OBSERVATION OF RESISTIVE DRIFT ALFVN WAVES IN A HELICON PLASMA

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We will present three dimensional electromagnetic wave frequency and amplitude measurements of low frequency instabilities observed in the expansion region of a magnetized helicon plasma. The wave is localized to the vicinity of the largest plasma density gradient and appears only at low neutral pressure. The wave amplitude grows rapidly with increasing magnetic field strength (and the wave frequency downshifts with increasing magnetic field strength), consistent with previous helicon source experiments. Because the waves arise in a plasma that satisfies the requirements for growth of resistive drift Alfven waves

$$1.0 >> \beta > (\nu_e/\omega_{ce}) > (m_e/M_i) \quad (1)$$

we have compared the measured wave frequencies to expectations for resistive-drift Alfven waves. The observed wave is a transverse electromagnetic wave and the wave frequency is consistent with expectations for a resistive-drift Alfven wave. With increasing magnetic field strength, the wave amplitude increases and eventually the plasma becomes unstable. A theoretical model of the resistive drift Alfven instability, developed by Mikhailovskii will be shown to accurately predict the measured wave frequency dependence on magnetic field strength. Other helicon research groups have suggested that similar low frequency waves observed in their experiments result from the resistive drift instability. Because these measurements are of electromagnetic and not electrostatic waves, we suggest that the relatively high beta of helicon sources actually places this wave in the drift-Alfven regime. Because of the large amplitude of these waves, it is possible (as suggested by others) that these waves could be responsible for reduced plasma confinement in helicon sources at large magnetic field strengths. We also note that because the wave appears under the same conditions as a spontaneously generated electric double layer, other researchers have suggested that similar observations may provide evidence of ion-ion streaming instabilities created in the double layer and not resistive drift waves. We will also compare our measurements to expectations for an ion-ion streaming instability.

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2. H - Waves in Plasma
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4. C - Contributed Paper
5. No special instructions