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Plasmoid and Kelvin-Helmholtz instabilities in Sweet-Parker current sheets NUNO LOUREIRO, Instituto de Plasmas e Fusão Nuclear, IST, ALEXANDER SCHEKOCHIHIN, University of Oxford, DMITRI UZDENSKY, CIPS, University of Colorado — A 2D linear theory of the instability of Sweet-Parker current sheets is developed. It is shown that the current sheet is unstable to two modes. Close to the center of the sheet the plasmoid instability is recovered: current sheets are unstable to the formation of a large wave number chain of plasmoids ($k_{max}L_{CS} \sim S^{3/8}$, where k_{max} is the wave-number of fastest growing mode, $S = L_{CS}V_A/\eta$ is the Lundquist number, L_{CS} is the length of the sheet, V_A is the Alfvén speed and η is the plasma resistivity), which grows super-Alfvénically fast ($\gamma_{max}\tau_A \sim S^{1/4}$, where γ_{max} is the maximum growth rate, and $\tau_A = Lsheet/V_A$). Away from the center of the sheet, it is found that the Kelvin-Helmholtz (KH) instability is triggered. The KH instability grows even faster than the plasmoid instability, $\gamma_{max}\tau_A \sim k_{max}L_{CS} \sim S^{1/2}$. The effect of viscosity (ν) on the plasmoid instability is also addressed. In the limit of large Prandtl number, $Pm = \nu/\eta$, it is found that $\gamma_{max} \sim S^{1/4}Pm^{-5/8}$ and $k_{max}L_{CS} \sim S^{3/8}Pm^{-3/16}$; it is predicted that the critical Lundquist number for plasmoid instability in the $Pm \gg 1$ regime is $S_c \sim 10^4 Pm^{1/2}$.

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