Optimal Use of Time Lags Between MMS Spacecraft : Application to the Estimation of Wave-Vectors

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Turner et al. (2017) made use of cross-correlations of SCM quasi monochromatic data between pairs of MMS spacecraft to estimate phase lags and to derive wave vectors of whistler mode chorus elements in the inner magnetosphere. A new approach has been developped to revisite this study. For a cluster of four spacecraft there are six pairs of spacecraft, each one giving raise to a scalar equation relating the vector position **R** from the first to the second spacecraft, the wave vector **K** and the phase lag $\Delta\phi$: **R.K**=$\Delta\phi$. A positive weight is attributed to each equation (w_j, j=1 to 6). A statistical ensemble of 6-uplets is built and we look for the 6-uplet giving the lowest condition number of matrix **M**. This procedure warrants the best accuracy of the pseudo-inverse of **M** and hence the best estimate of the wave vector **K**. Adding random perturbations to M and $\Delta\phi$ the procedure allows to estimate the uncertainties on **K.**

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