Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Generalized Plasmoid Instability in Time Evolving Current Sheets[1] LUCA COMISSO, MANASVI LINGAM, YI-MIN HUANG, AMITAVA BHATTACHARJEE, Princeton University — In the widely studied Sweet-Parker current sheets, the plasmoid instability grows at a rate proportional to S (Lundquist number) raised to a fractional positive exponent [1,2]. This implies that in large S systems, Sweet-Parker current sheets cannot be attained as current layers are linearly unstable and disrupt before this state is achieved. Here, we formulate a quantitative and mathematically precise theory of the plasmoid instability in time evolving current sheets based on a principle of least time [3]. We obtain the scaling relations for the growth rate, number of plasmoids, aspect ratio, plasmoid width and onset time. They are shown to depend on the initial perturbation amplitude, the characteristic rate of current sheet evolution, and the Lundquist number. An important finding of this analysis is that the final results are not simple power laws. The detailed dynamics of the instability is also elucidated, and shown to comprise of a long period of quiescence followed by sudden growth over a short time scale. [1] N.F. Loureiro, A.A. Schekochihin and S.C. Cowley, Phys. Plasmas 14, 100703 (2007) [2] L. Comisso and D. Grasso, Phys. Plasmas 23, 032111 (2016) [3] L. Comisso, M. Lingam, Y.-M. Huang, A. Bhattacharjee, submitted to Phys. Rev. Lett. (2016)

[1]This work is supported by NSF, Grant Nos. AGS-1338944 and AGS-1460169, and by DOE, Grant No. DE-AC02-09CH-11466.

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Date submitted: 15 Jul 2016 Electronic form version 1.4