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P,T violation in actinide molecules

Radioactive molecules have emerged as precision probes for the violation of fundamental symmetries. Those containing actinides produced at S3 possibly offer an unprecedented sensitivity to parity and time-reversal violation. The ambient temperature of molecules interacting with a laser beam, however, masks any sensitivity to fundamental symmetries. Making use of the Reglis gas cell at the S3 Low Energy Branch, we are now able to produce cold molecules below 20 kelvin within a supersonic gas jet. This approach provides an essential intermediate step toward the millikelvin regime achievable through laser cooling. We are now working on the controlled production of these radioactive molecules by means of improved gas purification and implementation of electrical fields in the gas cell.

Before a high-precision experiment can take place neutralization of the molecules and further cooling through subsequent implantation in a cryogenic solid matrix and/or collection in a magneto-optical trap will be needed. Such an experiment would necessarily take place at Desir, where the particles can be collected under well-understood conditions of background, whilst assuring the coherence of the sample and ultimately reaching the sensitivity that would allow to improve the present limits on symmetry violations.

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