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Cryogenic Positron Beams for Atomic Physics Experiments[1] M.R. NATISIN, J.R. DANIELSON, A.C.L. JONES, C.M. SURKO, University of California, San Diego — Trapped positron plasmas are routinely used to generate positron beams that can be used for a wide variety of experiments. For example, positron attachment to molecules occurs via the excitation of vibrational Feshbach resonances, yielding large peaks in the annihilation rate. These rates are measured as a function of positron energy by passing a beam through a molecular gas. While current beam generation techniques are sufficient for the measurement of positron-molecule binding energies,[2] more detailed studies are limited by beam energy resolution. Described here is a new method of positron beam formation using a buffer gas cryogenically cooled to 50 K. Simulations of the beam formation process are discussed and used to predict an energy resolution of ≈ 9 meV FWHM; a factor of 5 improvement over current techniques. Various possible physical measurements using this technique are discussed, including the ability to resolve individual multimode features in the resonant spectra,[3] and more detailed studies of annihilation involving intramolecular vibrational energy redistribution (IVR).

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[2]G. F. Gribakin, et al., *Rev. Mod. Phys.* **82**, 2557 (2010).
[3]A. C. L. Jones et al., *Phys. Rev. Let.* **108**, 093201 (2010).

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