanding and as input for the design and simulation of novel optical and electrooptical devices.

Biography: Mauro Pereira was born in Rio de Janeiro, Brazil and received the BSc in Physics at PUC/RJ in 1983 and the MSc in Physics in 1985. He completed the PhD in Optical Sciences at the Optical Sciences Center in Tucson/AZ in 1992 and received an equivalent Dr. ScL degree in Physics from UFRJ in 1993. He was a Research Associate at PUC/RJ, CBPF, Uni-Rostock, and the TU-Berlin, an invited Lecturer in Bremen, an Associate Professor of UFBA and a Senior Researcher at Tyndall National Institute before joining the Materials and Electrical Engineering Research Institute of Sheffield Hallam University as a Professor. He has over 70 journal and proceedings publications.

Sponsors SPIE

On the left is the ANNOUNCEMENT for the INVITED LECTURE of Prof. Mauro F Pereira.

A “.PDF” file of this announcement can be downloaded from chapter’s web site:

<http://studentrospie.inflpr.ro/news.html>

2009 Invited Lecture: *Prof. Mauro F Pereira*

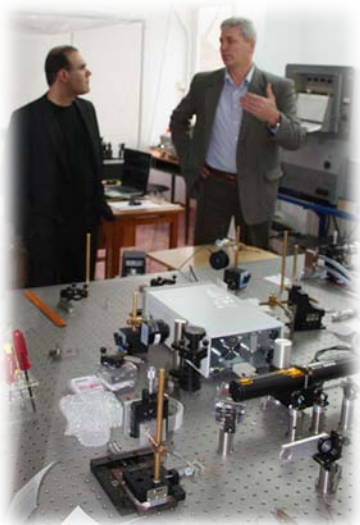
During his stay we had the chance to change scientific ideas and cultural impressions.

More pictures on the event
can be found on our
website:

[http://studentrospie.inflpr.ro/
activities.html](http://studentrospie.inflpr.ro/activities.html)



A visit to some of the laboratories in our institute was also organized, for Prof. Pereira to have a wider view of the scientific activity regarding Romanian physics research.



2009 Invited Lecture: *Prof. Mauro F Pereira*

We visited an art exhibition within the *Palace of Parliament* and had “coffee with the experts”. Even though the time was short the social program was rewarding.



March 2009, Bucuresti