Magnetic Reconnection Structures in the Solar Wind

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Magnetic reconnection is a plasma process that occurs throughout the heliosphere and is invoked as the underlying driver for a wealth of phenomena. Descriptions of reconnection based on the Petschek-like framework contain common observable features including a reconnection exhaust bounded by two current sheets and Alfvén waves travelling along the boundary. Also commonly seen are decreases in magnetic field strength and a corresponding increase in ion density. However, through detailed analysis of a number of events we find this is not always the case. Here we show an event that occurred on the 7th February 2006 which exhibits many of these features, including a double magnetic field rotation co-incident with an ion velocity enhancement, density enhancement and magnetic field strength decrease. The changes in V and B are correlated on one side of the exhaust and anti-correlated on the other. However the exhaust appears to continue for a short time after the two main current sheets have passed as does the magnetic field depression and the ion density enhancement. The Walen test is satisfied when the changes in the Alfvén and the plasma velocity over a discontinuity are equal; a successful Walen test indicates the presence of Alfvén waves. However the Walen test over the discontinuities is not sufficiently satisfied to suggest the presence of Alfvén waves running along the boundaries of the reconnection exhaust. This suggests that the structure of the reconnection event could be more complicated than previously thought and may, for example be bounded by more than two current sheets and or other discontinuities.