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Characterization of an Inverted Geometry Helicon Plasma Source

BENJAMIN MASTERS, DAVID RUZIC, University of Illinois - Plasma Material Interaction Group — Helicon plasmas are useful as hot, dense sources requiring low magnetic fields. Since Boswell's[1] use of helicon waves in low pressure gas, no single theory fully explains the wave-plasma coupling mechanism. However, Trivelpiece-Gould modes[2] remain a strong candidate. An inverted geometry helicon plasma source is further explored, using a dielectric-covered helicon antenna, placed within a vacuum chamber, in contrast to conventional antennas that surround a dielectric cylinder. A Nagoya Type III antenna is used, other antennas are equally feasible. Many industrial advantages of such a system exist; namely, more efficient electromagnets, as well as producing a plasma with a larger radius than the antenna. With this arrangement, diagnostic measurements can be made arbitrarily close to the antenna. To characterize the plasma, an RF-compensated Langmuir probe measures electron temperature and density, while a B-dot probe measures the field shape inside and outside of the antenna region. In addition, optical emission spectroscopy observes changes in plasma intensity for mode jumps, and measures line ratios. 1. R.W. Boswell, Phys. Lett. 33A, 457 (1970) 2. A.W. Trivelpiece and R.W. Gould, Jour. App. Phys. 30 (11) (1959)

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