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Progress towards the EDM3 instrument at FRIB: A tool for studying radioactive molecules embedded inside cryogenic solids

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Progress towards the EDM3 instrument at FRIB: A tool for studying radioactive molecules embedded inside cryogenic solids

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The study of radioactive molecules receives increasing attention due to their enhanced sensitivity to fundamental symmetry violations and Beyond Standard Model physics. In particular, 225RaF has been proposed as powerful probe due to its enhanced Schiff-moment. While the principle advantage of such systems is known for more than 30 years [1], the progress in the field relies on the development of novel instruments and the availability of suitable radioisotopes. At the Facility for Rare Isotope Beams (FRIB), the latter is being addressed by development of isotope harvesting techniques [2].

Within this contribution, we introduce the in-design FRIB-EDM3 instrument. The setup was designed to study polar radioactive molecules (like RaF) in transparent cryogenic solids by laser spectroscopy with the EDM3-method [3]. The efficient ionization of harvested radioisotopes from aqueous phase is pursued with a spray-ionization method [4]. Subsequently, the molecular ion beam is analyzed by mass-to-charge ratio by a quadrupole mass filter and neutralized in a charge-exchange cell before its implantation in a solid argon matrix. We will present the design of the instrument and report on the progress of its construction.

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