Contribution ID: **25** Type: **Submitted**

Shedding a light on the nuclear structure of Mn isotopes towards $N = 40$

Thursday, 3 December 2015 14:55 (15 minutes)

The region south of $^{68}_{28}\mathrm{Ni}_{40}$ has attracted much interest due to the sudden onset of deformation observed near $N = 40$. For a better understanding of the dynamics responsible for this change in nuclear structure, it is desirable to expand the experimental knowledge on how the interplay between single-particle and collective nature evolves as a function of proton and/or neutron number. In this light, the ground state properties of Mn ($Z = 25$) isotopes from $N = 28$ up to $N = 39$ were studied in two collinear laser spectroscopy experiments at ISOLDE. In combination with large-scale shell model calculations, these results illustrate the importance of particle-hole excitations across $N = 40$ and $Z = 28$ for Mn isotopes approaching $N = 40$. In particular, the strong influence of the neutron $\nu d_{5/2}$ orbital on the observed deformation is demonstrated.

In a first campaign, the hyperfine spectra of $^{51,53-64}$Mn were measured using standard bunched-beam collinear laser spectroscopy on atomic manganese. Although the magnetic moments and isotope shifts were extracted with high precision, the quadrupole moment sensitivity was low. Hence, in a follow-up experiment, laser spectroscopy was performed on a more sensitive ionic transition starting from a metastable state. To efficiently enhance the population of this metastable state, optical pumping in the cooler-buncher was successfully applied for the first time at ISOLDE.

Apart from the high-precision quadrupole moments, this second experiment also yielded isotope shifts providing a critical test of the electronic factor calculations which are needed for reliable mean-square charge radii extraction. The measured quadrupole moments and mean-square charge radii give complementary information on the development of deformation and will be the main topic of the talk.

Primary authors: BABCOCK, Carla (University of Liverpool (GB)); HEYLEN, Hanne (KU Leuven (BE))

Co-authors: MAASS, Bernhard (Institut fur Kernphysik, TU Darmstadt); CHEAL, Bradley (Oliver Lodge Laboratory, Oxford Street, University of Liverpool); MARSH, Bruce (CERN); WRAITH, Calvin (University of Liverpool); GEPPERT, Christopher (Gesellschaft fuer Schwerionen forschung mbH (GSI)-Unknown-Unknow); YORDANOV, Deyan (Max-Planck-Gesellschaft (DE)); MOORE, Iain (University of Jyväskylä); PAPUGA, Jasna (KU Leuven (BE)); BILLOWES, Jonathan (University of Manchester (GB)); KREIM, Kim (Max-Planck-Gesellschaft (DE)); BLAUM, Klaus (Max-Planck-Gesellschaft (DE)); XIE, Liang (University of Manchester (GB)); KOWALSKA, Magdalena (CERN); BISSELL, Mark (University of Manchester (GB)); WILFRIED, Noertershauser (Institut fur Kernphysik, TU Darmstadt); CAMPBELL, Paul (University of Manchester); NEUGART, Rainer (Johannes-Gutenberg-Universitaet Mainz); ROSSEL, Ralf Erik (Johannes-Gutenberg-Universitaet Mainz (DE)); SANCHEZ, Rodolfo (GSI Helmholtzzentrum fur Schwerionenforschung GmbH,); GARCIA RUIZ, Ronald Fernando (KU Leuven (BE)); ROTHE, Sebastian (CERN); LENZI, Silvia; MALBRUNOT, Stephan (CERN); GEITHNER, Wolfgang (GSI); GINS, Wouter (KU Leuven); YANG, Xiaofei (KU Leuven (BE))

Presenter: HEYLEN, Hanne (KU Leuven (BE))

Session Classification: Ground State Properties