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Enhanced Magnetic Reconnection By Drift-Wave Instabilities
M.J. PUESCHEL, P.W. TERRY, University of Wisconsin-Madison, D. TOLD, Max Planck Institute for Plasma Physics — A physical process is presented by which magnetic reconnection may be accelerated far beyond the rates usually achievable by tearing modes. The growth rates of reconnection processes are normally regulated by current gradients, whereas micro-scale instabilities in fusion devices tend to be driven by pressure gradients. Through gyrokinetic simulations, the interplay of these mechanisms and its potential consequences for reconnection physics are studied. As in [M.J. Pueschel et al., Phys. Plasmas **18**, 112102 (2011)], current sheets are used to drive reconnection, with background density or temperature gradients added independently. If sufficiently large, these gradients may excite a novel, drift-wave-type instability – described here in some detail – that relies fundamentally on parallel magnetic fluctuations. In particular, it is able to couple to the tearing mode via the Vlasov nonlinearity. In this case, the tearing mode starts to grow at the rate of the drift wave, independently of its own drive. Applying this mechanism to the solar corona, it is found that for pressure gradient length scales below 200 km, such gradient-enhanced tearing may be expected to exceed the usual reconnection rate.

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