The Scaling of Collisionless, Magnetic Reconnection for Large Systems

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ABSTRACT. Hybrid simulations with electron inertial, along with analytic scaling arguments, are presented which demonstrate that magnetic reconnection remains Alfvénic in a collisionless system even as the macroscopic scale length of the system becomes very large. This fast reconnection is facilitated by the whistler physics present near the x-line, which induces large electric fields in the outflow direction and accelerates the ions to their Alfvén speed within a microscopic distance of the x-line. The reconnection rate is found to be a universal constant corresponding to an inflow velocity towards the x-line of around 0.1 c_A.