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Purely-growing fast reconnection from a fourth-order fluid equation[1] PAUL BELLAN, Caltech — If either finite electron inertia or finite resistivity are included in 2D magnetic reconnection, the two-fluid equations become a pair of second-order differential equations coupling the out-of-plane magnetic field and vector potential to each other to form a fourth-order system. The coupling at an X-point is such that out-of-plane even-parity electric and odd-parity magnetic fields feed off each other to produce instability. The instability growth rate is given by an eigenvalue of the fourth-order system determined by boundary and symmetry conditions. The instability is a purely growing mode, not a wave, but has growth rate of the order of the whistler frequency. The spatial profile of both the out-of-plane electric and magnetic eigenfunctions consists of an inner concave region having extent of the order of the electron skin depth, an intermediate convex region having extent of the order of the ion skin depth, and a concave outer exponentially decaying region. If finite electron inertia and resistivity are not included, the inner concave region does not exist and the coupled pair of equations reduces to a second-order differential equation having non-physical solutions at an X-point.

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