



Contribution ID: 151

Type: **Talk (20 min + 5 min discussion)**

Moving into higher fields and collective behavior: recent advancements toward matter-antimatter pair plasmas

Thursday, 8 December 2022 15:50 (25 minutes)

The ultimate goals of the APEX (A Positron Electron eXperiment) Collaboration are the generation and investigation of confined, strongly magnetized, electron-positron plasmas in the laboratory. The mass symmetry of such plasmas simplifies many aspects of their physics, as has been described in more than four decades of theory/simulation predictions.

Our road map to conducting experimental studies requires unifying and advancing state-of-the-art physics and engineering in several areas, including:

- extended accumulation and high-capacity storage of large numbers of positrons (originating from NEPO-MUC);
- two superconducting, tabletop-sized toroidal confinement devices with complementary magnetic topologies (a dipole and a stellarator), in which the positrons will be combined with electrons and their plasma properties studied; and
- the development and verification of a number of essential enabling techniques – e.g., efficient transport of positrons across magnetic flux surfaces and subsequent trapping (previously demonstrated in the single-particle regime).

This talk will provide a broad overview of recent headway made along that road map, which has included progress in non-neutral plasma trapping; the further development of the positron beam and techniques for injecting it into toroidal geometries, including with an electron space charge present; and the development of the toroidal traps.

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Session Classification: Positrons

Track Classification: Positrons