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On correlation between the magnetic and the density fluctuations in a space plasma

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Fluctuations are ubiquitous in a space plasma. If we describe them as superposition of (linear) plasma waves, the relationship between the fluctuations of the magnetic field, plasma density, velocity, etc, at the leading order of the wave amplitude, is simply given by the linear dispersion relation. On the other hand, when wave amplitude is large (e.g., MHD turbulence in the foreshock), we are able to discuss correlation of fluctuations at the second order as well. We show that, by evaluating the correlation between fluctuation of the magnetic field envelope and that of the plasma density, we can determine how kinetic the plasma response is. Results of hybrid simulations will be presented.