Abstracts

Microwave Propagation in an Overdense Bounded Magnetoplasma

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The magneto-ionic theory shows that for plane wave propagation along the direction of the magnetic field in a magnetoplasma a mode of propagation exists when the frequency of the wave is smaller than the electron gyrofrequency of the medium. Electromagnetic waves will propagate in this mode regardless of the magnitude of the plasma frequency. It requires only that the collision frequency of the electrons in the plasma be sufficiently small so that collision damping does not excessively attenuate the waves. This mode of propagation has been used to explain very low frequency "whistles" associated with lightning discharges and very low frequency emissions in the earth's exosphere. It has been called the "whistler mode" by ionosphere physicists. For propagation in the whistler mode, a dense plasma has a large refractive index, is highly dispersive, and is highly anisotropic. In this paper experiments are described which attempted to use the properties of this mode of propagation as a diagnostic tool in the hot plasma of the magnetic field stabilized pinch discharges in ZETA. The ZETA discharge tube is of toroidal shape with a 1-meter bore and a 3-meter mean diameter. Because of its large size, plane wave propagation through the plasma was considered to be feasible, and hence, the whistler mode theory applicable to the experiment.

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