



## Abstract

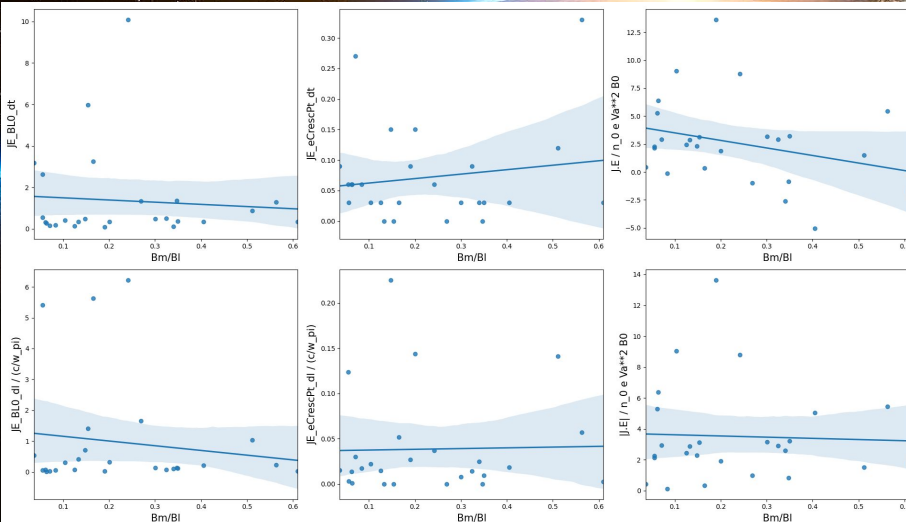
The understanding of magnetic reconnection's physical processes has considerably been improved thanks to the data of the Magnetospheric Multiscale mission (MMS). However, a lot of work still has to be done to better characterize the core of the reconnection process : the electron diffusion region (EDR). We previously developed a machine learning algorithm to automatically detect EDR candidates, in order to increase the available list of events identified in the literature. The addition of new EDR cases to the previously reported ones allows for statistical studies that could not have been conducted before.

The process of energy conversion at the EDR is a complex matter, and the effect of the presence of a guide field on this process is not yet fully understood because of the lack of cases to study. In this study, we show how the intensity of the guide field affects the energy conversion process at the EDR.

## Methodology

- We created a **machine learning algorithm** that we trained on the **32 EDR events reported in Webster et al. (2018)**. We found **18 new EDR candidates** in the data of the phase 1a of MMS. All these results can be found in **Lenouvel et al. (2021)** (in press at Earth and Space Science).
- We added the new EDR candidates to the list of already reported EDR events to conduct a study on the **largest EDR dataset ever studied**.
- The focus of this poster is to reproduce the study from **Genestreti et al. (2017)** about the **link between guide field and energy conversion** on a larger EDR database of around 40 cases
- We looked at the time separation between the peak of J.E, the  $B_z=0$  point and the electron crescent point.

## Analysis



- **1st column** : (Top) Time delta between Max J.E and  $B_z=0$  in [s] as a function of the Guide Field Bm/BI and (Bottom) the related distance [normalised unit]
  - The distance and the time decrease as the Guide Field increases as observed in Genestreti et al. (2017)
- **2nd column** : (Top) Time delta between Max J.E and electron crescent point in [s] as a function of the Guide Field Bm/BI and (Bottom) the related distance [normalised unit]
  - The scale of the increase in time and distance is very small so the max J.E and the electron crescent point are collocated with or without guide field
- **3rd column** : Intensity of the energy conversion J.E (Top) and IJ.EI (Bottom) [normalized units] as a function of the Guide Field Bm/BI
  - IJ.EI does not seem to vary as the guide field increases

## Conclusions

- The analysis conducted on around 40 EDR cases show that **the introduction of a guide field increases J.E at the X point**, which is consistent with the results from Genestreti et al. (2017)
- We also show that **the introduction of a guide field does not seem to reduce J.E near the electron crescent point** which is **not consistent with the results from Genestreti et al. (2017)**, but the scales are small and we have a limited scale of Bm/BI so it is **hard to conclude with certainty**
- **The Guide Field does not seem to constrain the intensity of the energy conversion**

## References

- Webster, J. M et al. (2018), Magnetospheric Multiscale Dayside Reconnection Electron Diffusion Region Events, *Journal of Geophysical Research: Space Physics*, 123(6), 4858–4878. doi: 10.1029/2018JA025245
- Lenouvel, Q et al. (2021), Identification of Electron Diffusion Regions with an AI approach on MMS data at the Earth's magnetopause, *Earth and Space Science*.
- Genestreti, K. J et al. (2017). The effect of a guide field on local energy conversion during asymmetric magnetic reconnection: MMS observations. *Journal of Geophysical Research: Space Physics*, 122, 11,342– 11,353. doi: 10.1002/2017JA024247