Regulation of Plasma Fluctuations by Kinetic Proton-Cyclotron Parametric Instabilities

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Abstract: The amplitude of magnetic fluctuations in the solar wind close to Earth is consistently observed to grow almost linearly with the proton beta, even near thermodynamic equilibrium [1,2]. Thus, the solar wind can develop large amplitude Alfvén wave fluctuations that could be subject to parametric decay instabilities. Hybrid simulations have shown that these instabilities may be responsible for the anisotropic heating and beam formation of proton velocity distributions [3]. Also, data from the WIND spacecraft suggests that these instabilities may be active in the solar wind at 1 AU [4], although this has been tested by using a fluid model probably not appropriate for high-beta plasmas. In this work, measurements of magnetic fluctuations from the WIND spacecraft are studied in the range of high proton betas, and compared against results from a kinetic theory for parametrically unstable Alfvén-cyclotron waves. It is expected that this model may improve our understanding of the plasma fluctuations, and contribute to the explanation of preferential heating and acceleration phenomena due to kinetic effects.

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References:

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