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Ground state properties of Chromium isotopes from stability to the N=40 Island of Inversion

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The Chromium isotopic chain sits half-way in between the magic Ca and Ni isotopic chains and displays the highest level of collectivity of the region [1]. Going from the N = 28 shell closure to the center of the N = 40 Island of Inversion 64Cr, drastic structural changes are observed along the Cr isotopic chain, driven by a complex interplay of single particle and collective behaviors that poses challenges to nuclear theories [2,3,4]. In order to get a comprehensive picture of the evolution from spherical and single particle behavior to deformed and collective structures, the Colinear Resonance Ionization Spectroscopy (CRIS) collaboration performed the first measurement of the evolution of ground state properties of neutron rich Cr isotopes. The ground state spin, magnetic dipole moment and changes in charge radii of 50–63Cr have been measured using high resolution collinear resonance ionization laser spectroscopy and nine isotopes have been measured for the first time with this technique.

The present ground-state spin measurement of 61Cr, differing from literature, has significant consequences on the interpretation of existing beta decay. Its structure and shape are interpreted with state-of-the-art Shell Model calculations, establishing the western border of the N = 40 Island Of Inversion (IoI) [5]. The shape evolution along the Cr isotopic chain is interpreted as a second order quantum phase transition at the entrance of the N=40 IoI.
Discontinuities have been observed in the evolution of charge radii, entering the Island of Inversion. These results provide the first insight into the evolution of the ground state properties of even-Z isotopes from the magical N = 28 to the N = 40 island of inversion.

In this talk, the CRIS experiment will be introduced. Preliminary results will be presented and discussed in relation to the formation of the N = 40 island of inversion.

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