Contribution ID: **21** Type: **not specified**

Beta-delayed neutron studies with the BRIKEN setup

Wednesday, 3 July 2019 11:00 (35 minutes)

Beta-delayed neutron-emission will be the dominant decay mechanism for almost all new neutron-rich nuclei that are to be discovered in the next decades with the new generation of radioactive beam facilities. Despite that, the present status and understanding of beta-delayed neutron emitters is surprisingly poor. Since the first observation of this decay process 80 years ago (R. B. Roberts et al., Phys. Rev. 55, 664 (1939)) for only half of the identified 621 beta-delayed neutron emitters a measurement of the one-neutron branching ratio has been carried out, and many of these measurements are rather uncertain.

40 years ago beta-delayed two-neutron emission was detected in 11Li, closely followed by the detection of the three-neutron emission in the same nucleus (R. Azuma et al., Phys Rev. Lett. 43, 1652 (1979), R. Azuma et al., Phys. Lett. B 96, 31 (1980)). And in 1988 the only beta-delayed four-neutron emitter, 17B, was detected (J.P. Dufour et al., Phys. Lett. B 206, 195 (1988)).

Despite this long history, the competition between neutron emission and de-excitation via gamma-decay, and the emission of several neutrons is not yet fully understood and has - until recently- been neglected in theoretical models. This leads to large discrepancies for the calculation of even more neutron-rich nuclei and hampers the accuracy of r-process model calculations since beta-delayed neutrons modify the r-process abundance distribution at late phases when emitted during the freeze-out while material is decaying back to stability.

Since 2016 the BRIKEN project ("Beta-delayed neutron measurements at RIKEN for nuclear structure, astrophysics, and applications") focusses on the most exotic beta-delayed neutron-emitters which can presently be produced. The setup combines the most efficient neutron detection array in the world with a state-of-the-art implantation detector and two clover detectors. Several experiments have been carried carried out so far and covered >250 neutron-rich nuclei in the region between 64Cr and 170Gd. For many of these isotopes, the neutron-branching ratios have been measured for the first time, e.g. for the doubly-magic 78Ni. In addition also about 50 new beta-decay half-lives have been deduced. More experiments for A>150 and A<60 will be carried out in the upcoming 2 years.
Apart from the remeasurement of a large number of beta-delayed neutron-emitters, approximately 150 new emitters will be added to the list of ~300 known beta-delayed neutron emitters. Also the number of measured multi-neutron emitters will be largely expanded. The results from the BRIKEN campaigns will help to improve the theoretical understanding of this complex decay mechanism tremendously, and help towards a better reproduction of the r-process abundance distribution in astrophysical network calculations.

Primary author: DILLMANN, Iris (TRIUMF)

Presenter: DILLMANN, Iris (TRIUMF)

Session Classification: Session