Exploring the Southern Boundaries of the "Island of Inversion" at the RIBF*

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When moving from the valley of stability of stable nuclei to regions of extreme proton to neutron ratios, the standard ordering of nuclear shells may be abandoned in favor of other configurations. The most famous example is the so-called "Island of Inversion", where $\nu(f_{7/2})$ states intrude into the *sd*-shell. Despite the "Island of Inversion" being already discovered in 1975 [1], not until 20 years later and with the aid of the then new experimental technique of intermediate Coulomb excitation of radioactive beams following projectile fragmentation the large collectivity of ^{32}Mg due to intruder states could be established [2].
However, spectroscopic information for nuclei lying within the "Island of Inversion" remains scarce in particular for the very neutron rich nuclei due to the limitations imposed by the experimental facilities producing radioactive beams. With the Radioactive Ion Beam Factory (RIBF) [3-5] being recently commissioned, previously inaccessible nuclei are now within spectroscopic range.
The presentation will report on the first in-beam γ-ray spectroscopy experiment performed at the RIBF, targeting the neutron rich nuclei $^{30-32}$Ne. The secondary beams, identified and selected by the BigRIPS spectrometer, were incident on thick C and Pb targets, thereby inducing fragmentation and Coulomb excitation reactions, respectively. De-excitation γ-rays were detected with the DALI2-array [6] and reacted particles were identified with the ZeroDegree spectrometer. Initial results of this experiment are presented, demonstrating the potential of the new RIBF facility.

[1] C. Thibault et al., Phys. Rev. C **12**, 644 (1975).
[2] T. Motobayashi et al., Phys. Lett. B **346**, 9 (1995).
[3] Y. Yano, Nucl Instr. and Meth. B **261**, 1009 (2007).
[4] Y. Yano, Proc. International Nuclear Physics Conference (INPC2007), Tokyo, Japan, June 3-8, 2007.
[5] Y. Yano, Proc. 22^{nd} Particle Accelerator Conference 07 (PAC07), Albuquerque, New Mexico, USA, June 25-29, 2007.
[6] S. Takeuchi et al., Riken Acc. Prog. Report 36, 158 (2003).

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