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Plans for a high field multi-cell trap for positron accumulation

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To form an electron-positron plasma in the 10L volume of a levitated dipole, large numbers of low-energy positrons are needed. The APEX (A Positron Electron eXperiment) collaboration plans to use a combination of multiple Penning-Malmberg traps for the accumulation of such large numbers, which will be installed at the NEPOMUC facility.

In this contribution we introduce the high-field multi-cell trap¹. The device consists of a master-cell trap and an array of 7 smaller storage cells in the 3 Tesla magnetic field of a superconducting solenoid. It will be used to accumulate pulses of low-energy positrons from the buffer-gas trap and confine them in the storage cells until numbers of $10^{10} - 10^{11}$ positrons are reached. These positrons can be delivered to further experiments, such as the electron-positron plasma experiments as well as to other users of the NEPOMUC facility.

We will present the results of experiments performed at IPP Greifswald² with pure electron plasmas of $10^8 - 10^9$ electrons. A particular focus of these experiments was the manipulation of the $m=1$ diocotron mode because of its importance for the plasma transfer to the off-axis cells. The superconducting magnet will be described, which is used to provide the magnetic field for the multi-cell trap. Several options will be discussed where it could be installed into the beamline. Finally, we will give a preview of the first steps and future experimental program in Garching.

1. C. M. Surko and R. G. Greaves, Radiat. Phys. Chem. 68, 419 (2003)
2. M. Singer et al., RSI (2021) (submitted)

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