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Addition of a buffer-gas trap system to the NEPOMUC positron beam line

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The buffer-gas trap (BGT) is a well-established method for accumulating a steady-state stream of positrons into dense, cool, single-component clouds/plasmas, which can in turn be used to generate pulses or beams tailored to the application at hand [1]. BGTs are regularly employed in the creation of anti-atoms, the generation of positronium, studies of atomic and molecular interactions with antimatter, and a variety of surface and materials science techniques, just to name a few examples.

The e+ beams most commonly accumulated in BGTs come from Ne-moderated Na-22 and have a flux of $<10^7$ e+/s; this results in an upper limit on how many positrons can be accumulated and a lower limit on the time required to do so. The NEutron-induced POsitron source MUniCh (NEPOMUC) at FRM-II can deliver significantly more positron flux, up to 10^9 e+/s [2]. Preparations are underway to outfit NEPOMUC with a BGT system, after which an experimental program will determine the optimal combination of beam settings and trap settings for maximizing positrons/pulse. This will be a key step toward trapping enough positrons to create a magnetically confined plasma of half matter and half antimatter (a compelling frontier in plasma physics research and the goal of the APEX Collaboration) [3].

[1] J.R. Danielson, et al. Rev. Mod. Phys. 87, 247 (2015).
[2] C. Hugenschmidt, et al. New J. Phys. 14, 055027 (2012).
[3] T. Sunn Pedersen, et al. New J. Phys. 14, 035010 (2012).

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