

Three Spacecraft Measurements to Study the Propagation of Nonlinear Alfvén Waves and Rotational Discontinuities

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In interplanetary space, Alfvén waves are often found to be associated with rotational discontinuities (RDs). These nonlinear waves are arc-polarized and the RDs are the phase steepened fronts of the waves. To interpret these features, two hypotheses have been proposed. One is that these are planar waves which propagate along their magnetic minimum variance direction, k , which is the same everywhere along the planar wavefront. Another explanation is that they are spherical waves which propagate around the intermediate variance direction, j . These two pictures are fundamentally different and have significantly different consequences. In this study we have used multispacecraft measurements to identify the wave normal and propagation directions. We will use three spacecraft (ISEE-3, IMP-8, and ISEE-1/2) measurements of tangential discontinuities (TDs) from magnetic field, time delay and space displacements, to verify that the solar wind velocity determinations at the three spacecraft are identical to a very high degree of accuracy. Geometric relationships will be used to calculate the Alfvén wave/discontinuity apparent velocity V . The wave phase velocity, V_{ph} is obtained from the difference between the V , based on discontinuity time delay from these spacecraft and the measured solar wind velocity, V_{sw} . The wave propagation direction will be uniquely determined by comparing with the discontinuity normals calculated from minimum variances.

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(b) 2109 discontinuities; 7839 nonlinear phenomena

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