Contribution ID: **1383** Type: **Invited Speaker / Conférencier invité**

Probing Nuclear Shell Evolution using Radioactive Ion Beams at ISOLDE, CERN

Wednesday 15 June 2016 15:45 (30 minutes)

The science of stellar nucleosynthesis aims at understanding how the elements in the universe are formed in stars. On a microscopic scale, the formation of elements is dictated by the properties of atomic nuclei and their interactions. Of special importance for r-process nucleosynthesis is a fundamental understanding of shell evolution towards neutron-rich nuclei. The finding of a soft N=2 harmonic oscillator shell in the "Island of Inversion"was one of the first discoveries of changing shell structure in exotic nuclei and triggered a renaissance in our field thanks to the availability of intense beams of unstable ions. Recent experiments at the RIKEN Nishina Center (Japan) indicate that also the N=3 harmonic oscillator shell is softened for extremely neutron-rich nuclei, which would effect the r-process flow in a dramatic way. I will discuss the underlying physics and will report on our recent experiments at the radioactive ion beam facility ISOLDE at CERN using the high-granularity MINIBALL array. In a series of studies we probed the N=3 Neutorn harmonic oscillator shell gap around 68Ni. Specially, using a multiple coulomb excitation experiment a clear indication for an onset of deformation beyond N=40 can be observed, indicating the pivotal role of subshell structure on the evolution of collevtice nuclear properties.

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Session Classification: W3-1 Nuclear Structure III (DNP) / Structure nucléaire III (DPN)

Track Classification: Nuclear Physics / Physique nucléaire (DNP-DPN)