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Spectroscopy of neutron rich nuclei using cold neutron induced fission of actinide targets at the ILL : the EXILL campaign

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To date the most successful method to study the low-lying excited states of neutron-rich nuclei in the mass range A~85-160 has been by placing spontaneous fission sources inside efficient arrays of germanium detectors, such as EUROGAM/EUROBALL or GAMMASPHERE. This method allows the structure of around 250 fission fragments to be studied concurrently. Decay schemes are created by performing γ–γ–γ coincidences, which allow a unique pair of fission fragments to be selected. Unfortunately only two spontaneous fission sources are available for such experiments, ^{252}Cf and ^{248}Cm.

The use of different fission systems would give access to the structure of many new nuclei. An excellent method for cleanly producing very neutron-rich fission fragments, suitable for study using large arrays, is to induce fission reactions in actinide targets using thermal or cold neutrons, from a neutron guide. As neutrons at these energies bring just enough energy into the reaction to produce fission, the fission fragments remain very neutron-rich as there is little prompt-neutron evaporation.

About ten different fissile targets are available for use with this reaction and of particular interest are targets of ^{235}U and ^{241}Pu. These two targets will give access to many nuclei where currently nothing or little is known, especially in the regions north-east of ^{78}Ni and beyond ^{132}Sn. These two regions of the nuclear chart are especially important for testing the interactions used in shell-model calculations far from stability.

In 2012 and 2013, a combination of EXOGAM, GASP and Lohengrin germanium detectors has been installed at the PF1B neutron guide of the ILL (the EXILL campaign). This talk will describe the facility as well as the preliminary results obtained from the various experiments performed during this campaign running for two reactor cycles (100 days).