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Publication Date
1959-08-28

UCRL-8918

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COMMENTS ON "EXPERIMENTAL DEMONSTRATION OF HYDROMAGNETIC WAVES IN AN IONIZED GAS"*

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August 28, 1959

Sawyer, Scott, and Stratton have reported the observation of hydromagnetic waves in a deuterium discharge plasma.[1] Their plasma was formed in a long cylinder 15 cm in diameter filled with deuterium to a pressure of 5 microns Hg and subjected to an axial magnetic field of 100 gauss.

In connection with the possibility of hydromagnetic wave propagation under these conditions, it is instructive to examine the attenuation to be expected. Newcomb has shown that the attenuation factor ϵ for the lowest-order principal-mode propagation in a cylindrical geometry is

$$\epsilon = \frac{c^2(k_c^2 + k^2)}{8\pi\sigma V}, \tag{1}$$

where k is the propagation constant, c is the velocity of light, σ is the plasma conductivity, V is the well-known Alfven velocity, and k_c is determined by the boundary condition of the plasma.[2] Newcomb has

*Work done under the auspices of the U. S. Atomic Energy Commission.

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also shown that the attenuation for this mode is smaller than that due to modes of higher order. Thus a lower limit to the attenuation expected in the rather complex case investigated by Sawyer, Scott, and Stratton can be set by Eq. (1). Using their values of temperature (~ 1 ev) to determine σ, the calculated Alfven velocity, and determining k_c from the condition that $J_1(k_c r) = 0$ at the tube radius, we find from Eq. (1) that $\epsilon = 1.2\ \mathrm{cm}^{-1}$. Thus the wave amplitude is expected to drop to 1/e in somewhat less than one centimeter.

It would appear difficult for an appreciable hydromagnetic wave propagation to exist under these circumstances, although some other mechanism may be capable of continuously supplying energy to the disturbance along the length of the discharge tube.

REFERENCES

1. Sawyer, Scott, and Stratton, Phys. Fluids 2, 47 (1959).
2. W. A. Newcomb, in *Magnetohydrodynamics* (Stanford University Press, Stanford, California, 1957) p. 109.