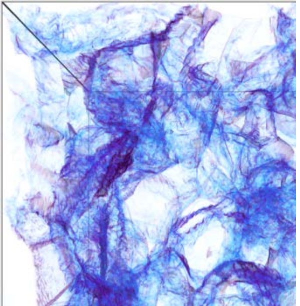

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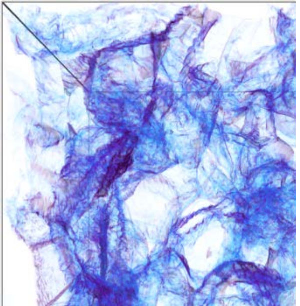
*"Subgrid models attempt to replace the physical processes of small scale dissipation with processes that mimic the nonlinear transfer of energy to smaller scales [...] The final goal is not to capture the dissipation processes, but to be able to preserve (with computational gains) the large-scale dynamics."*

Graham et al., PRE 80 (2009)



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# The Filtering Approach for MHD

- Induction equation for mean field:

$$\frac{\partial}{\partial t}\mathbf{B} = \nabla\times\left(\mathbf{v}\times\mathbf{B}\right) + \eta\nabla^2\mathbf{B}$$

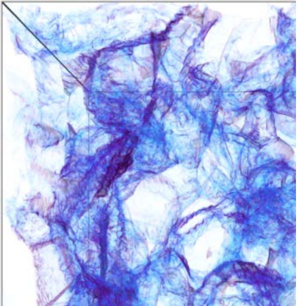
$$\rightarrow \quad \frac{\partial}{\partial t}\bar{\mathbf{B}} = \nabla\times\left\langle\mathbf{v}\times\mathbf{B}\right\rangle$$

- Simple model: α-dynamo and turb. magnetic diffusion

magnetic reconnection

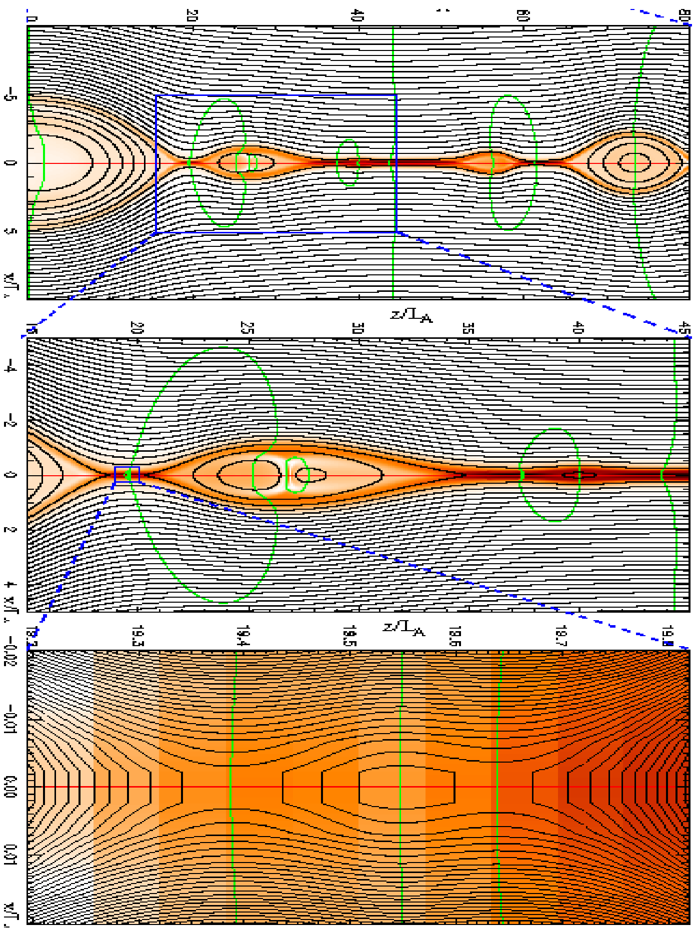
$$\nabla\times\left\langle\mathbf{v}\times\mathbf{B}\right\rangle \doteq \nabla\times\left(\tilde{\mathbf{v}}\times\bar{\mathbf{B}}\right) + \boldsymbol{\alpha}\cdot\bar{\mathbf{B}} + \eta_{\text{turb}}\nabla^2\bar{\mathbf{B}}$$

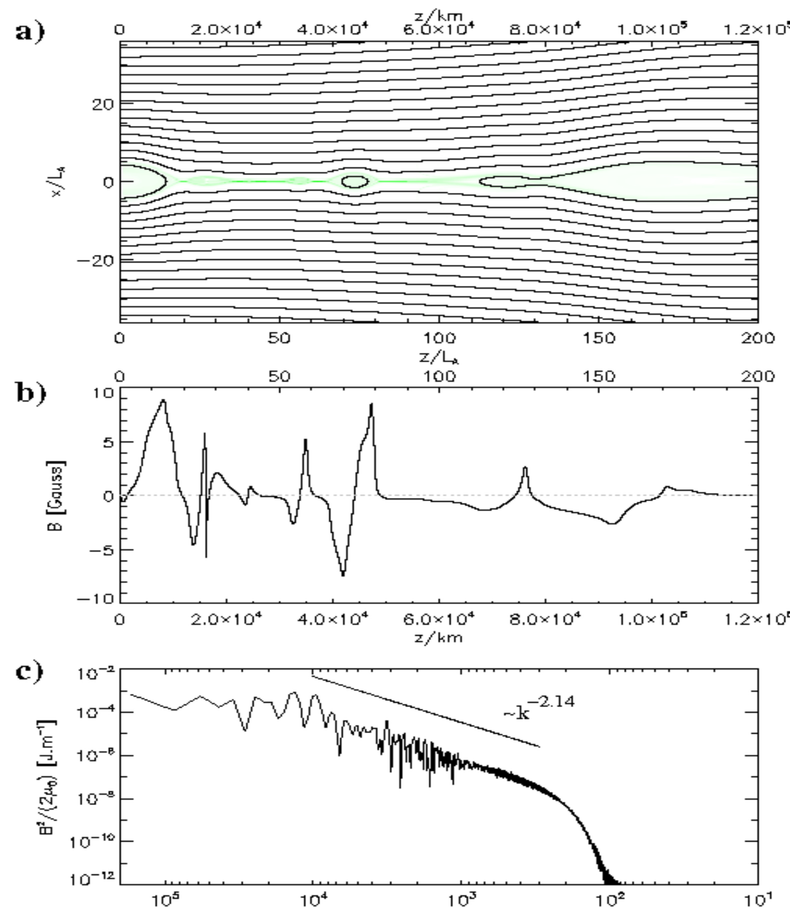
- Can we apply something like this in LES? If so, how to determine the model coefficients?



# Turbulent Reconnection on Microscales

- Determination of **effective transport coefficients** for microturbulent reconnection
- Kinetic simulations of small-scale processes




Barta, Büchner et al. 2011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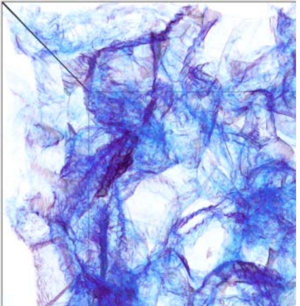

# From the Kinetic Regime to Magnetohydrodynamics