

# **Postdoctoral Research Associate for the Total Absorption Gamma Spectroscopy**

**Holifield Radioactive Ion Beam Facility  
Physics Division  
Oak Ridge National Laboratory  
Oak Ridge, Tennessee**

ORNL10-40-PD

## **Project Description:**

The Holifield Radioactive Ion Beam Facility (HRIBF) is operated as a National User facility for the U.S. Department of Energy, at the Physics Division of ORNL, producing high quality beams of short-lived radioactivities for studies of exotic nuclei. Most of these nuclei are produced using proton-induced fission of  $^{238}\text{U}$ . The ionized radioactive products diffuse out of the target-ion source system, are formed into a beam and selected according to their mass. These radioactive ions can be accelerated to about 0.2 MeV or to few hundreds of MeV total energy, to perform decay studies by means of beta, gamma, X-ray, conversion electrons and neutrons spectroscopy.

These investigations are expected to be complemented by the Total Absorption Gamma Spectroscopy with a new Modular Total Absorption Spectrometer (MTAS) to be constructed at the HRIBF. The proposed MTAS device will be used as a calorimeter measuring nearly all gamma radiation emitted from excited states populated in beta decay. This device would consist of many segments requiring individual testing and characterization of the response to different kinds of radiation, and have an active volume much larger than that of previous such spectrometers, and create the potential for discrimination of neutron-induced signals from gamma radiation. The MTAS measurements of total gamma energies released in the decay of  $^{238}\text{U}$  fission products will allow us to establish a true beta-feeding pattern, leading to the experimental determination of beta strength function.

These new reliable experimental data will be used to verify and develop further the microscopic models of beta decay properties and of related structure of neutron-rich nuclei. The importance of the studies with the MTAS reaches well beyond nuclear structure. In particular, measuring and understanding the “decay heat”, namely the amount and forms of energy released in the decay of fission products, is crucial for the analysis of nuclear reactor operations and the shut-down procedures, as well as for handling nuclear spent fuels. The MTAS measurements determining the decay heat related to gamma-emission will be used to refine and eventually replace the phenomenological description with a more accurate microscopic picture, accounting for the experimentally studied decays of individual fission products. This task represents an important contribution of low energy nuclear physics to the operation of existing nuclear power plants and to the design of future power reactors.

The candidate is expected:

- to work on the Modular Total Absorption Spectrometer (MTAS) project at the HRIBF.
- to design and construct the shielding of MTAS.

- to help in the design, construction and commissioning of MTAS auxiliary particle detectors.
- to help develop the data acquisition and analysis codes.
- to measure and analyze the response of MTAS to the complex nuclear decay patterns.
- to set up and perform on-line measurements involving MTAS at the HRIBF.
- to work on the the discrimination between gamma, electron and neutron signals using digital signal processing.
- to work on the proposals to the HRIBF Program Advisory Committee.
- to publish the papers based on the results obtained with MTAS.
- to help mentoring younger associates and graduate students involved in the project.
- to help during the decay spectroscopy measurements at the HRIBF.

**Qualifications:**

Ph.D. in nuclear physics, based on the studies involving the spectroscopy of nuclear radiation. At least five years of post-doctoral experience at the university or at the nuclear physics laboratory, are required. The candidate should have a broad knowledge on the structure of atomic nucleus studied through the decay spectroscopy methods confirmed by a co-authorship of about forty publications in the international journals. In particular, the experience with a Total Absorption Spectroscopy is necessary, and has to be confirmed by the co-authorship of several publications involving this kind of research.

**Additionally required skills :**

- the deconvolution of the complex gamma spectra and the determination of the resulting beta-strength function.
- the knowledge on data acquisition system using the digital pulse processing.
- technical skills related to the construction of a large scale experimental equipment at the nuclear laboratory.

The candidate should be self-motivated, have good interpersonal and communication skills and the team-work ability. The record of participation in the experiments at the HRIBF is an advantage.

**Technical Questions:**

For more information about this position please contact Dr. K.P. Rykaczewski ([rykaczewskik@ornl.gov](mailto:rykaczewskik@ornl.gov)) or Dr R. K. Grzywacz ([rgrzywacz@utk.edu](mailto:rgrzywacz@utk.edu)), at the Physics Division, Oak Ridge National laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6371, and reference this position title and number in your correspondence.

**How to Apply:**

Applications will be accepted until 15th of January, 2010 or until the position is filled. Qualified applicants must apply online at [https://www2.ornl.gov/ORNL\\_POST/](https://www2.ornl.gov/ORNL_POST/). All applicants will need to register before they can begin the online application. For complete

instructions, on how to apply, please see the instructions at <http://www.ornl.gov/orise/edu/ornl/ornl-pdpm/application.htm>.

This appointment is offered through the ORNL Postgraduate Research Participation Program and is administered by the Oak Ridge Institute for Science and Education (ORISE). The program is open to all qualified U.S. and non-U.S. citizens without regard to race, color, age, religion, sex, national origin, physical or mental disability, or status as a Vietnam-era veteran or disabled veteran.