

EGU Vienna (virtual), April 26, 2021

KU LEUVEN

Hunting for reconnection and energy exchange sites in 3D turbulent outflows

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tel Sacher Looking forward to meetin 2022





³ Lapenta, G., et al. "Local regimes of turbulence in 3D magnetic reconnection." ApJ888.2 (2)

Local Lorentz Transformation: finding a local reconnection plane in a 3D space

- In a 2D classic reconnection point, B vanishes in the plane normal to the reconnection electric field.
- New Proposed Lorentz Reconnection Indicator:
 - Find at each point in 3D what is the Lorentz frame change that eliminates the local value of B in the plane normal to E.
 - The frame change velocity is given by: $V_L = \frac{E \times B}{F^2}$
 - The key aspect is that this V_L is very large, in fact superluminal everywhere except in the immediate vicinity of a reconnection site
 - V_L can be used then as a very simple readily deployed **reconnection indicator**





Lorentz indicator in the vicinity of a 2D reconnection point

LorentzHR frame=000000



 $\mathscr{L} = \log_{10} \left(\frac{v_L}{c} \right) -0.5 \quad 0.0 \quad 0.5 \quad 1.0 \quad 1.5 \quad 2$

Lapenta, Giovanni. "Detecting reconnection sites using the Lorentz Transformatic for electromagnetic fields." arXiv:2103.02538, to appear, ApJ (2021).

Lorentz reconnection indicator used to find secondary reconnection sites in a turbulent reconnection outflow



for electromagnetic fields." arXiv:2103.02538, to appear, ApJ (2021).