FAR- FIELD RADIATION OF LINEAR ANTENNAS IN AN ANISOTROPIC PLASMA

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Assuming a sinusoidal current distribution on a linear antenna immersed in a uniform anisotropic plasma and ignoring the effect of a plasma sheath, an accurate expression for the stationary radiation field is derived using the Greens function method. We avoided the usual plane wave approximation for the calculation of the asymptotic field, and the resulting spherical waves have an index of refraction that is different from the plane wave solution and varies with the propagation angle. The relation of between the refractive indices of the plane and spherical waves is derived. All expressions are valid for any point in all eight regions of the cold plasma CMA diagram, except that the resonance and cutoff phenomena are not discussed. One important result is a significant difference in the radiation cones for some CMA regions between our general solution and the plane wave approximation. The analysis gives the polarization, the radiation pattern, and the radiation resistance including solutions for whistler mode frequencies. The analysis is performed for any given frequency-dependent plasma parameter and any antenna length (the short antenna is a special case in the discussion) and antenna orientation with respect to the magnetic field (parallel and perpendicular orientations are special cases). The two solutions for the anisotropic case merge into one wave for Y = fB/f 0 (the medium becomes isotropic), and reduce exactly to the well known free space solution for X = (fp/f)2 0. The effect of the plasma sheath is ignored in the derivations but its effect on the far-field is discussed.

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