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# Turbulence in low-$\beta$ reconnection events

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Abstract

Using a two-dimensional, two fluid, numerical model with finite electron inertia, we have observed turbulence to occur in plasmas undergoing magnetic reconnection when the plasma $\beta$ parameter is sufficiently small. This turbulence occurs in the outflow region downstream from the magnetic X-point, where a large out-of-plane current gradient is observed to develop. We show that ion force balance, in conjunction with the distortion of the field lines of the magnetic island, is the mechanism responsible for the formation of this current gradient. Furthermore, we show that this current gradient is the primary factor causing instability. We derive a local linear dispersion relation for this instability from the two-dimensional MHD equations, and also explore the nonlocal, nonlinear behavior of the system.