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Helicon Wave Excitation of M=+1, ±1 and ±2 Modes

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The characteristics of M=+1, ±1 and ±2 modes helicon waves excited using a solenoid antenna, Nagoya type III and quadrupole antenna respectively are investigated. The solenoid antenna is constructed by winding a copper cable on a quartz discharge tube. Two dimensional cross-field measurements of ArII optical emission induced by hot electrons are made to investigate RF power deposition. Components of the wave magnetic field measured with a single-turn, coaxial magnetic probe were compared with the field patterns computed for M=±1 and ±2 modes. The M=+1 mode plasma produced by the solenoid antenna has a cylindrical high intensity plasma column, which center is empty. This cylindrical high intensity column results from the rotation of the cross-sectional electric field pattern(right hand circularly polarization). The radial plasma density profile has a peak at r = 2.5 cm with axisymmetry. It has been found that the radial profile of the plasma density is in good agreement with the computed power deposition profile. The radial profiles of the wave magnetic field are in excellent agreement with computations. The plasma excited by Nagoya type III antenna has two high intensity columns which results from the linear combination of M=+1 and -1 modes(i.e, plane polarization). The radial plasma density profile is in good agreement with emission intensity profile of ArII line(488nm). The plasma excited by quadrupole antenna has four high intensity columns which results from the linear combination of M=+2 and -2 modes(i.e. plane polarization). In the M=±2 modes, the radial plasma density profile is also in good agreement with emission intensity profile of ArII line.