The Wave Curl Analysis: Revealing Fundamental Properties of EMIC Waves with Multi-Point Measurements

EMIC waves are important for many processes in the magnetosphere. But, the wave vector, \( \mathbf{k} \), is not well known observationally. Because \( \mathbf{k} \) affects wave growth, propagation, and interactions with local plasma, determining \( \mathbf{k} \) is a key component in understanding the effects of these waves.

- Using the 4 MMS satellites to get current density, we tested a new method for determining EMIC wave \( \mathbf{k} \) that applies Ampere’s law to the complex wave fields.
- With this method, we can fully determine the direction and magnitude of \( \mathbf{k} \).
- This method provides stable results and can handle user input variations.
- Our method agrees well with theoretical linear dispersion analysis, as well as with other methods for determining \( \mathbf{k} \).
- Our results give confidence that we can use this technique for future, large-scale studies to answer outstanding, fundamental questions involving \( \mathbf{k} \).

A newly developed technique based on closely-spaced multi-spacecraft measurements can now unlock critical information missing from our understanding of EMIC waves.