



VIU

**Venice
International
University**

Isola di San Servolo
Venezia - ITALY

July 11 – 18, 2010

2nd International School on
***Laser-surface interactions for new materials production: tailoring
structure and properties***

The purpose of the School is to offer a comprehensive overview on basic principles and relevant applications connected to the irradiation of solids by energetic laser beams. The goal is to explore the use of light in the development of novel materials with emphasis on specific control of their properties at nanometer scale. The field is relatively young and has grown at a very high rate in the last fifteen years, thanks to worldwide research activity. One area of very high interest is the use of lasers in deposition processes; it is possible, for example, to deposit virtually any material, including multi-component compounds, preserving the composition of the ablated target, and generally avoiding post-deposition thermal treatments. In addition, the experimental setup involved in pulsed laser deposition is generally compatible with in situ diagnostics of both the plasma and the growing film. The basic laser-surface interaction mechanisms possibly in an ambient atmosphere, either chemically reactive, or inert are a challenge to scientists, while engineers are mostly interested to the characteristics of the deposited materials and to the

possibility to tailor their properties through an appropriate tuning of the deposition parameters.

In addition, lasers can be used to modify materials in a highly controlled fashion; this includes both bulk and surface modification. Examples include production of surface nanostructures as well as nanoparticles (both bulk and surface). These laser-induced changes can strongly influence the optical and electronic properties of the irradiated material. Finally, a wide range of applications and characterization techniques involve understanding on a very basic level the interaction mechanisms. Plasmonics is one blossoming field requiring such knowledge.

Among the hot topics developed in recent years are ultra-short laser pulses to explore electronic excitation in solids and its relaxation with phonons in highly non equilibrium conditions, the synthesis of nanoparticles and their assembling to prepare nanocrystalline films and the deposition of metastable systems.

Well established International Conferences bring together every year many researchers in the field allowing for extensive scientific exchange. Based on the success of the First edition of the School, the Second is now scheduled with the explicit aim to educate doctorate students in the principles of laser-surface interactions especially in connection with the ablation processes and materials modification.

The proposed one-week School will focus on the deep interplay between experimental and theoretical investigations of laser-induced surface phenomena. The topics include laser-surface and -bulk interactions, the role of defects, non-linear absorption phenomena, surface melting, vaporisation, superheating, homogeneous and possibly heterogeneous nucleation, phase explosion and plasma formation, nanosecond and femtosecond laser pulses, film synthesis by pulsed laser deposition, nanoparticle nucleation, growth and assembling of nanocatalysts relevant to renewable energies and to the ambient, the fate of electrons and displaced atoms/ions in excited solids. The classes of considered materials span the entire realm of technological interest and include metals, semiconductors, and wide bandgap insulators. The main experimental techniques to characterize solids and surfaces before, during, and after irradiation, the plasma plume and the deposited film will be addressed. The true interdisciplinary nature of the School will help promoting fruitful interactions between researchers from such diverse fields as solid state and plasma physics and chemistry, materials science, metallurgy, ceramic, and polymer science.

We expect junior researchers will particularly profit from the proposed initiative.

The recognised success of the First edition of the School (directed by A. Miotello and P.M. Ossi) encouraged the Scientific Committee to plan the Second edition in the same place and maintaining the same scientific and organisation structure as that of the First edition. The facilities of Venice Intl. University demonstrated to be excellent and S. Servolo island is a beautiful, quiet garden that facilitates positive interaction among participants, yet it is a few minutes far from S. Marco Square and the very centre of Venice with its exciting cultural and recreational life, in the heart of the summer season.

The School is planned for about 50 students. Attention will be given to keep a truly international character of the event, also through a selection of the participants.

The School Directors

C. Boulmer-Leborgne
M. Dinescu
J.T. Dickinson
P.M. Ossi

Contacts

Before the School

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Prof. Maria Dinescu: dinescum@ifin.nipne.ro
Prof. Paolo M. Ossi: paolo.ossi@polimi.it

During the School (from July 11 to July 18, 2010)
School Secretary: +39 0412719550 (tel. + Fax)

Check-in/out

Check-in at S. Servolo is expected on July 11, from 12.00 and Check-out is expected on July 18, from 10.00.

Connections

Connections with Venice **railway station S. Lucia** and Venice **Intl. Airport Marco Polo**, as well as **public boat** timetables can be found at <http://www.sanservolo.provincia.venezia.it>

Organisation issues

To stimulate the scientific interactions both between Lecturers and students, the following timetable will be adopted:

9.00 – 10.00 : lecture

10.30 – 11.30 : lecture

12.00 lunch time

14.30 – 15.30 : lecture

16.00 – 17.00 : lecture/ posters

17.30 – 18.30 : lecture

Each student is asked to bring a poster with recent relevant results of his research activity. All the posters will be exhibited on the first day and they will be removed at the end of the School.

Two poster sessions are scheduled and awards will be given for the best posters.

Lecture Titles

The following **Lectures** will be delivered at the School:

J. Thomas Dickinson

Department of Physics, Washington State University, Pullman, WA USA

Important issues in laser materials interactions and relevant applications

David B. Geohegan

Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, U.S.A.

Laser Interactions and Diagnostics to Understand and Control the Synthesis of Novel Materials

Koji Sugioka

RIKEN – Advanced Science Institute, Wako, Saitama 351-0198, Japan

Ultrafast Laser Micro and Nano Processing - Fundamentals to Applications

Antonio Miotello

Dipartimento di Fisica, Università di Trento I-38100 Povo-Trento, Italy

Ion- or photon- irradiation of targets and selected applications

Leonid V. Zhigilei

Department of Materials Science & Engineering, University of Virginia,

Charlottesville, VA USA

Microscopic view of laser-induced structural and phase transformations from atomic-level simulations

Chantal Boulmer-Leborgne

GREMI Université d'Orléans, BP6744, Orléans cedex2 France

Plasma created by laser interaction with materials

Richard F. Haglund, Jr.

Department of Physics and Astronomy, Vanderbilt University, Nashville, TN USA

Wavelength-selective laser processing of polymers for device applications

Marta Castillejo

Instituto de Química Física Rocasolano, CSIC, Serrano 119, 28006 Madrid, Spain

Plasma Diagnostics and Synthesis of Nanostructured Metal Oxides and Semiconductors with ns and fs PLD

Nadezhda M. Bulgakova

Institute of Thermophysics SB RAS, 1 Lavrentyev Ave., 630090 Novosibirsk, Russia

Continuum models of ultrashort laser ablation: overview, advantages, and limitations

Peter Schaaf

Ilmenau University of Technology, Institute of Materials Engineering and Institute of Micro- and Nanotechnologies, POB 100565, 98684 Ilmenau, Germany

Free Electron Laser and conventional laser treatments for Functional and Innovative Materials and Structures

Carmen N. Afonso

Laser Processing Group, Instituto de Optica, CSIC, Serrano 121, E 28006 Madrid, Spain

Pulsed Laser Deposition: a Route for Controlling Materials in the Nanoscale?

Wolfgang Kautek

University of Vienna, Department of Physical Chemistry, Waehringer Strasse 42, A-1090 Vienna, Austria

Lasers in Cultural Heritage: Fundamentals of Paper and Textile Conservation

Anna Paola Caricato and Armando Luches

Università del Salento, Dipartimento di Fisica, 73100 Lecce, Italy

MAPLE: fundamentals and recent applications

Douglas B. Chrisey

Department of Material Science and Engineering, Rensselaer Polytechnic Institute, Troy, NY USA

Laser Processing Applied to Biological Systems

Corinne Champeaux

SPCTS UMR 6638 and Université de Limoges/CNRS, 87060 LIMOGES Cedex, France
Synthesis of Thin Films, Clusters and Nanocomposite Materials by Laser Ablation for Telecom and Optic Applications

Ion Mihailescu

National Institute for Lasers, Plasma and Radiations Physics, Bucharest, Romania
Nanostructured biomaterials thin films synthesized by pulsed laser-assisted methods

Thomas Lippert

Paul Scherrer Institut, 5232 Villigen-PSI, Switzerland
Laser direct writing methods: laser-induced forward transfer (LIFT) and related techniques

Maria Dinescu

National Institute for Lasers, Plasma and Radiation Physics, Bucharest, Romania
PLD based techniques for oxides thin films growth: applications to dielectrics, ferroelectrics and multiferroic

Paolo M. Ossi

Dipartimento di Energia, Politecnico di Milano, via Ponzio 34-3, 20133 Milano Italy
Cluster synthesis in laser-generated plasmas and controlled nanostructure assembling

2010 Venice School Timetable

Schematic of the **Lecture distribution** along the day:

Morning : 9.00 – 10.00
 10.30 – 11.30

Lunchtime : 12.00

Afternoon : 14.30 – 15.30
 16.00 – 17.00
 17.30 – 18.30

The **Lecture sequence** is the following:

July 12 Morning : Dickinson
 Geohegan

 Afternoon : Sugioka
 POSTER 1
 Miotello

July 13 Morning : Zhigilei
 Leborgne

 Afternoon : Haglund
 POSTER 2
 Castillejo

July 14 Morning : Bulgakova
 Schaaf

 Afternoon : FREE

July 15 Morning : Afonso
 Kautek

 Afternoon : Luches
 FREE (proposed guided tour at an exhibition)

July 16 Morning : Chrisey

Champeaux

Afternoon : Mihailescu
POSTER 3
Lippert

July 17 Morning : Dinescu
Ossi

Poster Awards - Conclusions

Cultural Events

On **Wednesday, July 14**, early afternoon (from 2.00 PM) the School participants are invited to take part to a guided tour of the S. Servolo Island, including a visit of the gardens, the pharmacy, the chapel and the psychiatric hospital museum (one of the very few such historical scientific museums in Italy). The remaining of the afternoon is free to visit Venice.

On **Thursday, July 15** afternoon, a visit to the “Forms of the Modern” Exhibition at Ca’ Pesaro is planned.