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First life time measurements in the ^{78}Ni region with AGATA and VAMOS at GANIL

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Yrast (the state with the lower energy for a given spin-parity) and near-Yrast states were populated in the ^{78}Ni region by fusion-fission reaction $^{238}\text{U}(^9\text{Be}, X\gamma)$ at GANIL. The prompt γ -rays were detected by the AGATA array^[S. Akkoyun et al., AGATA - Advanced GAMMA Tracking Array, NIM A668 (2012) 26-58] and particle identification was achieved using the VAMOS++ spectrometer^[M. Rejmund et al., Performance of the improved larger acceptance spectrometer : VAMOS++, NIM A646 (2011) 184-191]. Life time measurements were performed using the Recoil Distance Doppler Shift technique developed at Cologne^[J. Litzinger et al., Transition probabilities in neutron-rich $^{84,86}\text{Se}$, Phys. Rev. C 92, 064322 (2015)] with the Orsay plunger device OUPS^[J. Ljungvall et al., The Orsay Universal Plunger System, NIM A679 (2012) 61-66].

The goal of the experiment was to populate Yrast states in $N=51$ neutron-rich odd-isotones from ^{89}Sr ($Z = 38$) down to ^{83}Ge ($Z = 32$) in order to study the high- ℓ single-particle states effective energy evolution above the $N = 50$ shell gap and complement the scarce direct nucleon exchange data presently available^[J.S. Thomas et al., Single-neutron excitations in neutron-rich ^{83}Ge and ^{85}Se , Phys. Rev. C 76, 044302 (2007)]. These reactions are indeed difficult to exploit with presently available post-accelerated radioactive ion beams (especially for high- ℓ orbitals) in this exotic region. More specifically, we have focused our attention on the $\nu 1g_{7/2}$ monopole drift which is key to understanding the possible evolution of the spin-orbit splitting due to the action of the proton-neutron interaction terms in the ^{78}Ni region. Our strategy was to measure low lying $7/2^+$ states life times as their relative change along the $N = 51$ line towards $Z = 28$ should reflect their possible $\nu 1g_{7/2}$ composition. The tensor mechanism^[T. Otsuka et al., Evolution of nuclear shells due to the tensor force, Phys. Rev. Lett. 95, 232502 (2005)] indeed predicts increasing low-lying $\nu 1g_{7/2}$ single particle components in the wavefunctions approaching ^{79}Ni .

In this talk, the particle identification and the life time measurement method will be presented with some examples.

Auteurs principaux: M. DELAFOSSE, Clément (IPNO); Dr VERNEY, David (Institut de Physique Nucléaire d'Orsay)

Orateur: M. DELAFOSSE, Clément (IPNO)

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