



Properties and evolution of mirror structures in the magnetosheath: Cluster observations and interpretation

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Mirror modes are large amplitude non-propagating compressive structures frequently observed in the magnetosheath. They appear in two forms: magnetic dips anti-correlated with enhancements of density, and magnetic peaks associated with density depletions. In our study we present an analysis of the properties of mirror mode structures in the magnetosheath of the Earth based on a database of Cluster observations and also a detailed case study of one magnetosheath traversal. We focused primarily on the identification of conditions associated with the magnetic dips and magnetic peaks. It is shown that the character of mirror structures is related to the local degree of instability of plasma with respect to mirror instability: peaks are typically observed in an unstable plasma, while mirror structures observed deep within the stable region appear almost exclusively as dips. This observation is found to be consistent with recent theoretical and numerical studies. An abrupt transition of mirror structures from peaks to dips at an approximate distance of 2 Earth radii from the magnetopause was identified by multi-spacecraft analysis and we interpret this effect as a consequence of plasma expansion in the vicinity of the magnetopause locally changing the plasma conditions towards a more stable state.