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Development of high-resolution resonance ionization spectroscopy of exotic beams at CRIS

The progress towards high-resolution laser spectroscopy at the Collinear Resonance Ionization Spectroscopy (CRIS) experiment will be presented. This high spectral resolution is necessary to access nuclear observables like the electrical quadrupole moment, the spin and the change in mean charge radii of e.g. the ground states and isomers of the neutron-rich Ga and Cu isotopes (IS571 and IS531). In order to understand how to minimize the linewidth of the resonance ionization spectra, simulations on the laser-atom interactions were performed and compared to experimental results.

First, the theoretical framework underlying these simulations will be outlined. Additionally, experimental data obtained with stable beams of 39K will be shown, validating the theoretical simulations. These measurements were performed using a continuous-wave Ti:Sa laser in combination with a Pockels cell external to the laser cavity. During these offline tests, the FWHM of the hyperfine spectra could be reduced to ˜50 MHz in the CRIS geometry. Finally, the implications of these results on the exotic beam program of CRIS will be discussed.

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