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Molecular ion beams at CERN-ISOLDE – development and facilities

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The CERN-ISOLDE facility at CERN uses the Isotope Separation On-Line (ISOL) method to provide experiments with radioactive ion beams (RIBs). Isotopes are produced in thick targets and must undergo diffusion and effusion before reaching the ion source, where they are then ionized. Forming volatile molecules with the radioactive species of interest is a technique occasionally used to efficiently extract beams of refractory elements [1-4] and to eliminate isobaric contamination by mass-separation on a molecular sideband. Certain radioactive molecules are candidates for studies of fundamental symmetry violations and new physics beyond the standard model [5,6]. Recently, radium fluoride was studied using laser spectroscopy at ISOLDE [7], demonstrating experimental capabilities to study radioactive molecules at RIB facilities.

Developments from the ISOLDE targets and ion sources are essential to characterize ionization and breakup channels of these molecular species of interest, facilitating delivery as molecular ion beams. For fragile molecules with low dissociation temperatures, alternative methods of production are needed [8]. For all molecular species, separation and identification are required for systematic studies. The ISOLDE off-line facilities are upgraded in terms of production, manipulation, and detection of molecules, thus enabling systematic studies on the formation, ionization and dissociation of molecular beams. We will present the infrastructure and developments for molecular beam studies as well as first results of ongoing offline developments for molecular beams.

References

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