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## The CRIS technique and its latest advances: towards more exotic isotopes and beyond nuclear structure studies

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In the last decade, the collinear resonance ionization spectroscopy (CRIS) technique [1,2] has proven to be a powerful tool for investigating atomic and nuclear properties of exotic nuclei across the nuclear chart [3,4,5]. CRIS stands out through its combination of conventional collinear resonance spectroscopy with resonance ionization, enabling the extraction of high-resolution data on nuclear moments, mean-square charge radii, and the unambiguous determination of nuclear spins, even for isotopes produced at rates as low as a few tens of ions per second [6]. More recently, the CRIS experiment has also pioneered studies on short-lived radioactive molecules, in particular RaF, opening a new path for future beyond standard-model physics searches at low energies [7].

With the latest developments on the CRIS experiment, the versatility of the technique has been further enhanced. The addition of a new field ionization unit and widely tuneable laser systems gives opportunities for an improved sensitivity of the technique. These upgrades additionally support the efficient identification of experimentally yet unknown electronic levels for new atomic physics studies, and for laying the foundation for future high-precision measurements. CRIS has recently also enabled the study of negative ions, most notably RaF<sup>-</sup> anions, which were successfully produced for the first time and investigated via laser photodetachment studies. These methodological advances provide essential groundwork for a potential implementation of a cooling and trapping scheme for this radioactive molecule.

In this contributions, recent highlights and technical upgrades of the CRIS experiment are presented and an outlook on further developments for on-line experiments at ISOLDE at the extremes of the nuclear landscape are given.

[1] K.T. Flanagan et al. Phys. Rev. Lett. 111, 212501 (2013).

[2] R.P. de Groote et al. Phys. Rev. Lett. 115, 132501 (2015).

[3] K.M. Lynch et al. Phys. Rev. X 4, 011055 (2014).

[4] A. Koszorus. et al. Nat. Phys. 17, 439–443 (2021).

[5] A.R. Vernon et al. Nature 607, 260–265 (2022).

[6] R.P. de Groote et al. Nat. Phys. 16, 620–624 (2020).

[7] R. Garcia Ruiz et al. Nature 581, 396–400 (2020).

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## Classification

Ion traps and laser techniques

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