

## Theory and observation of plasmoid-modulated magnetic reconnection

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The short timescale of the solar flare reconnection process has long proved to be a puzzle. Recent studies suggest the importance of the formation of plasmoids in the reconnecting current sheet [e.g. 1], with quantifying the aspect ratio of the width to length of the current sheet in terms of a negative power  $\alpha$  of the Lundquist number, that is,  $S^{-\alpha}$ , being key to understanding the onset of plasmoids formation [2].

In this talk, we present our application (the first of its kind) of theoretical scalings for this aspect ratio to observed flares. By doing this we are able to evaluate how plasmoid formation may connect with observations. For three different flares that show plasmoids we find a range of values of  $\alpha=0.26$  to  $0.31$ . This is close to the theoretically predicted value, but due to the presence of  $\alpha$  in the exponent of the powerlaw, these differences are somewhat difficult to reconcile. The values in this small range implies that plasmoids may be forming before the theoretically predicted critical aspect ratio ( $\alpha=1/3$ ) has

been reached, potentially presenting a challenge for the theoretical models. We will discuss the implications for understanding flare reconnection and how to potentially reconcile these differences.

### References

- [1] Takasao, S., Asai, A., Isobe, H., & Shibata, K. (2012). Simultaneous observation of reconnection inflow and outflow associated with the 2010 August 18 solar flare. *The Astrophysical Journal Letters*, 745, L6
- [2] Pucci, F., & Velli, M. (2014). Reconnection of quasi-singular current sheets: The “ideal” tearing mode. *The Astrophysical Journal Letters*, 780, L19
- [3] Hillier, A., & Takasao, S. (2022). Connecting theory of plasmoid-modulated reconnection to observations of solar flares. *Experimental Results*, 3, E26

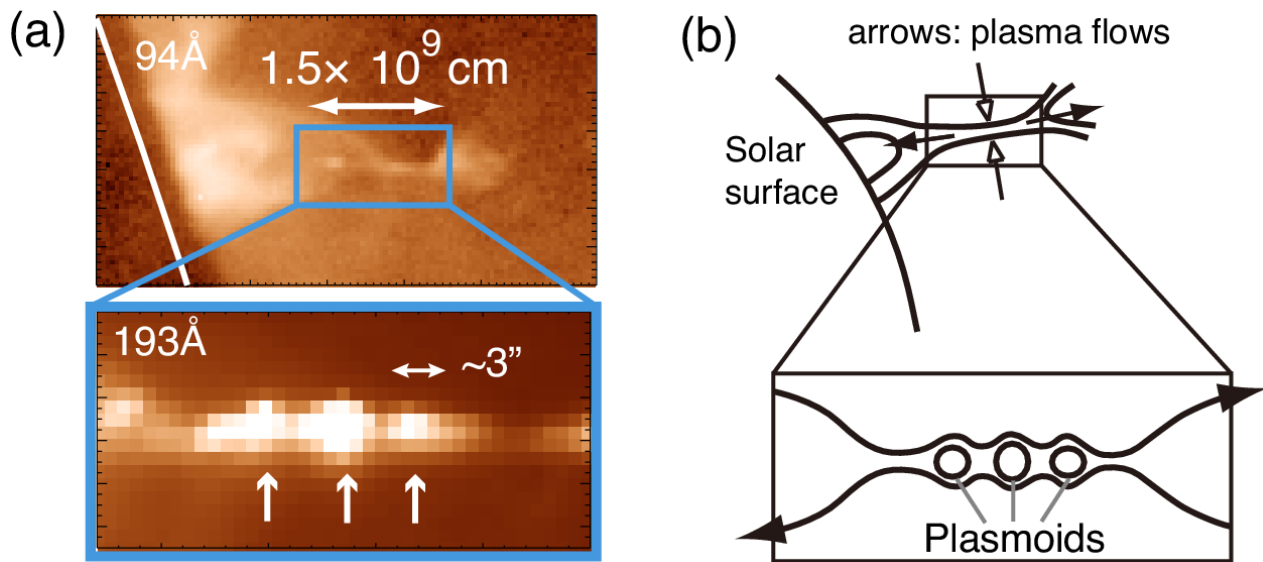


Figure 1: Image of a solar flare observed on August 18, 2010 with the Atmospheric Imaging Assembly (panel [a]). The zoomed image shows plasma blobs formed in the plasma sheet. Panel (b) presents a schematic diagram of these observations where the plasma sheet is understood as a current sheet with the plasma blobs interpreted as plasmoids [1]