International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

β-decay properties of fission fragments in the r-process path

M. Madurga[1], R. Surman[2], I.N. Borzov[3], R. Grzywacz[1,4], K. P. Rykaczewski[4], W.A. Peters[5], C.J. Gross[4], D. Miller[1], D.W. Stracener[4], D. Bardayan[4], J.C. Batchelder[6], N.T. Brewer[7], J.A. Cizewski[8], L. Cartegni[1], J.H. Hamilton[7], J.K. Hwang[7], A. Fijałkowska[9], S.H. Liu[5], S.V. Ilyushkin[10], C. Jost[1], M. Karny[5,9], A. Korgul[5,9], W. Królas[11], B. Manning[8], M. Matoš[4], C. Mazzocchi[5,9], A.J. Mendez II[4], K. Miernik[4], S.W. Padgett[1], S.V. Paulauskas[1], A.V. Ramayya[7], A. Ratkiewicz[8], J.A.Winger[10], M. Wolińska-Cichocka[4,6], E.F. Zganjar[12]

[1] *Dept. of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37996, USA*
[2] *Dept. of Physics, Union College, Schenectady, New York 12308, USA*
[3] *Joint Institute for Nuclear Research, 141980 Dubna, Russia*
[4] *Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830, USA*
[5] *Joint Institute for Heavy-Ion Research, Oak Ridge, Tennessee 37831, USA*
[6] *Oak Ridge Associated Universities, Oak Ridge, Tennessee 37831, USA*
[7] *Dept. of Physics and Astronomy, Vanderbilt University, Nashville, Tennessee 37235, USA*
[8] *Dept. of Physics and Astronomy, Rutgers University, New Brunswick, NJ 08903 USA*
[9] *Faculty of Physics, University of Warsaw, Warszawa PL 00-681, Poland*
[10] *Dept. of Physics and Astronomy, Mississippi State University, Mississippi 39762, USA*
[11] *Institute of Nuclear Physics, Polish Academy of Sciences, Kraków, PL 31-342, Poland*
[12] *Dept. of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803, USA*

Contact email: *mmadurga@utk.edu*

The study of nuclei far from stability offers unique opportunities to test and validate our understanding of nuclear structure.For example, the region of nuclei around and above N=50 has been subject of recent experimental and theoretical studies, see i.e. [1,2]. The new isotope separation platform IRIS-2 at the Holifield Radioactive Ion Beam Facility (HRIBF) at ORNL was used to produce high-intensity high-purity beams of neutron rich nuclei in the N=50 region. We will report the measurement of the beta decay half-lives of several exotic fission products including ^{82,83}Zn and ^{85}Ga isotopes [3]. These three new half-lives are found to be substantially shorter than the predictions from Finite Range Droplet Model, but close to our new microscopic model based on density functional DF3a [4]. Further, the newly measured nuclei fall, under certain conditions, in the path of the rapid neutron capture, or *r*, process. The r-process abundances obtained using our new calculated half-lives show a significant redistribution across the whole pattern, with increases of more than 200% at A=200.

Ultimately, integrated values like the mass or half-life contain limited information. Qualitatively, the beta-decay strength distribution may provide a deeper insight on the nuclear structure. Since large beta-delayed neutron branching ratios are known or predicted in the N=50 region, comprehensive beta-decay studies will require measuring delayed neutron energies. For this purpose, the time-of-flight Versatile Array for Neutron Detection at Low Energy (VANDLE) was built at HRIBF. The setup consisted of 48 individual plastics scintillator bars for a combined 14% efficiency at 1 MeV. Selected results will be presented about the campaign to measure the beta-delayed neutron emission of twenty-eight precursors at HRIBF. In several of the studied decays, the measured neutron energy spectrum points to large β strength from Gamow-Teller transitions, as predicted by our DF3a microscopic model. This work was supported by the U.S. Department of Energy Office of Nuclear Physics (DE-FG02-96ER40983), and the National Nuclear Security Administration's Stewardship Science Academic Alliances (DE-FG52-08NA28552).

[1] T. Otsuka, T. Suzuki, R. Fujimoto, H. Grawe, and Y. Akaishi, Phys. Rev. Lett. **95**, 232502 (2005).
[2] S. Padgett *et al.*, Phys. Rev. C **82**, 064314 (2010).
[3] M. Madurga *et al.*, Phys. Rev. Lett. **109**, 112501 (2012).
[4] S.V. Tolokonnikov and E.E. Saperstein, Phys. At. Nucl. **73**, 1684 (2010).