Production and study of the most exotic neutron-rich nuclei via fast neutron induced fission

We have recently successfully demonstrated a new technique for production and study of many of the most exotic neutron-rich nuclei. LICORNE, a newly developed directional inverse-kinematic fast neutron source at the IPN Orsay, was coupled to the Miniball high resolution gamma ray spectrometer to study nuclei the furthest from stability using the ^{238}U(n,f) reaction. This reaction is the most neutron-rich fission production mechanism achievable and was employed to simultaneously populate hundreds of neutron-rich nuclei up to spins of ~16h. High selectivity in the experiment was achieved via triple gamma-ray coincidences and the use of a 400ns period pulsed neutron beam, a technique which is unavailable to other population mechanisms such as ^{235}U(n_{th},f) and ^{252}Cf(SF) used in the past. The pulsing allows time correlations to be exploited to separate delayed gamma rays from isomeric states in the hundreds of nuclei produced which are then used to cleanly select a particular nucleus *and* its exotic binary partners.

New ideas on what experimental setups could be feasible with a much more intense neutron source of 14 MeV neutrons such as the proposed IFMIF/ELAMAT facility will be presented. In particular, this may open the possibility to use thinner targets and mass separation of at least one of the fast fission fragments in order to gain selectivity and perform spectroscopy of the most exotic neutron rich fragments. Possible physics cases for nuclear structure studies at the proposed IFMIF/ELAMAT facility will be discussed.