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Laser-Induced Fluorescence Detection of He_2 Molecules in Superfluid Helium as a New Detector Technology[1] W.G. RELLERGERT, S.B. CAHN, A. CURIONI, J.A. NIKKEL, J.D. WRIGHT, D.N. MCKINSEY, Yale University — Ionizing radiation events in liquid helium result in the copious production of long-lived He_2 triplet molecules (τ = 13 s). We present results on the detection and imaging of these molecules in superfluid helium using laser-induced fluorescence. We show that a laser tuned to 905 nm can excite the molecules via a two photon transition which results in the emission of detectable red photons at 640 nm. Upon deexcitation, molecules return to their ground triplet state, and can be excited again. This cycling transition can be repeated many times during the lifetime of the molecule, potentially enough times to allow for single molecule detection. We present emission and absorption spectra and show images obtained using an intensified CCD camera. This technique gives rise to a new detector technology with applications in the detection of gamma rays, WIMP dark matter, and ultracold neutrons.

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[X] Prefer Oral Session
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