Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Electron Density Measurement using a Partially Covered Hairpin Resonator in an Inductively Coupled Plasma YHOSHUA WUG, XINGCHEN FAN, JIA HAN, PATRICK PRIBYL , TROY CARTER, University of California, Los Angeles — Hairpin probes are used to determine electron density via measuring the shift of the resonant frequency of the probe structure when immersed in a plasma. We present new developments in hairpin probe hardware and theory that have enabled measurements in high electron density plasma, up to approximately 10^{12} cm^{-3}, corresponding to a plasma frequency of about 9 GHz. Hardware developments include use of both quarter-wavelength and three-quarter-wavelength partially covered hairpin probes in transmission mode, together with an easily reproducible implementation of the associated microwave electronics using commercial off-the-shelf components. The three-quarter-wavelength structure is operated at its 2nd harmonic with the purpose of measuring higher electron densities. New theory developments for interpreting the probe measurements include the use of a transmission-line model to find an accurate relationship between the resonant frequency of the probe and the electron density, including effects of partially covering the probes with epoxy. Measurements are taken in an inductively coupled plasma (ICP) sustained in Argon at pressures below 50 mTorr. Results are compared with Langmuir probe and interferometry measurements.

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Date submitted: 25 Jun 2020 Electronic form version 1.4