地球マグネットシースおよび磁気圏内における多点衛星観測データを用いた波動ベクトル解析の有効性について

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Validities of wave vector analysis techniques using multi-spacecraft observation in the magnetosheath and magnetosphere

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There are some difficulties in identifying wave vectors uniquely even if their wave modes are assumed. Wave vector analysis techniques utilizing multi-spacecraft observations have been developed in this decade [e.g., Narita, 2017]. Recent Magnetospheric Multiscale (MMS) mission enable us to resolve smaller wavelength in the ion kinetic range. It is important to assess the validities of the wave vector analysis techniques utilizing multi-spacecraft observations. We applied several techniques to synthetic and observed data.

The wave telescope or k-filtering techniques [Neubauer and Glassmeier, 1990; Narita et al., 2011] are based on the direction of arrival estimation by array antennas. Gershman et al. [2017] performed Bellan's method in which pre-Maxwell Ampere's law is assumed [Bellan, 2016] with use of the current density determined by the curlometer technique [Dunlop et al., 2002]. These techniques can provide the wave vectors with a high accuracy, though not always. The accuracy depends on specific parameters and situations, e.g., the wave vector direction with respect to the spacecraft formation. The frequency-wave vector distributions estimated using observed data by MMS in the magnetosheath and magnetosphere well agree with those calculated by the linear theory, but tend to disagree when the spacecraft are close to the wave sources.