Evolution of ground state properties of Chromium isotopes from stability to the $N = 40$ Island of Inversion

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The Cr 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 centre of the $N = 40$ Island of Inversion ^{64}Cr, drastic structural changes are observed along the Cr isotopic chain, driven by a complex interplay of single particle and collective behaviours that poses challenges to nuclear theories [2,3,4]. In order to get a comprehensive picture of the evolution from spherical and single particle behaviour to deformed and collective structures, the measurement of the evolution of ground state properties of neutron rich Cr isotopes is highly desired.

Over the summer 2023 the CRIS collaboration will measure the ground state properties of $^{50-63}$Cr using high resolution laser spectroscopy [5]. This measurement will allow: i) an unambiguous spin assignment of the ground state of the odd-A Cr, ii) determination of nuclear moments to better understand the wave function composition of their ground state and the influence of rising deformation, iii) determination of the charge radii of all Cr isotopes to investigate the various structural changes observed along the isotopic chain. These results will 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 of the experiment will be presented and discussed in relation to the formation of the $N = 40$ island of inversion.

[1] S. M. Lenzi, F. Nowacki, A. Poves, and K. Sieja, Phys. Rev. C **82**, 054301 (2010)
[2] S. Suchyta *et al*, Phys. Rev. C **89**, 034317 (2014)
[3] M. Kortelainen *et al*, Phys. Rev. C **105**, L021303 (2022)
[4] M. Mougeot *et al*, Phys. Rev. Lett. **120**, 232501 (2018)
[5] L. Lalanne *et al*, CERN-INTC-2022-015, INTC-P-627 (2022)