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Low frequency electromagnetic waves and corresponding ion velocity distributions from space plasmas

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Observations of low frequency ion waves and corresponding ion velocity distribution functions (VDFs) from the solar wind and Earth's magnetosphere have been presented in this study using the Cluster and Magnetospheric Multiscale Mision (MMS) observations. The observed ion VDFs are found to be non-Maxwellian and consisted of a bulk cold component in addition to hot tenuous components. By using the fitting parameters of the observed VDFs, we derive the dispersion relation of low frequency ion waves and obtained the real frequency and growth rate expressions. We then investigate the effect of superthermal particles on the real frequency and growth rate of such low frequency ion waves.