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Generation of Nonlinear Magnetic Disturbances in the Solar Wind

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Nonlinear magnetic disturbances are prevailing over the interplanetary space as revealed by many spacecraft observations. The origin of these magnetic perturbations however remains an open issue. A systematic study is undertaken of the mirror and firehose instabilities driven by temperature or pressure anisotropy based on MHD and Hall MHD models. It is shown that magnetic structures with depressed magnetic field and/or increased plasma density similar to the magnetic holes observed in the solar wind and magnetosheath may develop during the evolution of both instabilities. The Hall currents may further lead to the formation of magnetic flux rope and both cascade and inverse cascade processes can be seen in the evolution of firehose instabilities.