Report 52nd IUVSTA Workshop:
STRUCTURE AND DYNAMICS OF FREE AND SUPPORTED NANOPARTICLES USING SHORT WAVELENGTH RADIATION, "Ettore Majorana" Foundation & Centre for Scientific Culture, Erice, Italy. 21-27 July 2007

Workshop Directors:
Prof. Olle Björneholm - Department of Physics, Uppsala University

Prof. Eckart Ruehl, Institut für Chemie und Biochemie, Freie Universität Berlin

Prof. Paolo Milani, Department of Physics, Università di Milano, Italy

PURPOSE OF THE WORKSHOP

The ability to synthesize and to manipulate nanoscale building blocks from the gas-phase promises to lead to fundamentally new advances in materials science and engineering and to exciting opportunities for innovation in technology. Short wavelength radiation in the vacuum ultraviolet- as well as in the soft and hard X-ray regimes (synchrotron radiation, free electron laser, laboratory-based radiation sources) are being increasingly applied to free and supported clusters using specific spectroscopic approaches. These experimental tools provide invaluable probes to achieve fundamental information on structural and dynamical size effects in condensed matter. Tightly related to experiments are novel theoretical approaches. Recent development and perspectives of this rapidly evolving research area will be presented and discussed with particular emphasis on the combination of novel free clusters production methods with high-brilliance photon sources and novel aspects of the interaction of short wavelength interaction with confined systems.

This workshop has brought together both junior and senior scientists belonging to different communities working with synchrotron radiation to study surfaces, supported nanoparticles, free nanoparticles, molecular and atomic systems in order to favour the establishment of a common platform for novel experimental and theoretical approaches.

The goal is to develop integrated methods for the study of free and supported nanoparticles exploiting short wavelength radiation and to discuss the possibilities opened by the new generation of radiation sources such as high-brilliance synchrotron radiation sources and free electron lasers.

The workshop has been focused on the following topics: Electronic and geometric structure of free clusters probed by core-level spectroscopy, free electron laser as a probe for cluster dynamics, decay mechanisms of highly excited clusters, reactivity of free clusters probed by electronic spectroscopy, synchrotron radiation for nanotechnology, production and characterization of high-intensity cluster beams, size-dependent functional properties of

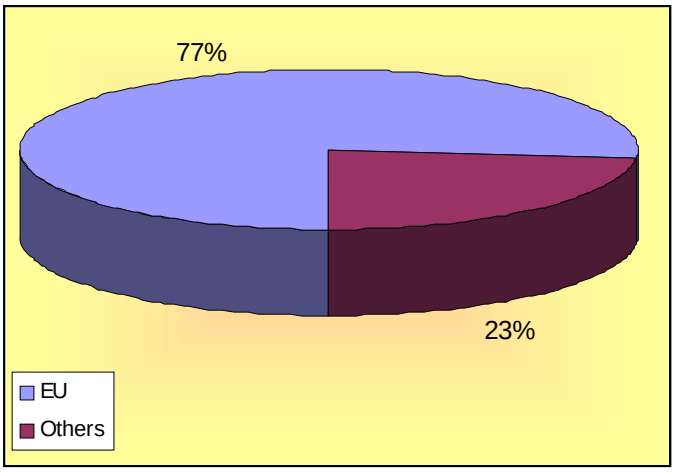
nanocrystals, free clusters vs. deposited nanoparticles. A Hot Topics session and a Poster session gave the opportunity to all participants to exchange the results of their work.

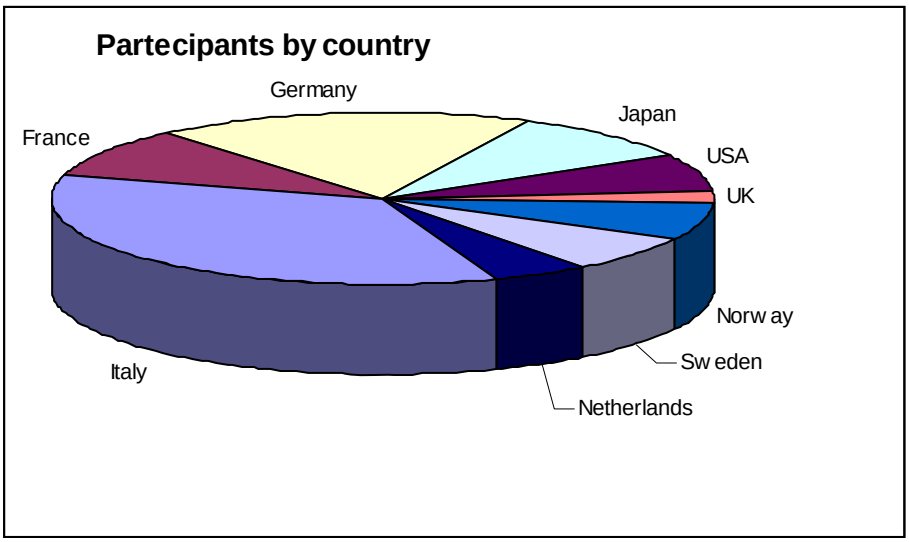
The workshop was held between July 21st and 27th 2007 with almost all of the participants being present for the whole period and attending all the sessions. One of the main objectives of the conference was cross-fertilization among different approaches to the rapidly growing field of the study of clusters and nanoparticles using short wavelength radiation: the latest results on supported nanoparticles and free clusters were discussed in order to provide the basis for the establishment of a paradigm of the evolution of the solid state from isolated systems to bulk ones. The role and the opportunities offered by novel sources such as free electron lasers were also deeply discussed, synchrotron radiation scientists presented in detail the most recent experimental approaches as well as scientist involved in nanoparticle production and manipulation. The truly interdisciplinary character of the workshop was clearly understood and enthusiastically accepted and shared by all the participants as explicited in public remarks and private communications to the organizers.

The long time given to oral presentations has proven to be beneficial for the achievement of the highest understanding of the presented materials and results by all the participants, despite of the belonging to different scientific communities. This was also evident from the large number of questions and comments following all the contributions. Time available for discussions was also satisfactorily long enough.

The lunch break was long enough to have short meetings in restricted groups for scientific discussions or to set up plans for future collaborations. The workshop location in a small isolated village was also a good point for the stimulation of such meetings. This was one point appreciated by all the participants.

The composition of the group of participants was only slightly unbalanced by a majority of people coming from EU countries (77%). Non EU participants were coming from Japan (about 9%), USA (about 7%) and Norway (about 7%). Among the EU countries Italy was the most represented.


77%
23%
EU
Others


Partecipants by country
Germany
Japan
France
USA
UK
Norway
Sweden
Italy
Netherlands

PROGRAM

21 July

Arrival and accomodation

22 July

9.00-9.30 Opening and welcome
Synchrotron radiation for nanoparticles
9.30-10.30 T. Moeller: *FEL*
10.30-11.00 Break
11.00-12.00 M. Kiskinova: *Supported clusters*
12.00-13.00 K-H Meiwes-Broer: *Metal clusters in the light of synchrotron and XUV free electron radiation: electronic properties and magnetism*
16.00-17.00 P. Rudolf: *Nanocluster aggregation by complementary hydrogen-bonding*
17.00-17.30 Break
17.30-18.30 K. Ueda: *Interatomic energy and charge transfer in rare-gas clusters after Auger decay by multicoincidence momentum imaging*
18.30-19.30 K. Børve *Insight to the structure of molecular clusters from XPS and theoretical modeling*

23 July

9.00-10.00 P. Piseri: *XAS on free metallic clusters*
10.00-10.30 Break
10.30-11.30 M. Tchaplyguine: *X-ray photoelectron spectroscopy on free clusters: from perfect dielectrics to metallic nanoscale particles*
11.30-12.30 K. Nagaya: *Studies on structure and dynamics of free clusters by using hard x-ray*
16.00-16.50 Poster session
16.50-17.20 Break
17.20-19.00 Poster session

24 July

9.00-10.00 C. Maurizio: *Local structure of metallic nanoparticles by Xray Absorption Spectroscopy*
10.00-10.30 Break
10.30-12.00 Hot topic session (15+5 minute talks)
J.T. Lau: *Mass Resolved Soft X-ray Ion Yield Spectroscopy at the 2p Absorption Edges of Free Transition Metal Clusters*
L. Bianchettin: *Electronic structure of highly under-coordinated Rh and Pt atoms on homo-metallic surfaces: photoelectron spectroscopy and DFT calculation*
C. Lenardi: *Resonant photoemission spectroscopy at Ti L2,3 edge of cluster assembled titanium dioxide films*
H. Bergersen: *Photoelectron spectroscopy and lineshape modeling of free neutral methanol clusters produced by adiabatic expansion*
Afternoon Excursion

25 July

9.00-10.00 N. Kosugi *Intermolecular interaction and multi-electron processes in photoionization of free molecular clusters*

10.50-10.30 Break
10.30-11.30 N.V. Kryzhevoi: *Interatomic Coulombic Decay induced by helium droplets*
11.30-12.30: R. Saykally *X-ray absorption spectroscopy of water microjets*
16.00-17.00 H. Ebert: *Magnetic properties of free and supported transition metal clusters by magnetic circular dichroism in X-ray absorption*
17.00-17.30 Break
17.30-19.00 Hot topic session (15+5 minute talks)
C.M. Graf: *Magnetic and structural investigation of Mn2+ doped ZnSe semiconductor nanoparticles*
F. Tournus: *Core/shell properties of well-defined magnetic nanostructures produced by assembling gas-phase CoxPt1-x clusters*
L. Ravagnan: *NEXAFS characterization of sp-rich carbon clusters in the gas phase and in cluster assembled films*
P. Dudin: *Comparative SPEM study of micro- and nano-scale rhodium particles in oxidation and reduction with hydrogen*

26 July

9.00-10.00 G. Beaucage: Dynamics of nanoparticle growth from smallangle X-ray scattering
10.00-10.30 Break
10.30-11.30 E. Rühl: *Light scattering from free nanoparticles*
11.30-12.30 C. Binns: Synchrotron *Radiation Studies of Magnetic Nanoparticles and Nanoparticle-assembled Materials*
15.30-16.30 M. Bogan: *Femtosecond diffractive imaging of nanoparticles*
16.30-17.00 Break
17.00-18.00 Round Table: Future FEL experiments on nanoparticles
18.00-18.30 Concluding Remarks

27 July

Departure

LIST OF PARTICIPANTS

Invited Speackers

Prof. Gregory Beaucage, Department of Materials Science and Engineering, University of Cincinnati - USA
Prof. Chris Binns, Department of Physics and Astronomy, University of Leicester - UK
Dr. Michael J. Bogan, Lawrence Livermore National Laboratory - USA
Prof. Knut Borve, Department of Chemistry, University in Bergen - Norway
Prof. Hubert Ebert, Department Chemistry and Biochemistry - Physical Chemistry, Ludwig-Maximilians-University of Munich - Germany
Dr. Maya Kiskinova, Sincrotrone Trieste - Italy
Prof. Nobuhiro Kosugi, UVSOR, Institute for Molecular Science - Japan
Prof. Nikolai Kryzhevoi, Physikalisch-Chemisches Institut, UniversitÃ¤t Heidelberg - Germany
Prof. Thomas Moeller, Institut fuer Atomare Physik und Fachdidaktik,Technische Universitaet Berlin - Germany
Dr. Chiara Maurizio, CNR-INFM c/o European Synchrotron Radiation Facility - France
Prof. Karl H. Meiwes-Broer, Institut fuer Physik, Universitaet Rostock – Germany
Dr. Kiyonobu Nagaya, Graduate School of Science, Division of Physics and Astronomy, Kyoto University - Japan
Dr. Paolo Piseri, Dipartimento di Fisica and CIMAINA, Università degli Studi di Milano - Italy
Prof. Petra Rudolf, Zernike Institute for Advanced Materials, University of Groningen - Netherlands
Prof. Richard J. Saykally, Department of Chemistry, University of California - USA
Dr. Maxim Tchaplyguine, MAX-lab, Lund Universitet - Sweden
Prof. Kiyoshi Ueda, Tohoku University - Japan
Dr. Bernhard Wassermann, Institut für Chemie und Biochemie - Physikalische und Theoretische Chemie, Freie Universität Berlin Germany

Participants

Dr. Matteo Amati, CIMAINA – University of Milano, Milano Italy
Dr. Fabrizio Bardelli, GILDA c/o CNR-INFM – Grenoble France
Henrik Bergersen, Dept. of Physics, Uppsala University - Sweden
Laura Bianchettin, Physics Department and Center of Excellence for Nanostructured Materials, Trieste University and Laboratorio TASC INFM-CNR - Italy
Nils Blanc, UMR CNRS 5586 – Lyon, France
Dr. Gero Bongiorno, Dipartimento di Fisica and CIMAINA, Università degli Studi di Milano - Italy
Matteo M. Dalmiglio, Sincrotrone Trieste - Italy
Dr. Monica De Simone, CNR - INFM TASC – Trieste Italy
Dr. Pavel Dudin, Sincrotrone Trieste, Elettra - Italy
Dr. Marcela P. Felicissimo, Zernike Institute for Advanced Materials - Netherlands
Dr. Christina Maria Graf, Freie Universität Berlin - Germany
Jarle Harnes, University of Bergen - Norway
Dr. Tobias Lau, Technische Universitaet Berlin, IOAP EW 3-1 - Germany
Dr. Cristina Lenardi, Istituto di Fisiologia Generale e Chimica Biologica, Università di Milano - Italy
Dr. Tommaso Mazza, CIMAINA and UniMi – Italy

Dr. Masanari Nagasaka, Institute for Molecular Science - Japan
Dr. Luca Ravagnan CIMAINA, Università degli Studi di Milano Italy
Davide Sangalli, Università degli studi di Milano, Dipartimento di Fisica - Italy
Dr. Fabrizio Siviero, Dipartimento di ingegneria nucleare, Politecnico di Milano - Italy
Dr. Florent Tournus, LPMCN - CNRS and Université Lyon 1 - France
Carlos E. Viol Barbosa, University of Trieste - Italy
Mathias Winkler, Institut of Chemistry, University of Bergen Norway