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Large amplitude nonlinear waves in Venus magnetosheath

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Abstract

Observations by the Venus Express magnetometer have shown the existence of large-amplitude variations of the magnetic field within the Venus magnetosheath. The spatial scale of the variations is determined by ion gyration and comparable to the ion gyroradius. We interpret these variations as a periodic nonlinear wave, standing between the Venusian bow shock and the pileup. We derive the shape of one-dimensional nonlinear waves standing downstream of an oblique shock within two-fluid hydrodynamics. The magnetic field profile of these waves is in a good agreement with the observations, given the approximate nature of the assumption of one-dimensionality. We speculate that the standing waves appear due to the small distance between the two boundaries, the shock and the pileup.