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Improved Matching and Plasma Formation Using Frequency Tuning During RF Pulsing in a Helicon Source[1] JOHN SCHARER, MATT WIEBOLD, YUNG-TA SUNG, University of Wisconsin - Madison — A flowing argon helicon plasma is formed in a 10 cm diameter, 1.5 m long Pyrex chamber with an axial magnetic field in nozzle or flat configuration, variable up to 1 kG in the source region. RF power is fed from a 1 kW tube-based supply into a capacitive matchbox that is tuned for low reflected power ($< 5\%$) during steady-state helicon operation. A 18 cm long, 12 cm diameter half-turn double-helix antenna is used to excite helicon waves in the source. During pulsed operation, a high ($\sim 10^{14}$ cm^{-3}) transient electron density is observed that leads to a poor RF match during the transient. Calculated variation of the RF frequency (from 12 MHz to 15 MHz) during the pulse allows for low reflected powers during the gas breakdown and the approach to and formation of the steady state plasma. Microwave interferometry (105 GHz), collisional radiative spectroscopic codes and diamagnetic loops are used to measure electron density and temperature during pulsed (5 ms) RF operation. Potential other circuit schemes are investigated that offer a larger matching bandwidth or an increased range of "matchable" plasma/antenna impedances.

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