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Two-Neutron transfer into the "Island of Inversion" at HIE-ISOLDE

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In the so-called "Island of Inversion"around 32Mg, the ground states of nuclei exhibit larger binding energy than expected from simple models. Extra binding energy can stem from the onset of deformation. Indeed, the systematics of excitation energies and B(E2) values in the Mg isotopes indicate a softening of the N=20 shell closure and it was suggested that the nuclear tensor force has a major influence. Recently, a shell model interaction for the entire sdfp shell model space was deduced using the EKK-theory from realistic nucleon-nucleon interactions without a fit of two-body matrix elements. The new prediction is a drastic change to the earlier belief: the calculations suggest that only 25% of the groundstate in 30Mg is made from 0p0h contributions, whereas 50% and 25% are due to 2p2h and 4p4h configurations, respectively. This contrasts with all previous investigations, like the E0 measurement in 30Mg, performed at ISOLDE, which all conclude that 2p2h and 4p4h contributions in the groundstate of 30Mg are as small as 5%.
We present new data from experiment IS651 at the new HIE-ISOLDE facility, CERN. An intense radioactive beam of 28Mg ($1.5{\cdot}10^6$pps) was scattered off a radioactive tritium target to populate states in 30Mg after two-neutron transfer. For the first time, the full HIE-ISOLDE beam energy of 9.5 MeV/u was used for a transfer experiment at MINIBALL. Thanks to the higher beam energies, the data allow insight into the full complexity of three-state mixing in the IOI, for the first time. We discuss the implications of the preliminary data analysis to our understanding of nuclear shell evolution.

Primary authors: Mr MUECHER, Dennis (University of Guelph); ZIDAR, Tammy (University of Guelph); KROELL, Thorsten (Technische Universitaet Darmstadt (DE)); BERNER, Christian (Technische Universitaet Muenchen (DE)); HENRICH, Corinna (Technische Universitaet Darmstadt (DE)); ATAR, Leyla (Technical University Darmstadt & GSI & University of Guelph); BURBADGE, Christina; GAFFNEY, Liam (CERN); GARRETT, P.E. (University of Guelph); GERNHAEUSER, Roman August (Technische Universitaet Muenchen (DE)); GREAVES, Beau Gregory (University of Guelph); ILIEVA, Tanja (TU Darmstadt); PAKARINEN, Janne (University of Jyvaskyla (FI)); RAABE, Riccardo (Instituut voor Kern- en Stralingsfysica, K.U.Leuven); REFSGAAARD, Jonas (K.U. Leuven); REITER, P. (University of Cologne); ROSIAK, D. (University of Cologne); SCHECK, Marcus (University of the West of Scotland); SEIDLITZ, Michael (Universitaet zu Koeln (DE)); SVENSSON, Carl (University of Guelph); VON SCHMID, Mirco (TU Darmstadt); WARR, Nigel Victor (Universitaet zu Koeln (DE)); WIMMER, Kathrin (University of Tokyo (JP))

Presenter: Mr MUECHER, Dennis (University of Guelph)

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