

**Ministry of Higher Education & Scientific Research
Research & Development Office
Pioneer Projects Department**

**Training Course in National Institute of Optics
(Nonlinear Dynamics in Optics and Application)
Italy. November 2012.**

Thursday 01/11/2012:

The group arrived to Florence at 12.30 P.M.

Friday 02/11/2012:

09:30-13:00	Reception	Meeting in the hotel with <i>Prof. R. Meucci and Dr. Kais Al-Naimee</i> the organizers of the program and discussion was hold up about the application of the syllabus, followed by registration and reception at INO.
14:00-16:00	Guided tour in the Institute	- INO labs. Tour, includes: 1- Solar Collectors. 2- Visual impact on the psychological state of the person using the advanced spectral camera. 3- Study of small particle sizes using optical methods using laser scattering study. 4- Fourth Lab contains solid state laser system Nd-YAG. The aim of this Lab. is to study solid-state lasers and how to increase their efficiency.

Monday 05/11/2012:

09:30		Banking and fees payment
14:00-16:00	Lecture	1-Nonlinear dynamics in optics to cognitive processes (<i>Prof. F Tito Arcocchi</i>). He was a candidate for Nobel prize. Outline Lectures: <ul style="list-style-type: none">• How to organize observations.• Fourier transforms.• Time code for spike sequences.• Degree of freedom.

Tuesday 06/11/2012:

09:30-13:00	Lecture	Nonlinear dynamics in optics (<i>Prof. F Tito Arcocchi</i>) Outline Lecture: <ul style="list-style-type: none">• The electromagnetic field and its quantization.
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14:00-15:30	Lecture	Chaos in semiconductor devices (<i>K. Al-Naimee</i>) <ul style="list-style-type: none"> • Bifurcation diagrams • General chaos knowledge • Chaos generation by optical feedback, and Chaos generation by opto-electronic feedback.
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Wednesday 07/11/2012:

10:00-13:00	Lecture	Nonlinear dynamics in optics (<i>Prof. F Tito Arcocchi</i>) Laser materials: <ul style="list-style-type: none"> • Ruby • Neon • CO₂
14:00-15:30	Lab. activities	Chaos in semiconductor devices (<i>Sora F. Abdalah</i>)

Thursday 08/11/2012:

10:00-13:00	Lecture	Chaos in optics, role of the CO ₂ LASER (<i>R. Meucci</i>) <ul style="list-style-type: none"> • Homoclinic Chaos (HC): a key study for investigation of noise effects. • Coherence Resonance, Stochastic Resonance and Enhanced Phase Synchronization in HC. • Control and synchronization of laser bursting.
14:00-15:30	Lab. activities	Chaos in electronic circuits (<i>S. Euzzor</i>)

Friday 9/11/2012:

City Tour

Monday 12/11/2012:

10:00-12:00	Lecture	Nonlinear dynamics in optics (F. Tito Arcocchi) <ul style="list-style-type: none"> • Maxwell-Bloch equations • Linear polarization • Quadratic polarization
12:00-13:00	Lecture	Nonlinear dynamics and complexity in semiconductor devices (<i>Sora F. Abdalah</i>).
14:00-15:30	- Lab. activities	Complexity in semiconductor devices (<i>Sora F. Abdalah</i>)

Tuesday 13/11/2012:

10:00-13:00	Lecture	Participant seminars
14:00-15:00	Lecture	Nonlinear dynamics in optics (<i>F. Tito Arecchi</i>) <ul style="list-style-type: none"> • Quantum optomechanic

Wednesday 14/11/2012:

10:00-13:00	Lecture	High power lasers at INO (<i>A. Lapucci</i>) <ul style="list-style-type: none"> - Laser engineering: the problem of managing high powers: <ul style="list-style-type: none"> • Thermal effects. • Beam Quality degradation. - Our Experience with High Power Lasers: <ul style="list-style-type: none"> • Gas Lasers. • Diode Pumped Solid State Lasers. • Beam quality enhancement. -High Energy Lasers (Pulsed Operation) and their applications.
14:00-16:30	Lecture	Solar collectors (<i>D. Jafrancesco</i>)

Thursday 15/11/2012:

10:00-13:00	Lecture	Phase control of chaos (<i>R. Meucci</i>) <ul style="list-style-type: none"> • Phase control of chaos. • Phase control of escapes. • Phase control of a neuron model.
14:00-15:30	Lab. activities	Phase control of chaos (<i>S. Euzzor. R. Meucci</i>)

Friday 16/11/2012:

City Tour

Monday 19/11/2012:

Full day visit to LENS labs.:

LENS is (European Laboratory for Nonlinear Spectroscopy), and the “Nello Carrara” Institute of Applied Physics (IFAC) is part of the National Research Council (CNR), which is the main public organization promoting research and innovation in Italy.

The visit to LENS included the following laboratories:

- 1- Study light scattering in heterogeneous materials.
- 2- Advanced Molecular Spectroscopy Laboratory to study track follow of C¹⁴ isotopes using carbon dioxide lasers and Technology of femtosecond.
- 3- Laboratory of cooling molecules and atoms using liquid helium.
- 4- Quantum optics Lab.

- 5- Laboratory of High Resolution Spectroscopy.
- 6- Cooling atoms by using laser, and the cooling temperature is 10^{-9} K.
- 7- Water quality control by Fluorescence.
- 8- In micro-and nano photonics lab. researchers work with the individual photons or large fluxes to complex microscopic systems ranging from random to periodic ones.
- 9- The final purpose is to investigate fundamental aspects of the interaction between light and matter and use natural phenomena to build novel materials with special optical properties.

The visit for (IFAC) included the following laboratories:

- 1- Optical micro-technology Lab.
- 2- Optoelectronics lab.
- 3- Remote sensing for geological applications lab.
- 4- Industrial Laser Lab.
- 5- Solid State Laser Lab.
- 6- LIDAR (Light detection and ranging) Lab.
- 7- Archaeological carvings Laser Treatment Lab.
- 8- Colors Lab to deal with paintings in museums.

Tuesday 20/11/2012:

10:00-13:00	Lecture	Nonlinear dynamics in biology (<i>M. Ciszak</i>)
14:00-15:30	Lecture	Excitability in optics (<i>F. Marino</i>)

Wednesday 21/11/2012:

10:00-13:00	Lecture	Digital IR Holography (<i>M. Locatelli</i>) <ul style="list-style-type: none"> • Analog holography. • Digital holography. • Infrared digital holography. • Setups and results. Holography is therefore a two steps process: <ul style="list-style-type: none"> • Hologram recording. • Hologram reconstruction.
14:00-15:30	Lab. activities	Digital IR Holography (<i>M. Locatelli</i>)

Thursday 22/11/2012:

10:00-13:00	Lab. activities	Digital Holography.
14:00-15:30	Lecture	Holography and interferometric optics (<i>S. De Nicola</i>) Interferometry and holography for material characterization:

		<ul style="list-style-type: none"> • Wavefront reconstruction techniques. • Digital interferometric and holographic metrology. • Material science. • Material research-surface quality and topography characterization. • Semiconductor, MEMS, MOEMS. • Reflective and transparent objects.
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Friday 23-11-2012:

Visit to (CNR - ISTECH, Faenza) involved:

Visiting the laboratories of the institute and meeting the researchers and the directory and discussing the possibility of cooperation and they suggested the followings

- Initiation and collaboration with graduated students and offering support for training.
- Cooperation with the (Chemistry and Technology for the Environment and Materials-Curriculum: Traditional and Innovative Materials), Faculty of Chemistry-University of Bologna.
- Offers the possibility for companies to carry their staff, specific training courses and training workshops, specially formulated for the special educational and organizational needs in ceramic.

Monday 26/11/2012:

10:00-11:00	Lecture	Polarization dynamics in CO ₂ LASER (<i>R. Meucci</i>)
11:00-11:30		Reports
14:00-5:30		Certificates and departure from INO- institute

Tuesday 27/11/2012:

Full day visit to laboratories of Roma University.

Wednesday 28/11/2012:

Full day visit to laboratories of Roma University.

Thursday 29/11/2012:

Full day visit to laboratories of Roma University.

Friday 30-11-2012:

Departure from Rome to Baghdad

The following pictures represent some of the Laboratories we were visits:-

Conclusion and Recommendation:

Conclusion:-

- The training course was very useful and the group had a new knowledge, especially the field of nonlinear dynamics, in optics and other fields.

Recommendation:

- We suggest adding more theoretical lectures in quantum optics and photonics.
- Cooperation between our universities and the INO- institute.
- Scientific projects with graduated students, scientists, and post doctorate study.

Acknowledgment:

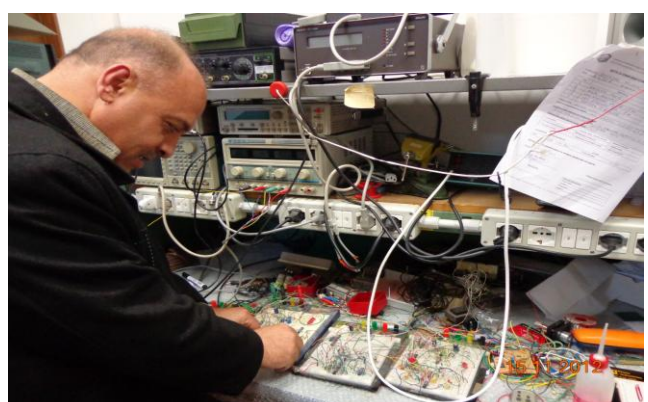
We are fully thankful, time and efforts, especially to *Dr. Saywan Barzani* (Ambassador of the Republic of Iraq in Rome), *Dr. Abdulsalam A. M. Al-Ani* (Cultural Attaché - Rome), also fully thankful for all the staff at INO for their hospitality and help: *Prof. F. Tito Arecchi*, *Prof. R. Meucci* and *Dr. K. Al-Naimee*, and we express our gratitude to *Stefano*, *Eugenio*, *Massimiliano* and *Sora (INO- Italy)*, also our thankful to *Ali H. Neimah and Raheem S. Jaber* (Employs at Cultural Attaché - Rome) thanks for all of you.

Best Regards
The Iraqi Group

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