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Technical design of a compact, levitated dipole for confinement of a low-temperature, long-lived, electron-positron plasma ALEXANDER CARD, MATTHEW R. STONEKING, THOMAS SUNN PEDERSEN, Max Planck Institute for Plasma Physics, APEX COLLABORATION — A low-temperature, long-lived (LTLL) electron-positron pair plasma has never been produced in a laboratory environment. Recent advances in positron sources have enabled the production of a LTLL pair plasma. In the APEX levitated dipole experiment positrons from a reactor-based source, along with equal numbers of electrons, will be trapped in a magnetic dipole field. We present technical design plans for this experiment. A closed coil wound with high-temperature REBCO superconducting tape will produce the dipole field. The closed dipole coil (floating coil) will be magnetically levitated by use of a water-cooled copper coil (lifting coil) located above the floating coil. A feedback circuit will vary the lifting coil current in response to input from three laser rangefinders. A cooled radiation shield (RS) insulates the floating coil from room temperature radiation. We estimate a total levitation time on the order of hours. The RS is segmented into eleven electrodes. ExB drift is utilized to move incoming positrons onto closed field lines. The floating coil is mechanically lifted into place and cooled by retracting into a small sub-chamber, which is then pressurized with helium to provide thermal contact with the cold faces. The superconducting charging coil is integrated into this sub-chamber, allowing the floating coil to sit on-plane with the charging coil thus enabling efficient inductive charging. Assembly and first tests with positrons are expected early 2021.

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