Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Numerical studies of filamentary plasma formation in high power millimeter wave field TENSEI TAKEICHI, TOSHIKAZU YAMAGUCHI, MASAFUMI FUKUNARI, HIROYUKI KOIZUMI, KIMIYA KOMURASAKI, YOSHIHIRO ARAKAWA, The University of Tokyo — Filamentary structure characterizes millimeter-wave discharge in air and the ionization front propagates at supersonic speed in a high power millimeter-wave, generating a shock wave. In this study, the filamentary structure was studied experimentally and analytically using a 170GHz Gyrotron at the peak intensity range of 50 kW/cm^2 to 200kW/cm^2. On the propagation process of ionization front, it is important to investigate steady plasma formation process in a filamentary form through millimeter wave. Each filamentary element observed in the ionization front propagates not along or perpendicular to the electric field, but obliquely. To solve this mechanism, 2-dimensional numerical analysis was conducted assuming this phenomenon as a plasma fluid model. In dozens of times the size of plasma element scale, the steady plasma structure formation was simulated, and the calculation was compared with previous experimental results. The calculated formation patterns were in good qualitative agreement with experiments. The calculation model provides a physical interpretation of the pattern formation and dynamics. From the interpretation, it was found that accurate ionization model in low electric field is needed for good agreement with experiments. Moreover, for a quantitative agreement, not only the ionization model but also consideration of 3-dimensional effects are necessary, since 2-dimensional simulation cannot estimate accurate wave reflection and interaction by plasma.

Tensei Takeichi
The University of Tokyo

Date submitted: 13 Jun 2012 Electronic form version 1.4