

Use of Non-neutral Plasmas to Enable Creation of Positron-Electron Plasma in a Levitated Dipole Trap

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The APEX project (A Positron-Electron eXperiment) aims to produce the world's first magnetically confined, short-Debye-length, positron-electron plasma in order to test predictions of its unique properties; in particular, such plasmas are expected to be remarkably stable to typical sources of plasma microturbulence. We plan to use a levitated superconducting coil to generate a dipole magnetic field for confinement. While the goal is to produce a quasi-neutral pair plasma, production of non-neutral (both pure positron and pure electron) plasmas is necessary in preparation for combining them. In addition, we anticipate producing un-neutralized combinations of positrons and electrons. In this contribution, we present various non-neutral plasma considerations, both theoretical and experimental, that are relevant for the APEX project. These include non-neutral plasma accumulation, manipulation, and delivery using Penning-Malmberg, buffer-gas, and multi-cell traps as well as equilibrium and stability considerations for non-neutral plasmas in dipole magnetic fields.