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ONE DIMENSIONAL NUMERICAL STUDY OF DRIFT BALLOONING MODE IN UMIST QUADRIPOLE

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ABSTRACT

The one dimensional linear theory of drift balloning mode, based on the model developed by Hastie and Taylor [1] has been solved numerically yielding an eigenvalue and eigenfunction corresponding to potential perturbation along the field line. The shape of the eigenfunction along the fieldline is not found sinusoidal.

INTRODUCTION

Drift waves have been studied both theoretically and experimentally in the UMIST GOLUX by Carter [2], and Edwards and Rusbridge [3]; the theory was based on the general theory of the quadrupole given by Hastie and Taylor [1]. Most of this work was concerned with the ordinary drift mode which has its maxima at the points of minimum field strength and is anti-symmetric between the two sedes of the machine, though Crarter [2] searched experimentally for the 'drift-ballooning mode' of the opposite symmetry which has its maxima at the field maxima and is anti-symmetric between the top and bottom of the machine. No trace of this mode was found; this was unexpected because previous studies of the drift waves in quadrupole [4] had concluded that this was made expected to be unstable. Later, it became possible to launch waves in the quadrupole [5] and a damped propagated mode of the drift-balloonong character was successfully launched. Accordingly, a theoretical syudy of the drift ballooning mode was undertaken and is described in this paper.

The plasma in the UMIST quardrupole [6] has typically

$$T_e \sim 0.5 \text{ eV}, \quad n \sim 10^{15} \text{ m}^{-3}$$

where the drift waves are strongly excited. The plasma is only weakly collisional, and the plasma properties are guaranteed to be constant along field lines. The important features of quardrupole geometry are closed lines of force, giving a well-defined parallel wavlength and no problems with boundry conditions; and strong variation of field strength along the field lines, implying a preponderance of trapped over passing particles.