Abstract Submitted
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Temporally and Spatially Resolved Electron Density Measurements of an Air Breakdown Plasma Using a 1.4 MW, 110 GHz Gyrotron[1] SAMUEL SCHAUB, JASON HUMMELT, WILLIAM GUSS, MICHAEL SHAPIRO, RICHARD TEMKIN, Massachusetts Inst of Tech-MIT — A megawatt-class, 110 GHz gyrotron was used to produce a linearly polarized, quasioptical beam in 3 μs pulses. Using a lens, the beam was focused to a 3.2 mm spot size, producing a peak electric field of 57 kV/cm, after transmission losses. This electric field was great enough to produce a breakdown plasma in air at pressures ranging from a few Torr up to atmospheric pressure. The resulting breakdown plasma spontaneously forms a two-dimensional array of filaments, oriented parallel to the polarization of the beam, that propagate toward the microwave source. In our latest experiments, a needlepoint initiator has been introduced at the focal point of the beam, creating highly reproducible plasma arrays. Taking advantage of this reproducibility, the dynamics of the array formation and propagation were captured using a 2 ns fast gating intensified CCD camera (ICCD). The ICCD was combined with a two-wavelength laser interferometer, operating at 532 and 635 nm, to make spatially and temporally resolved electron density measurements of the plasma array. Abel inversion techniques were applied to the resulting line integrated data resulting in local measurements of electron density.

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