
A NEW TECHNIQUE TO PRODUCE AND STUDY THE MOST EXOTIC NEUTRON-RICH NUCLEI

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We have recently successfully demonstrated a new technique for production and study of many of the most exotic neutron-rich nuclei. LICORNE[1,2], a newly developed directional inverse-kinematic fast neutron source at the IPN Orsay, was coupled to the Miniball[3] high resolution gamma ray spectrometer to study nuclei the furthest from stability using the $^{238}\text{U}(n,f)$ 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 $\sim 16\hbar$. High selectivity in the experiment was achieved via the use of a 400 ns period pulsed neutron beam, a technique which is unavailable to other population mechanisms such as $^{235}\text{U}(n_{th},f)$ and $^{252}\text{Cf}(SF)$ used in the past[4,5]. The pulsing allows time correlations to be exploited to separate delayed gamma rays from isomeric states in the hundreds of nuclei produced. These are then used to cleanly select a particular nucleus and its exotic binary partners. The most interesting cases occur when the isomeric state is in a nucleus closer to stability (e.g. ^{130}Te), which guarantees from mass/charge conservation that the binary partners ($^{106,108}\text{Zr}$) are at/beyond the very limit of our present knowledge. In the recent experiment several physics cases are simultaneously addressed such as the evolution of collectivity, shape coexistence, the evolution of shell closures, and the spectroscopy of nuclei in the r-process path near $N=82$. Preliminary results will be presented.

REFERENCES

- [1] J.N. Wilson et al., Physics Procedia 64 (2015) 107
- [2] M. Lebois et al., Nucl. Instrum. Meth. Phys. Res. A, 735 (2014) 145
- [3] N. Warr et al., Eur. Phys. J. A 49 (2013) 40
- [4] T. Constantinopoulos et al., EPJ Web of Conferences Volume 62, (2013) 01006
- [5] I. Ahmed and W. Phillips, Rep. Prog. Phys. 58 (1995) 1415