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On the fast magnetic reconnection rate YI-HSIN LIU, Dartmouth College — The magnitude of the reconnection electric field parallel to the reconnection x-line not only determines how fast reconnection processes magnetic flux, but can also be crucial for generating super-thermal particles. Observations and numerical simulations have revealed that collisionless magnetic reconnection in the steady state tends to proceed with a normalized reconnection rate of an order of 0.1 in disparate systems. However, the explanation of this value has remained mysterious for decades. We propose that this value 0.1 is essentially an upper bound value constrained by the force balance at the upstream and downstream regions [1], independent of the dissipation-scale physics, independent of the mechanism that localizes the x-line [2]. The prediction from this model compares favorably to particle-in-cell simulations of magnetic reconnection in both the non-relativistic and extremely relativistic limits, from symmetric to asymmetric reconnection [3]. These results may be significant for solar, magnetospheric, astrophysical and fusion plasmas. [1] Liu et al., Phys. Rev. Lett. 118, 085101 (2017). [2] Liu et al., Phys. Plasmas, 25, 080701 (2018). [3] Liu et al., Geophys. Rev. Lett. 45, 3311-3318 (2018).

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