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On the Electron Dynamics during Rapid Asymmetric Magnetic Island Coalescence: Insights on the Electrons Agyrotropy with the Presence of a Guide Field

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The work presents a fully kinetic analysis of the electrons dynamics during rapid island coalescence in asymmetric magnetic reconnection, especially focused on the comparison between the case with and with no initial guide field. Formation and growth of the islands are caused by an intentionally unstable initial configuration across the current sheet with the same asymmetric profiles as those traditionally proposed in the literature (e.g. Pritchett, 2008). Particular attentions is given to the different evolution of the presumed reconnection sites. Three main regions are eventually identified, named by X-, D- and M-regions, which describe, respectively, the regions featuring a traditional reconnection event, those showing an opposite behavior with respect to the former and the reconnection regions occurring between two magnetic islands (Cazzola et al., 2015). Further analysis is mainly addressed to evaluate both the electrons departure from the isotropic and gyrotropic behavior. Whether the first quantity has been clearly established and confirmed by observations, the latter has always appeared of difficult interpretation, and an ultimate accepted method on how to render it from PIC simulations still seems far to be achieved. In light of the upcoming data from the freshly launched MMS NASA mission, outcomes from some of the main techniques to spot agyrotropic regions are here compared to highligh the presence of possible relevant differences (Scudder and Daughton, 2008; Swisdak, 2015).

References

[1] P. Pritchett, “Collisionless magnetic reconnection in an asymmetric current sheet,” *Journal of Geophysical Research: Space Physics (1978–2012)*, vol. 113, no. A6, 2008.

[2] E. Cazzola, M. E. Innocenti, S. Markidis, M. V. Goldman, D. L. Newman, and G. Lapenta, “On the electron dynamics during island coalescence in asymmetric magnetic reconnection,” *Physics of Plasmas (1994-present)*, vol. 22, no. 9, p. 092901, 2015.

[3] J. Scudder and W. Daughton, “Illuminating electron diffusion regions of collisionless magnetic reconnection using electron agyrotropy,” *Journal of Geophysical Research: Space Physics (1978–2012)*, vol. 113, no. A6, 2008.

[4] M. Swisdak, “Quantifying gyrotropy in magnetic reconnection,” *arXiv preprint arXiv:1509.00787*, 2015.