Abstract Submitted
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Improved basis set for low frequency plasma waves[1] PAUL BELLAN, Caltech — It is shown that the low frequency plasma wave equation [Stringer, Plasma Physics **5**, 89(1963)] can be obtained much more directly than by the previously used method of solving for the determinant of a matrix involving the three wave electric field components $\tilde{E}_x, \tilde{E}_y, \tilde{E}_z$. The more direct method uses a 2D wave current density vector space that is precisely equivalent to the previously used 3D electric field vector space. Unlike $\tilde{\mathbf{E}}$, the current density $\tilde{\mathbf{J}}$ is restricted by quasi-neutrality to a 2D vector space. Comparison with previously obtained dispersion relations is provided. An exact analytic method is presented for obtaining the three roots of the cubic dispersion relation. The commonly used kinetic Alfvén dispersion is shown to be valid only for near-perpendicular propagation in a low β plasma. It is shown that coupling between Alfvén and fast modes vanishes when $\omega^2 = k^2 c_s^2$ so that the Alfvén mode reverts to its cold form even if $v_A < v_{Te}$. A method is prescribed by which measurement of $\tilde{\mathbf{J}}$ removes the space-time ambiguity previously believed to be an unavoidable shortcoming of single-spacecraft frequency measurements.

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