POLITECNICO DI MILANO

UNIVERSITÀ DEGLI STUDI DI TRENTO
Dipartimento di Fisica

Ist International School

"Laser-surface interactions for new materials production: tailoring structure and properties"

School Directors
P.M. Ossi
A. Miotello
C.E. Bottani

Isola di San Servolo
Venezia
July 13 – 20, 2008

VIU Venice International University

EOS European Optical Society — Coherence for Europe®

SIOF Società Italiana di Ottica e Fotonica

I[st] International School on

Laser-surface interactions for new materials production: tailoring structure and properties

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Omicron NanoTechnology GmbH, Roma

San Servolo Island
Venezia - ITALY

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The purpose of the proposed Course is to provide participants with a comprehensive overview of fundamental principles and relevant applications connected with the exposure of solids to energetic laser beams. Such issues are important to develop novel materials with a specific control of their properties at the nanometer scale. The field is relatively young and it grew at a high rate in the last ten years, with a research explosion that has spurred worldwide activity. The main reasons are on the one hand the possibility to deposit virtually any material, including multi-component compounds, preserving the composition of the ablated target and generally avoiding post-deposition thermal treatments and on the other hand the simple experimental setup which is compatible with in situ diagnostics of both the plasma and the growing film. The basic interaction mechanisms between an intense laser beam and the material exposed to it, 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. 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 nanometer scale clusters and their assembling to prepare nanocrystalline films and the deposition of metastable systems.

Some well established International Conferences bring together every year many researchers in the field and allow for extensive scientific exchange. It is now time to schedule the first International School to educate doctorate students in the principles of laser-surface interactions especially in connection with the ablation processes. The proposed one-week Course will illustrate the deep interplay between experimental and theoretical investigations of laser induced surface phenomena. The addressed topics include radiation-solid interaction, 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, cluster nucleation, growth and assembling on a substrate. The classes of considered materials span metals and alloys, ceramics and polymers. The main experimental techniques to characterize the plasma plume, the irradiated target and the deposited film will be addressed. The true interdisciplinary nature of the Course will help promoting fruitful interactions between researchers from such diverse fields as solid state and plasma physics, materials science, metallurgy, ceramic and polymer science.

Junior researchers are expected to particularly profit from the proposed Course. The School is planned for 60 students. Attention will be given to keep a truly international character of the event, also through a selection of the participants.

With the aim to offer the contents of the School to a much larger audience than the attendants in S. Servolo, the School Proceedings will be published.

The School is hosted by Venice Intl. University (VIU) (see http://www.univiu.org/) at its quarters at S. Servolo Island, a site in the centre of the city, with a fascinating, long standing history, that was recently restored to be used for cultural events (see http://www.sanservolo.provincia.venezia.it).

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Contacts

Before the School
Prof. Carlo E. Bottani: carlo.bottani@polimi.it
Prof. Antonio Miotello: miotello@science.unitn.it
Prof. Paolo M. Ossi: paolo.ossi@polimi.it

During the School (from July 14 to July 19)
School secretary: +39 0412719550 (tel. + Fax)

Check-in/out

Check-in at S. Servolo is expected on July 13 and Check-out is expected on July 20.

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 scheme will be adopted:

9.00 – 10.30 : lecture
10.30 – 11.00 : interval
11.00 – 12.30 : lecture

lunch time

14.30 – 16.00 : lecture
16.00 – 16.30 : interval
16.30 – 18.00 : lecture/ posters

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

The following Colleagues have given their availability to act as Lecturers at the School:

S.I. Anisimov, Russia*
J. Reif, Germany
T.K. Lippert, Switzerland
M. Dinescu, Romania
N.M. Bulgakova, Russia
L.V. Zhigilei, U.S.A.
A. Luches, Italy
W. Kautek, Austria
P. Schaaf, Germany
D. Chrisey, USA
D. Geohegan, USA
I. Mihailescu, Romania
C. Leborgne, France
K. Sugioka, Japan
R. Haglund, USA
A. Miotello, Italy
C.E. Bottani, Italy
P.M. Ossi, Italy

***** regrettably, Prof. S. I. Anisimov was forced for personal reasons to cancel his participation to the School

Lecture schedule

Monday, **July 14** Morning : School Opening (9.00)
Chrisey (9.30)
Lippert (11.30)

Afternoon : Geohegan (15.00)
Kautek (17.00)

Tuesday, **July 15** Morning : Miotello (9.00)
Dinescu (11.00)

Afternoon : Haglund (14.30)
Posters (17.30)

Wednesday, **July 16** Morning : Reif (9.00)
Mihailescu(11.00)

Afternoon: Leborgne (14.30)
Posters (16.15)

Thursday, **July 17** Morning : Zhigilei (9.00)
Chrisey (11.00)

Afternoon: Sponsor Session (14.15)

Friday, **July 18** Morning : Sugioka (9.00)
Bulgakova (11.00)

Afternoon : Luches (14.30)
Bottani (16.30)
Posters (18.15)

Saturday, **July 19** Morning : Schaaf (9.00)
Ossi (11.00)
Concluding remarks (12.40)

Lecture Titles

Carlo E. Bottani : In situ scanning probe characterization of nanostructures produced by PLD

Chantal Boulmer-Leborgne : Nanoparticle formation by femtosecond laser ablation

Nadezhda M. Bulgakova : Continuum models of fs laser ablation

Douglas B. Chrisey : Fundamentals of laser-surface interaction

Douglas B. Chrisey : Laser direct writing of collagen-expressing tissue constructs

Maria Dinescu : PLD of piezoelectric and ferroelectric materials

David B. Geohegan : Laser synthesis and characterization of nanomaterials: time-resolved, *in situ* studies

Richard F. Haglund, Jr. : Thin film deposition of complex organic materials by resonant infrared laser ablation

Wolfgang Kautek : Lasers in cultural heritage: the non-contact intervention

Thomas Lippert : Laser ablation of polymers: from structuring to thin film deposition

Armando Luches : Fundamentals and applications of MAPLE

Ion Mihailescu : Nanostructured biomaterial thin films synthesized by pulsed laser methods: application to advanced biomimetic implants

Antonio Miotello : A comparison between basic processes in ion- and photon- interactions with surfaces

Paolo M. Ossi : Cluster synthesis and cluster-assembled film deposition in ns pulsed laser ablation

Juergen Reif : Basic physics of femtosecond laser ablation

Peter Schaaf : Direct laser synthesis of functional innovative coatings by laser treatments, including Free Electron Laser

Koji Sugioka : Ultrafast laser processing of glass down to the nano-scale

Leonid V. Zhigilei : Atomic-level simulations of laser-materials interactions

Proceedings

The full contents of the School will be published by Springer Verlag as a volume of the Springer Series in Materials Science.

Cultural Events

On **Tuesday, July 15**, afternoon 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).

On **Thursday, July 17** afternoon, a guided visit to the "Rome and the Barbarians" Exhibition at Palazzo Grassi is planned.

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(Venice, 13-20 July 2008)

Registration Form

please, fill in and send by e-mail to paolo.ossi@polimi.it

First Name

Family Name

Title

Position

Institution

Department

Mail address

Zip

City

Country

Phone

Fax

E-mail

☐ **male**
☐ **female**

I would prefer a room with

☐ **1 bed (1250 Euro*)**
☐ **2 beds (950 Euro*)**
☐ **3 beds (850 Euro*)**
☐ **4 beds (800 Euro*)**

(*) School fee, including all meals and Proceedings.

☐ **I need a Visa**

The deadline for paying the School fee is May 15, 2008.

Payment should be done by bank transfer in **Euro** to the following **School account**:

Bank Name: Banca Popolare di Sondrio, Ag. 21, Politecnico
Address: via Bonardi, 4, 20133 Milano, Italy
Account number: 09255/61
Beneficiary: POLIMI-Ossi Paolo-VE School
Iban code: IT76 A056 9601 6200 0000 9255 X61
SWIFT code: POSO IT22

Bank commissions, exchange charges, and fees are under the responsibility of the registrant.
After payment, please send **by fax** a receipt to the number: +39 02 23996309, **attn. Paolo Ossi**, quoting clearly your name.