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Self-consistent modeling of helicon sources GUANGYE CHEN, B. BREIZMAN, A. AREFIEV, C. LEE, R. BENGTSON, L. RAJA, The Univ. of Texas at Austin — We developed a self-consistent model of helicon discharge. The model takes into account the rf wave excitation, electron heat transfer and ion transport, assuming a given neutral density. As a case study of validating the model, we simulated an early experiment [1] in which a jump in plasma density was observed in a scan of external magnetic field. Our calculation shows that a classical heat transport is unable to sustain the plasma density profile observed in the experiment. Solutions comparable to the experiment are obtained only when extra heat conductivity is used. The radial density profiles and excited wave-lengths are in good agreement with the experiment. In particular, the dual-stable solution found in the simulation supports the observed plasma density jump. The rf-field solver from our simulation code was also used to model a recent experiment at the Univ. of Texas at Austin [2]. The experimentally measured density profile was used to calculate the rf field structure. In comparison with the experimentally measured $B_r(z, r = 0)$, the simulated results agree in the field k_z spectra, the field amplitude and phase only when the electron collision frequency is enhanced by a factor of 10. This indicates the need to identify a stronger wave damping mechanism than electron-ion Coulomb collisions. [1] R. W. Boswell, Plasma Phys. Control. Fusion, 26, 1147, 1984 [2] C. Lee, PhD thesis, The Univ. of Texas at Austin, 2008.

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