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International Centre
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United Nations
Educational, Scientific and
Cultural Organization

IAEA
International Atomic Energy Agency

Joint ICTP-IAEA Workshop on Advanced Ion Beam Techniques: Imaging and Characterisation with MeV ions

30 September - 4 October 2013

ICTP, Miramare - Trieste, Italy

The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy, in cooperation with the International Atomic Energy Agency (IAEA), Vienna, Austria, is organizing a Workshop on **Advanced Ion Beam Techniques: Imaging and Characterisation with MeV ions**, to be held from 30 September to 4 October 2013, in Trieste, Italy.

The purpose of this workshop is to introduce and discuss recent developments of accelerator based analysis techniques with MeV ions. Ion beam analysis (IBA) techniques have excelled in many fields for decades. In recent years there has been a strong development of IBA especially based on heavy ions, greatly enhancing its power. Beside the recent improvement of the sensitivity and accuracy of IBA techniques, new applications have also opened up using mass spectrometry of secondary ions created by swift heavy ions, a technique becoming known as "MeV-SIMS".

IBA is a group of accelerator-based nuclear techniques using ion beams as probes. Its unique feature is that it provides 3D analytical information in a non-destructive way. IBA is sensitive to all the elements in the periodic table. The sensitivity is usually 1 part per thousand, but it often approaches a few parts per million and better in special cases. Isotopic analysis is possible for most light elements. Quantification is more often than not standard-less, based on first principles. The depth of information usually varies from the first surface atomic layer up to a few tens of micrometers. Absolute elemental depth profiling can be done with a depth resolution of 2 nm at best. This depth resolution is very competitive even compared with the destructive SIMS technique. However, high resolution depth profiling is very difficult both from the experimental and data evaluation point of view. Therefore, this technique is not routinely used in IBA laboratories and needs to be disseminated to the wider community.

These unique capabilities lead to IBA being applied in almost every field of research that requires analysis of materials. For decades, most applications of IBA have been in materials science, but there are countless applications in environmental sciences, cultural heritage, art and archaeometry, geophysics, earth and planetary sciences, and biology and medicine. IBA is not intentionally destructive: valuable art objects are analysed and returned to museums without damage. On the other hand IBA is also regularly used where the sample structure is unknown, that is, it is used to provide a model-free analysis without prior knowledge of the sample. IBA is fully quantitative: all IBA techniques have an accuracy which is usually absolutely traceable.

MeV-SIMS is an emerging technique where secondary molecular ions are emitted by swift heavy ions. These secondary ions can be extracted from the target and analysed in a time-of-flight secondary ion mass spectrometer (ToF-SIMS) to gain molecular information of the surface material. By combining ToF-SIMS with a nuclear microprobe providing focussed ion beams with a scanning option it is possible to produce molecular maps of surfaces. As the sample irradiation is done in-air, this new technique provides excellent perspectives for non-destructive analysis. Simultaneous application of elemental characterisation by traditional IBA techniques with molecular imaging is a very recent and on-going development which opens up new horizons for materials characterisation using accelerator-based techniques.

PARTICIPATION

Early stage researchers (primarily post-docs and PhD students) actively working in the field of Ion Beam Analysis including heavy ions are invited to submit their application. Each participant should present the results of their research in the form of a poster. Appropriate time will be allocated for scientific discussions in order to stimulate further development and co-operation among the participants.

Participants from all countries that are members of the UN, UNESCO or IAEA can attend the Workshop. The main purpose of the workshop is to help to stimulate interaction between researchers from both developed and developing countries. As the activity will be conducted in English, participants must have an adequate working knowledge of that language. As a rule, travel and subsistence expenses of the participants are borne by their home institutions. However, limited funds are available for some participants from, and working in, developing countries, not more than 45 years of age, to be selected by the Organizers. **Such financial support is available only for those who attend the entire activity.** Every effort should be made by candidates to secure support for their fare (or at least half-fare) from their home country.
There is no registration fee to attend the Workshop.

HOW TO APPLY FOR PARTICIPATION

The application form can be accessed at the activity website:
http://agenda.ictp.it/smr.php?2488
Once in the website, comprehensive instructions will guide you step-by-step, on how to fill out and submit the application form. Kindly send all file attachments in PDF format.

Secretariat:
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TOPICS TO BE COVERED:

- **Introduction to accelerator based techniques**
- **Heavy ions: probing the entire periodic table**
- **Sensitivity and resolution**
- **Total IBA: synergistic treatment of data from multiple IBA techniques**
- **Learning and using state of the art codes to affect the IBA analyses**
- **Pitfalls in IBA data analysis**
- **Beyond Elemental Analysis; MeV-SIMS, High resolution PIXE**

APPLICATION DEADLINE

25 May 2013

Workshop web page:
http://agenda.ictp.it/smr.php?2488