Injection and Trapping of Positrons in a Magnetic Dipole Trap: Toward Magnetic Confinement of Positron-Electron Plasma

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The APEX collaboration aims to produce the first magnetically confined, long Debye length, positron-electron plasma. Because mass symmetry leads to theoretical simplicity, Per Helander dubs such a system, "the hydrogen atom of plasma physics" and predicts that it should be linearly stable in large parts of parameter space [1]. The APEX approach is to use a levitated dipole to realize magnetically confined positron-electron plasma. Preliminary experiments have used a reactor-based positron source and a dipole magnetic field produced by a permanent rare-earth magnet. Those experiments have demonstrated nearly lossless injection of low-energy (5 eV) positrons into the dipole field [2], and persistence of positron orbits for times in excess of one second [3]. This talk will present a summary of those results as well as an update on development of 1) a buffer gas trap to accumulate positrons, 2) a levitated superconducting dipole trap that will confine plasma of arbitrary non-neutrality, and 3) diagnostics for positron-electron plasma.

References

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