

Title: Quantifying flux rope characteristics in relativistic 3D reconnection simulations

Speakers: Jesse Vos

Collection/Series: Magnetic Fields Around Compact Objects Workshop

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Abstract:

Plasmoid-dominated magnetic reconnection is known to convert magnetic energy into heat and kinetic energy and is thought to be closely related to high-energy emission features originating near compact objects. We present preliminary results of high-resolution special-relativistic resistive magnetohydrodynamic simulations of reconnecting 3D current sheets starting from a Harris equilibrium. We focussed on identifying and quantifying flux rope structures and how the properties of produced magnetosonic waves (potentially generating winds around compact objects) rely on the underlying plasma description. We show that while the initial stage does not differ substantially from 2D results, a secondary turbulent reconnection phase can only be studied in 3D.

Quantifying flux rope characteristics in relativistic 3D reconnection simulations

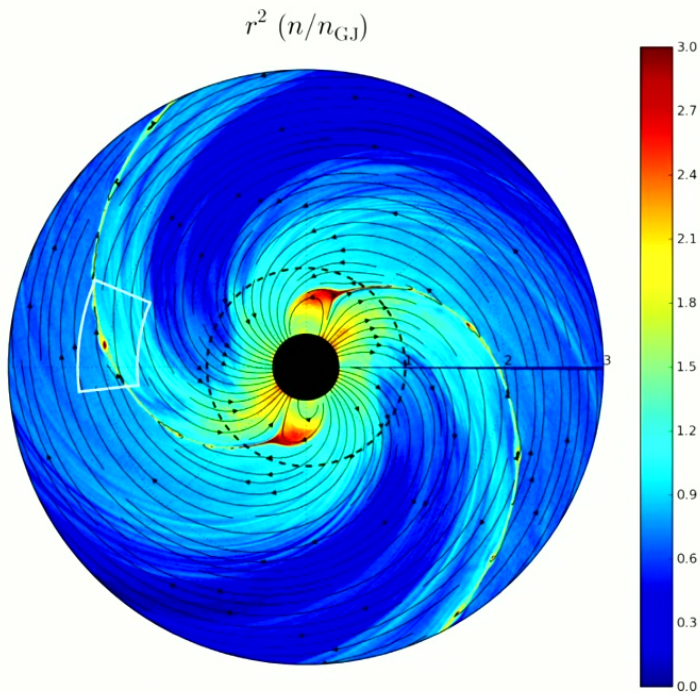
Jesse Vos,

Fabio Bacchini, Bart Ripperda

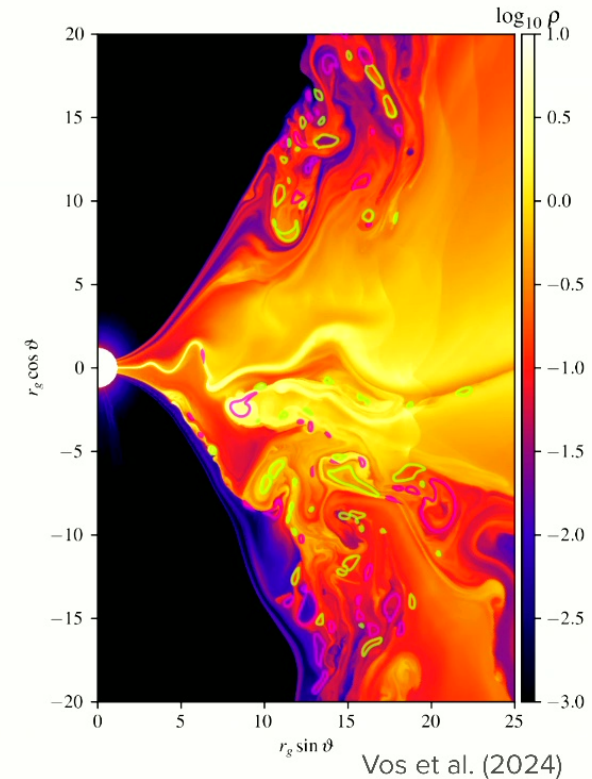
KU LEUVEN

Where does one find current sheet?

- Most compact objects are likely to have prominent current sheets
- Predominantly investigated in 2D



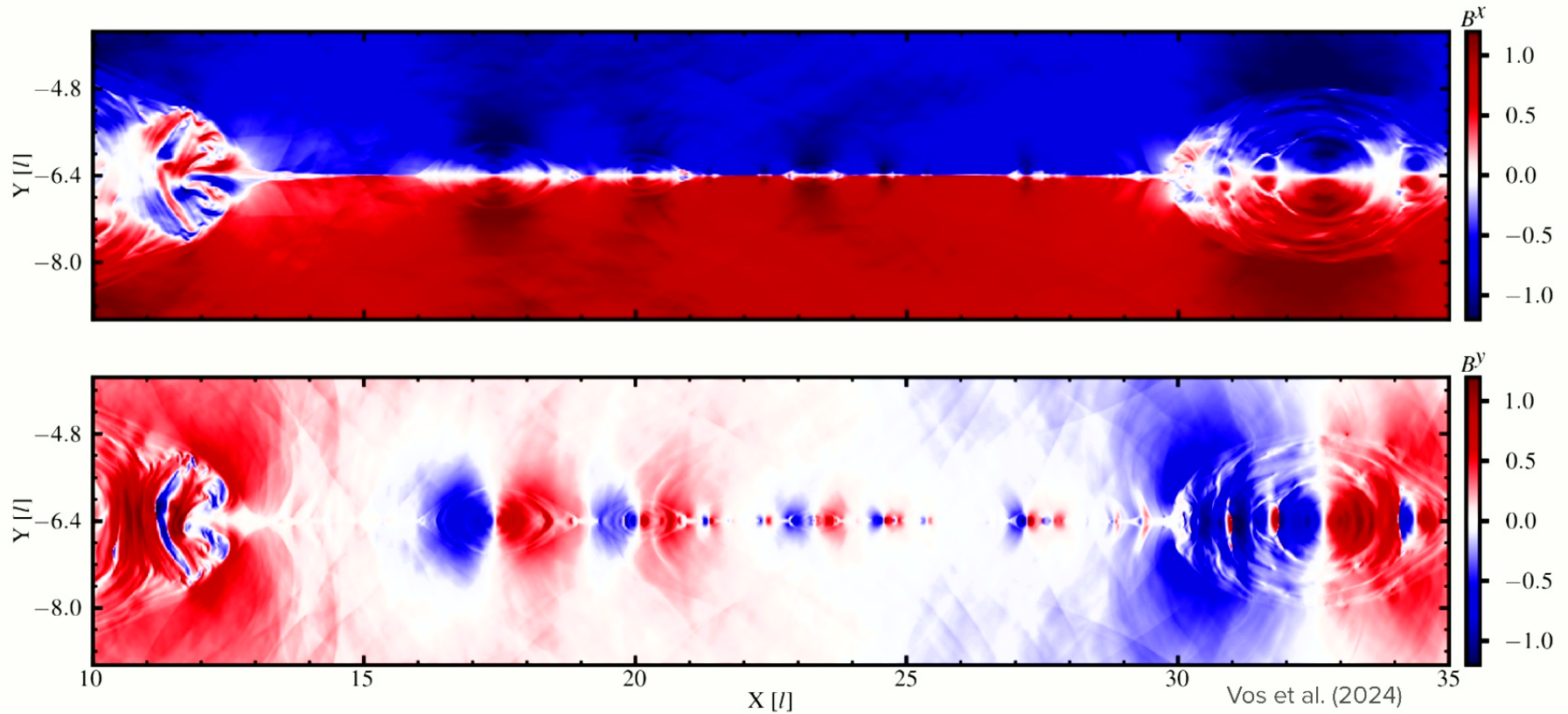
Philippov et al. (2019)



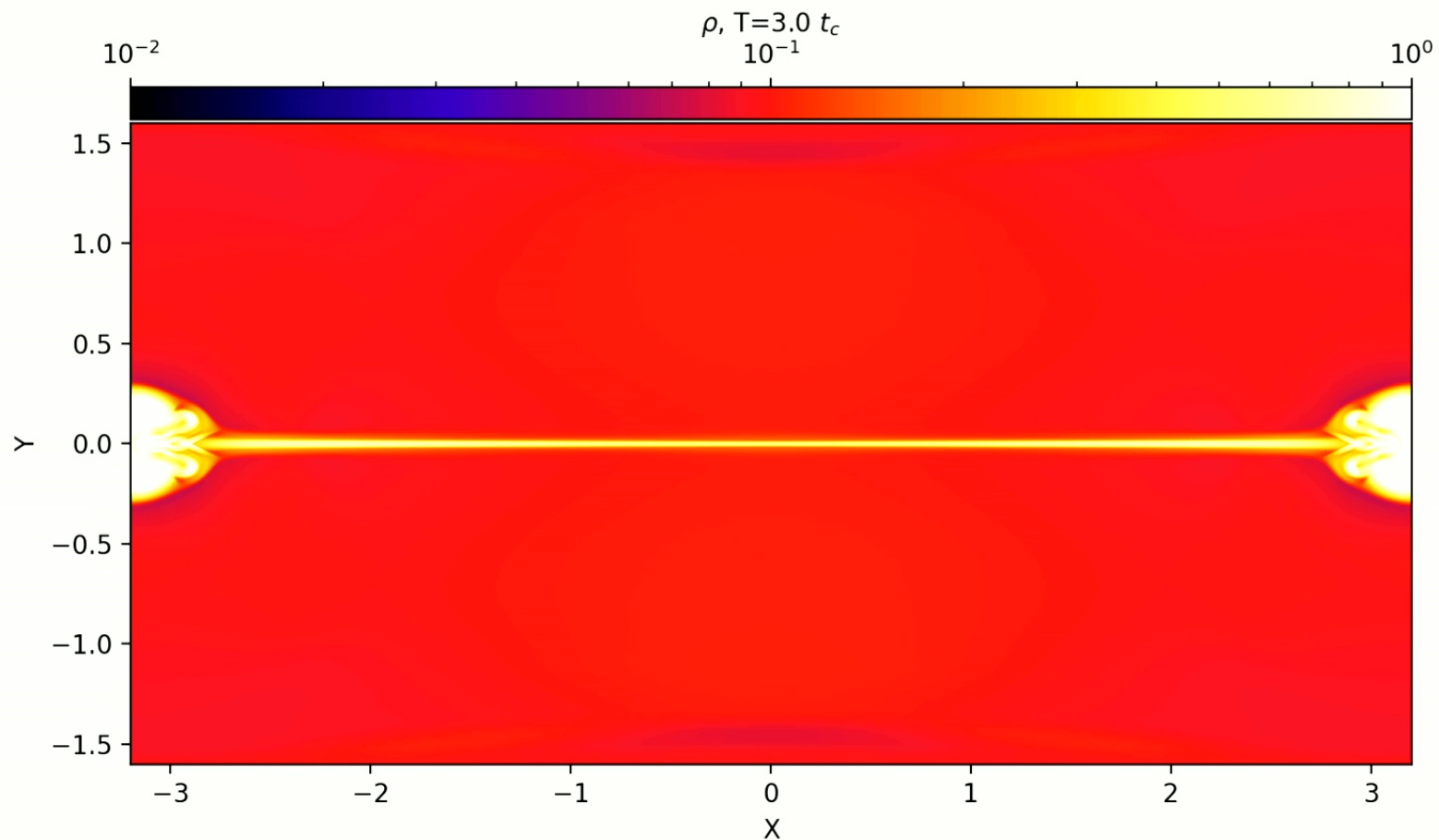
Vos et al. (2024)

What does a reference 2D current sheet look like?

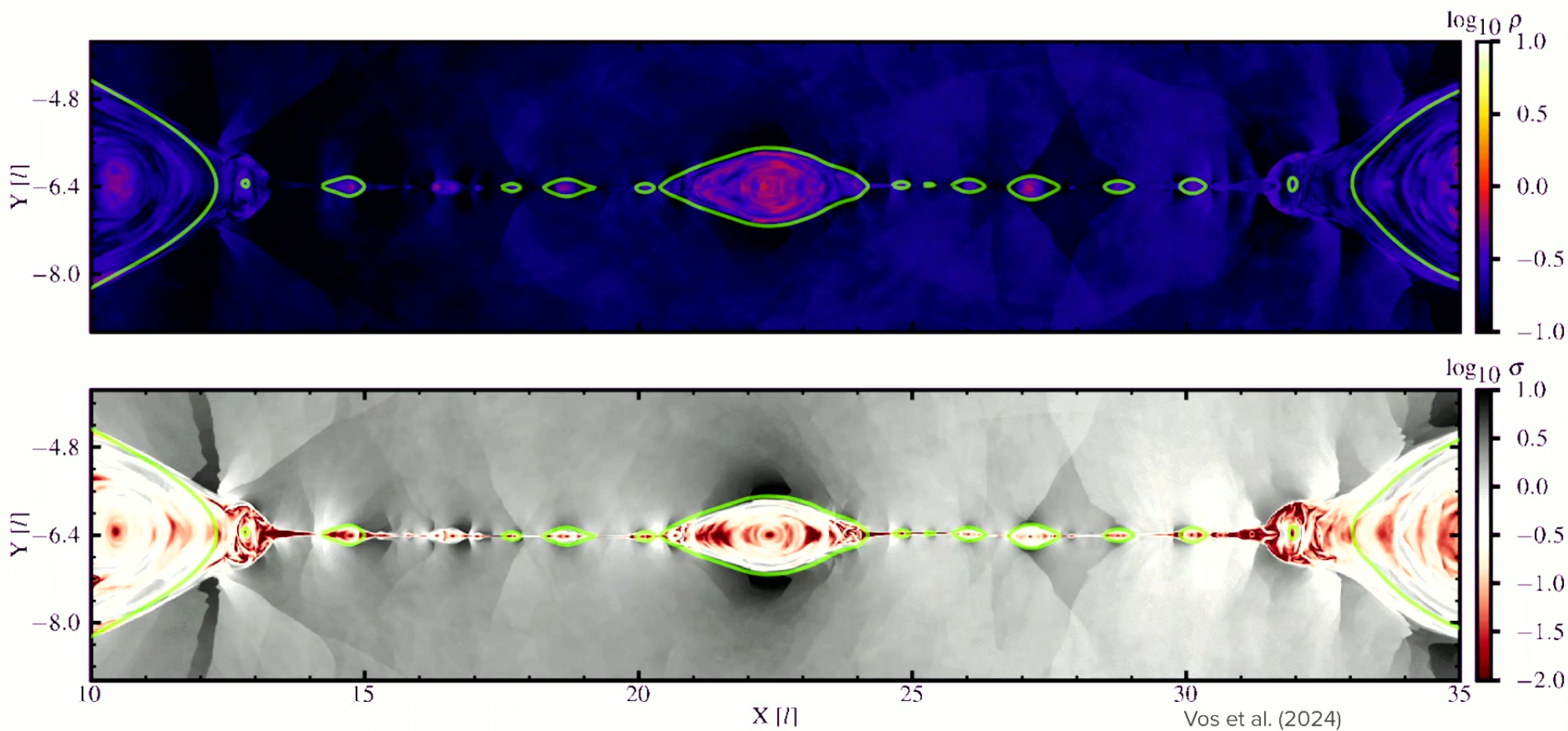
- Plasmoid-unstable regime, circular magnetic field structure, etc.



A 3D current sheet looks different: XY slice

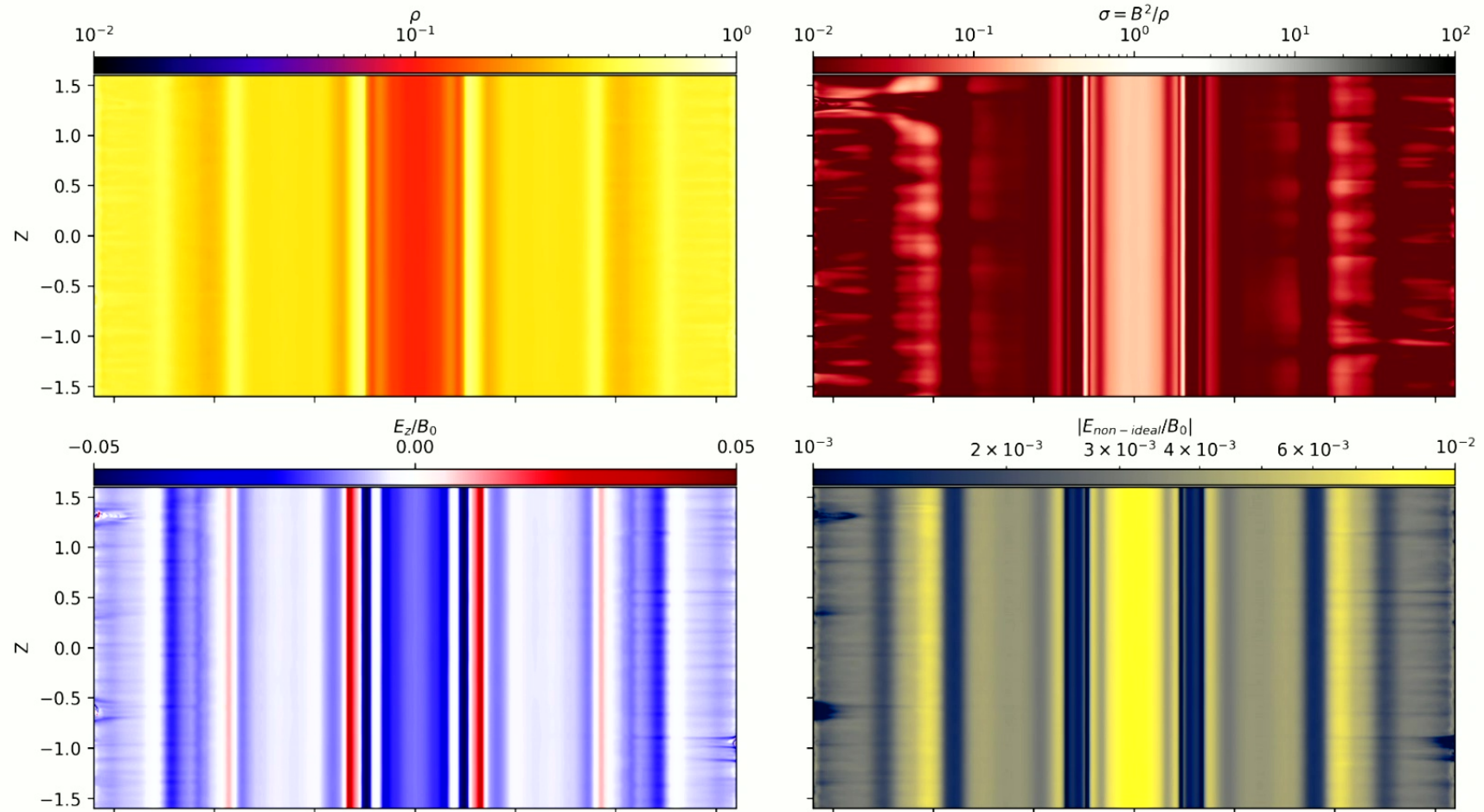


Detecting 2D plasmoids



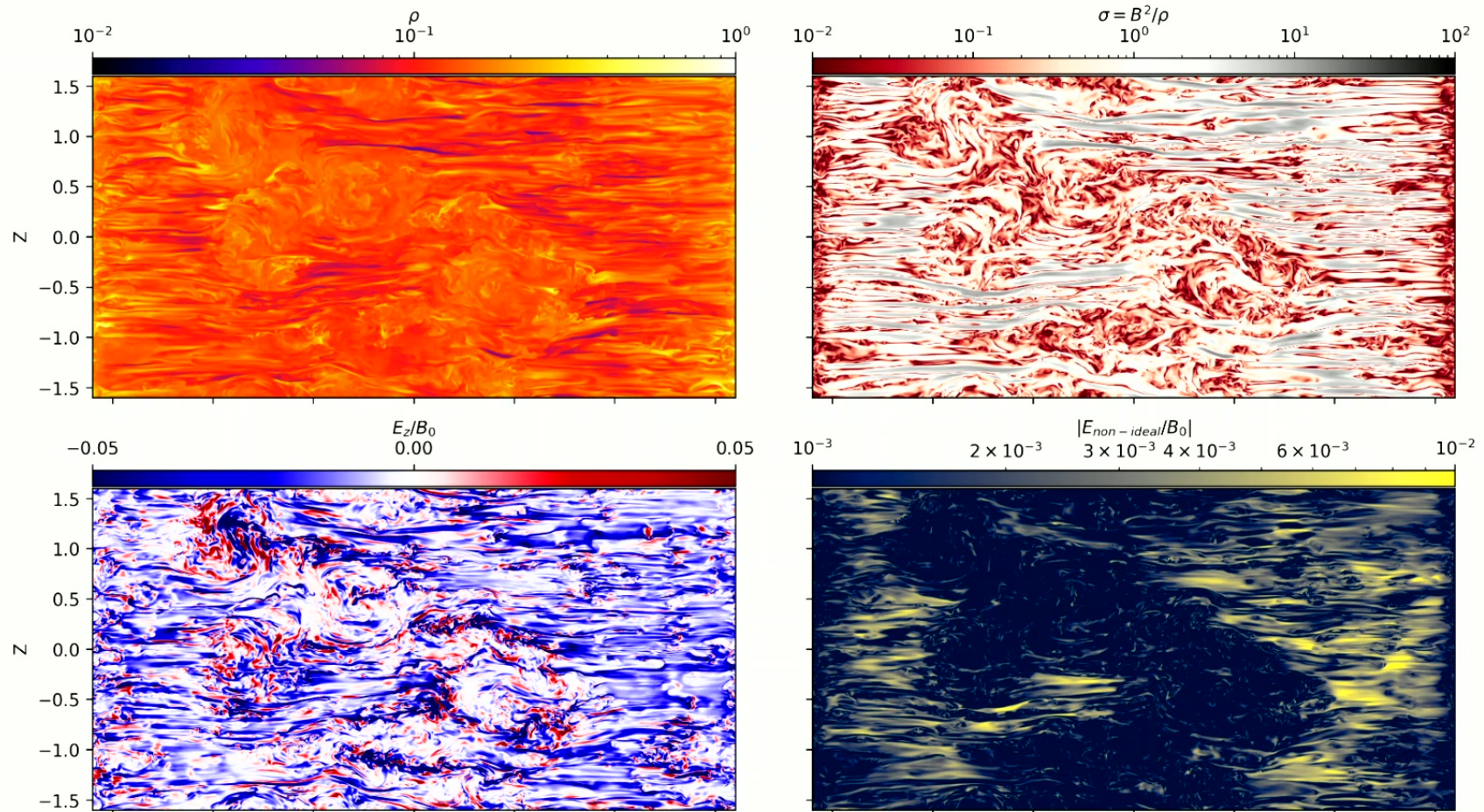
4

A 3D current sheet looks different: XZ slice



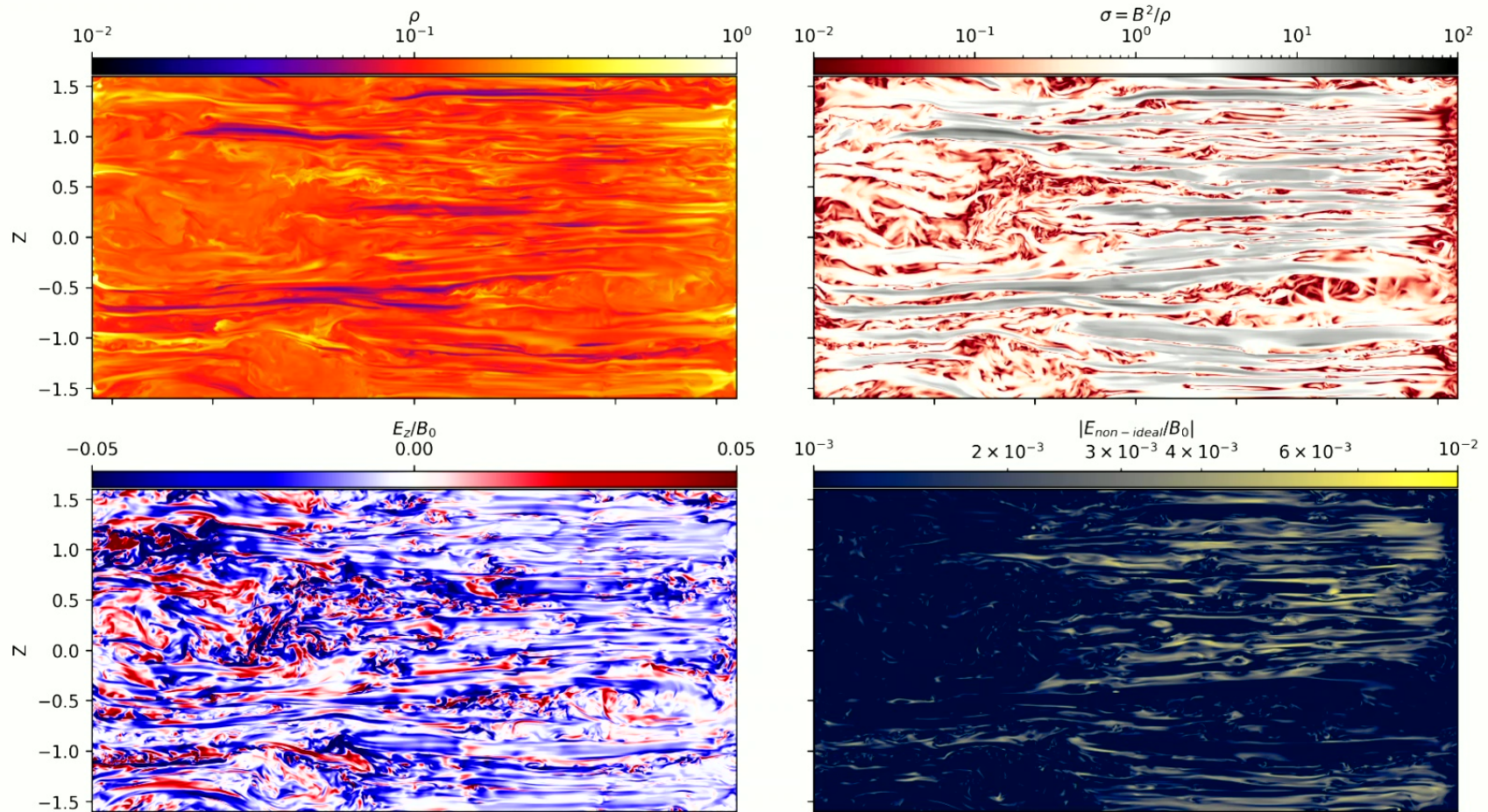
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A 3D current sheet looks different: XZ slice

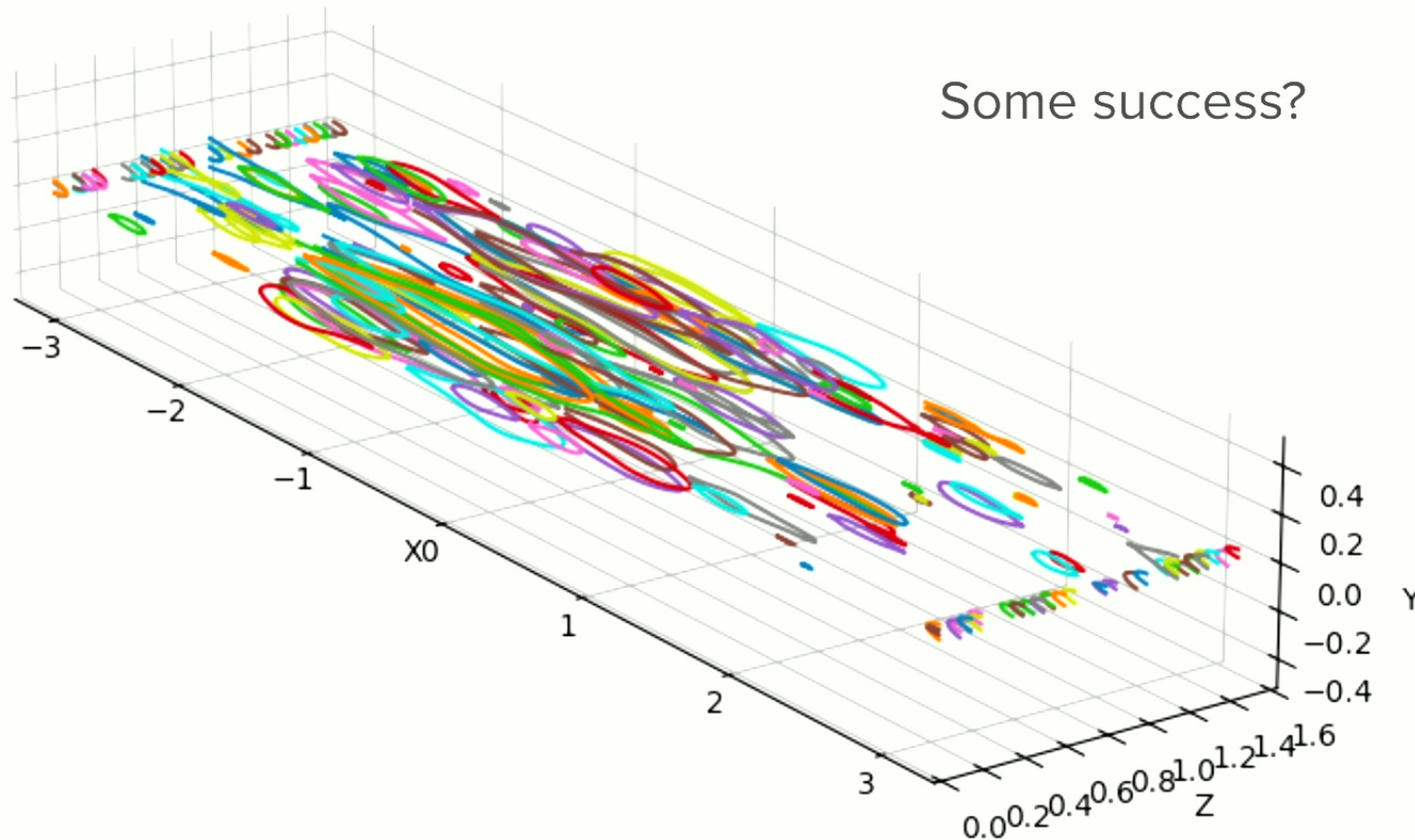


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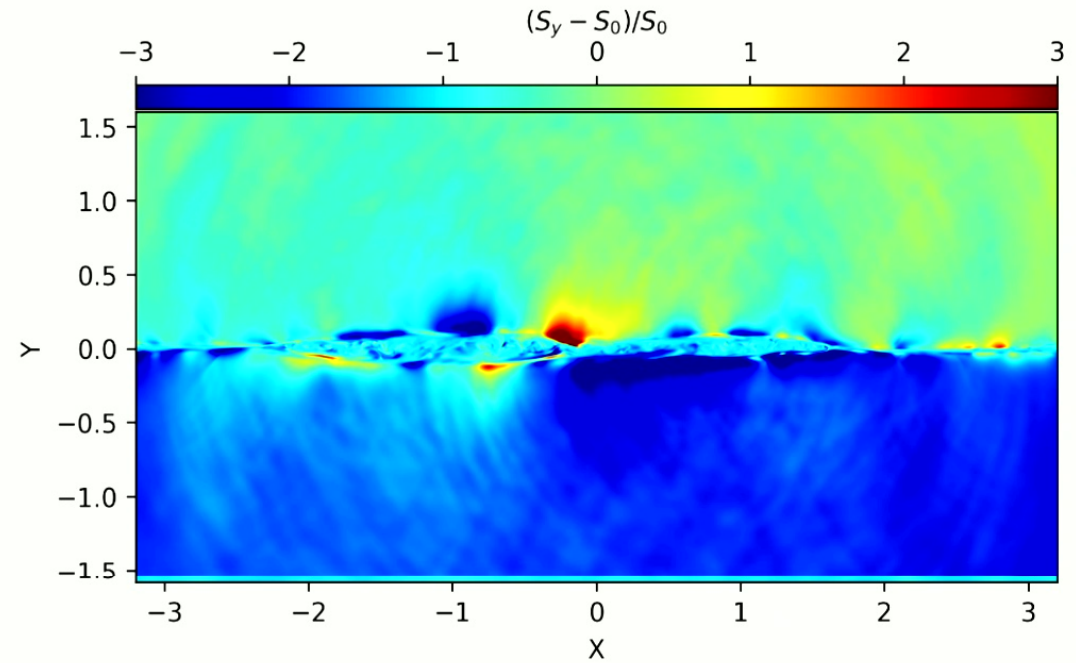
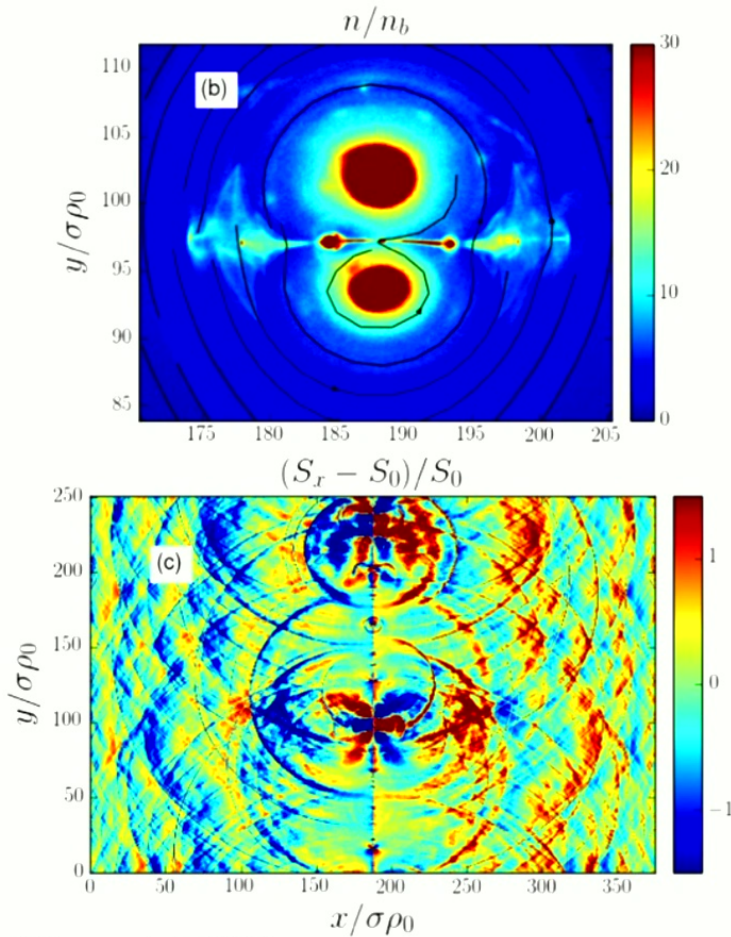
A 3D current sheet looks different: XZ slice



Attempts at identifying 3D flux rope structures



Poynting fluxes look more diffuse in 3D?



Suggestions are welcome!

Also here: jesse.vos@kuleuven.be

Philippov et al. (2019)

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