IRiS 10

1st Workshop on
Inelastic Reaction Isotope Separator for Heavy Elements
March 01, 2010, GSI, Darmstadt, Germany

Workshop Goal

The unique opportunity exists to build a new separator dedicated to the isolation of heavy element isotopes produced in multi-nucleon transfer reaction. This device, named IRiS (Inelastic Reaction isotope Separator for Heavy Elements), will be set up at the GSI in Darmstadt in a collaborative effort headed by the Institut für Kernchemie at the Johannes Gutenberg-University Mainz, the GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt, and the Helmholtz Institute Mainz.

The idea of this workshop, which will be the first of a series of annual workshops, originates from the success of the **TASCA** project, in which a separator for the isolation of superheavy fusion-evaporation reaction products was built in the framework of a broad international collaboration. Overwhelmingly positive experience with the building and the commissioning phases of TASCA encourages us to repeat this approach and establish an open collaboration within the scientific community. We invite interested experts from any field related to IRiS aspects to join our efforts. The goal of this workshop is to form such a collaboration and define tasks and establish working groups leading to building and operating the best separator.

Scope

The main focus of the IRiS10 workshop is:

- To evaluate various design options and to discuss a possibly optimal design of a separator/spectrometer suitable for the separation of heavy element isotopes produced in multinucleon transfer reactions.
- To establish an international community among interested experts in the fields of separator design, atomic - and nuclear physics and nuclear chemistry to design, build, test and operate such a separator, including its detection system, and perform chemistry of the heaviest elements in combination with it.

Scientific Background

The question of the possible production of very heavy elements in nuclear transfer reactions was carefully studied in the 1970's and 1980's. Numerous neutron-rich isotopes of transuranium elements were synthesized, but the search for superheavy elements produced in such reactions has reached the limits of contemporary detection capabilities. Therefore, these studies were almost completely abandoned and for the following 30 years, the focus was shifted to nuclear fusion reactions. During this time novel, highly efficient techniques were introduced, which allowed for the detection of a large number of new isotopes synthesized in fusion reactions. Among others, advances in detection techniques lead us to reconsidering the potential of multi-nucleon transfer reactions once again.

Theoretical calculations published in last years predict favorable cross sections for multi-nucleon transfer reactions, opening the possibility to study yet unknown isotopes of very-neutron-rich transuranium isotopes. These new isotopes can be produced **exclusively** in transfer reactions. Study of neutron-rich transuranium isotopes will bring new insight into:

- r-process systematics
- Spontaneous fission systematics and the influence of the shell closures

- Spontaneous fission of ^{264}Fm, which could undergo symmetrical decay to form two nuclei of the doubly magic ^{132}Sn
- Testing the robustness of the deformed N=152 and N=162 shell closures with increasing distance from Z=100 and Z=108
- Exploring potential newly appearing shell closures
- Possibility of beta-delayed decay

Neutron-rich isotopes are predicted to have longer half-lives compared to the neutron-deficient isotopes accessible in nuclear fusion reactions. This feature is of extreme importance for both, nuclear chemistry and precise mass measurement. Chemical systems with longer reaction times can be investigated with unparalleled efficiency. Mass measurements in electromagnetic traps can be performed with truly single atoms, if these are sufficiently long-lived.

Technical Background

At this very early stage of the project, specifying the optimum design of the device suitable for studying heavy elements produced in nuclear transfer reactions is the most pressing question. The device should have the following properties:

- Good separation of the transfer reaction products from the primary beam and from elastically scattered particles
- Large angular acceptance
- High overall efficiency (> 10%)
- Separated products must be delivered to the detection system in the form suitable for their further investigation by chemical means, for nuclear structure studies, and for precise mass measurement
- Use of transuranium targets
- Design reactions include those with ^{18}O, ^{136}Xe, and ^{238}U projectiles on actinide targets

Topics

The following topics will be presented and discussed, and we kindly ask for submission of contributions to these topics:

- Status of theoretical understanding of the multi-nucleon transfer reactions and discussion of important scientific topics, which could be resolved with help of the transfer reactions
- Status of current experimental knowledge in this area
- Status and design of existing transfer product separators, spectrometers, and other relevant tools
- Discussion of concepts for IRiS

Program, Submission of Contributions and Fee

There will be invited talks as well as oral presentations selected from the submitted contributions. In the spirit of a workshop, there will also be time allotted for short, spontaneous contributions and ample time for discussions.

The workshop will organized by the Helmholtz Institut Mainz. It will be held at the GSI Darmstadt. It will begin in the morning of March 1, 2010, at 9:00 and it will end in the late afternoon.

All authors – those with invited talks and those submitting an oral contribution – are requested to **submit a short abstract before January 29, 2010.**
Send the abstract (a few sentences up to **max**. one page including the **title, author(s), affiliation(s),** figure(s), table(s) and references) as an MS WORD doc-file to **iris@gsi.de**.

The official language is **English.**

No fee will be charged for the workshop.

Please note:

The **IRiS10 Workshop** will be held before the
"***NuSTAR Annual Meeting 2010***"
which will be held at the GSI.

Important Dates

The **deadline for abstract submission is January 29, 2010.**

Authors will be notified and the program will be available on February 12, 2010.

The **deadline for registration is February 23, 2010.**

Venue

The workshop will be held at the GSI, Darmstadt. More information about the location of the GSI and how to get there can be found under 'Travel & Accommodation'
.
Important notice: Important notice: as the GSI "barracks" do not exist anymore, only a very limited number of rooms is available at GSI – managed by the GSI guest office – and due to high demand these rooms can go fast.

Proceedings

Instead of proceedings, we are planning to make copies of all files / transparencies presented during the workshop, and make these available on the workshop website (subject to author's permission).

Authors are requested to provide the organizers with an **electronic file** before the end of the workshop.

Important notice

To register for the IRiS10 workshop, use the web Registration Form.

In case you experience any problems send an e-mail to
iris@gsi.de with your

- Name
- Affiliation
- Telephone Number
- Fax Number
- e-mail address

The **deadline for registration is February 23, 2010.**