Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Electron Density Measurement with Hairpin Resonator in Processing Plasma[1] XINGCHEN FAN, Basic Plasma Science Facility at UCLA — Hairpin probes are used to measure electron density in plasmas. Previous hairpins have been described and are constructed as a quarter-wave resonant structure typically made from a folded piece of wire. The present work extends the hairpin measurement to approximately 10ˆ12/cmˆ3, corresponding to a plasma frequency of about 9 GHz. We describe an easily reproducible implementation of the associated microwave electronics using commercial off the shelf components that are inexpensive compared to the network analyzer that is typically required. Correction coefficients are derived for both the plasma sheath effect and the wire coating. A third previously unreported correction in these probes accounts for the support of the resonant structure that masks direct contact with the plasma over a portion of the resonant wires. Measuring even higher densities requires increasing the resonant frequency, which we were unable to do below the scale of 4 mm. Toward this end we therefore report on operating a hairpin structure at its 3d harmonic (3/4 wavelength resonator). Measurements are taken in a plasma processing tool operating in Argon at pressures below 20 mTorr. Results are compared with Langmuir probe measurements and a microwave interferometer.

[1]Department of Energy and the National Science Foundation

Matthew Jacobs
Basic Plasma Science Facility at UCLA

Date submitted: 12 Jul 2019 Electronic form version 1.4