Abstract Submitted
for the GEC20 Meeting of
The American Physical Society

SPRIGHT – Small Plasma Reflection Interrogation by GHz Transmitter ANDREI KHOMENKO, SERGEY MACHERET, Purdue University — A new diagnostic method for small-size and microplasmas is proposed. Microplasma diagnostics is quite difficult: microwave interferometry does not work due to the small size and the surrounding walls, probes perturb the small plasma, and optical diagnostics is challenging when the walls are not transparent. The new method is dubbed SPRIGHT (Small Plasma Reflection Interrogation with GigaHertz Transmitter) and is based on applying a weak RF probing signal to the plasma and measuring the reflected signal's amplitude and phase over a wide frequency range. Thus, both real and imaginary parts of the impedance are found over the wide frequency range. If several criteria are satisfied, a simple lumped-parameter equivalent circuit can be used to infer the key plasma parameters, such as the sheath thickness, the electron density, and the momentum transfer collision frequency (and the electron temperature). An experimental setup was developed and implemented to enable application of the weak probing signal to the same electrodes that are used for RF plasma excitation while isolating the two dissimilar-frequency circuits from each other. The method was applied to different plasma cells and was experimentally validated for a small RF plasma at a gas pressure of 1-5 Torr.

Andrei Khomenko
Purdue University

Date submitted: 11 Jun 2020 Electronic form version 1.4