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Collinear resonance ionization spectroscopy of stable ^{64,66,67,68,70} Zn isotopes

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To study the exotic nuclear structure phenomenon in more neutron-rich isotopes beyond the neutron magic number N = 50 in the nickel mass region [1,2], experiment to measure the ground state properties of ^{81,82}Zn isotopes has been proposed at ISOLDE-CERN by using the collinear resonance ionization spectroscopy (CRIS) setup [3]. Prior to the online experiment, offline measurements have been performed on the stable^{64,66,67,68,70}Zn isotopes at CRIS setup at ISOLDE. Several atomic transitions (4s4p ^{3}P$_{0,1,2}$ −4s5d ^{3}D$_1$ /4s4p ^{3}P$_{1,2}$ −4s5d ^{3} D$_2$ /4s4p ^{3}P$_2$ −4s5d ^{3}D$_3$ / 4s4p ^{3}P$_{1,2}$ −4s7s ^{3}S$_1$) have been probed in this work, allowing to systematically extract their hyperfine structure parameters and isotope shifts. The experimental results show an unexpected abnormal isotope shift at the odd-A ^{67}Zn isotope, which is particularly significant in atomic transitions involving the 4s5d ^{3}D$_{1,2,3}$ states, and could possibly be attributed to the mixing of hyperfine levels. To have a full understanding of this experimentally observed abnormal phenomenon, further atomic theoretical calculations based on the second order perturbation using relativistic multiconfiguration Dirac–Hartree–Fock wavefunctions are ongoing [4].

In this presentation, the details of this offline experimental measurement, and the achieved atomic results (hyperfine structure parameters and isotope shifts) for all probed atomic transitions of stable $^{64-70}$ Zn, will be reported. Current progress on the atomic calculation will also be introduced.

Reference:
[1] R. Taniuchi, C. Santamaria, P. Doornenbal, et al. Nature 569 (2019), 53.
[2] G. Hagen, G. R. Jansen, and T. Papenbrock, Physical Review Letters 117, (2016), 172501.
[3] X. Yang, T. Cocolios, S. Geldhof, et al. CERN-INTC CERN-INTC-2020-064 (2020) INTC–P–579.
[4] J. Ekman, P. Jönsson, M. Godefroid, et al. Computer Physics Communications 235 (2019), 433–446.

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