The simulation of helicon plasma discharge

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Helicon plasma is a high-density and low-temperature plasma generated by the electromagnetic helicon wave (i.e., bounded whistler wave) excited in the plasma. It is considered useful for various applications. The helicon plasma discharge is a very complex system that involves many physical processes: the wave propagation and mode conversion to the electrostatic TG wave (determined by the wave dispersion relation), collisional and non-collisional wave damping, plasma heating, and ionization/recombination of neutral particles which in turn renews the dispersion relation. While the steady state of the helicon plasma is relatively well understood, there remain some important unsolved questions, such as how the discharge grows, how the helicon and the TG waves influence the plasma density and the electron temperature, and how their spatial profiles are determined. We have constructed a self-consistent model of the discharge growth that takes into account the wave excitation, electron heat transfer, and diffusion of particles. We discuss some quantitatively different states arising due to different choices of plasma parameters.

Keywords: Helicon plasma, Helicon wave, TG wave, Self-consistent discharge model

