ヘリコンプラズマ放電の自己無撞着モデル

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Self-consistent discharge growing model of helicon plasma

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Helicon plasma is a high-density and low-temperature plasma generated by the electromagnetic (Helicon) wave excited in the plasma. It is thought to be useful for various applications including electric thrusters. Physics of helicon plasma production involves such fundamental processes as the wave propagation (dispersion relation), collisional and non-collisional wave damping, plasma heating, ionization/recombination of neutral particles, and modification of the dispersion relation by newly ionized plasma. There remain a number of unsolved physical issues such as, how the Helicon and the TG modes influence the plasma density, electron temperature and their spatial profiles. While the Helicon mode is absorbed in the bulk plasma, the TG mode is mostly absorbed near the edge of the plasma. The local power deposition in the helicon plasma is mostly balanced by collisional loss. This local power balance can give rise to the inhomogeneous electron temperature profile that leads to time evolution of density profile and dispersion relation. In our study, we construct a self-consistent model of the discharge evolution that includes the wave excitation, electron heat transfer, and diffusion of charged particles.