The three phases of the KHI dynamo

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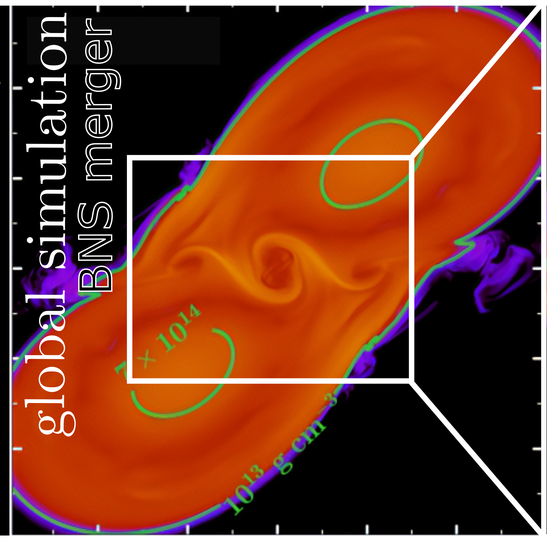
Motivation:

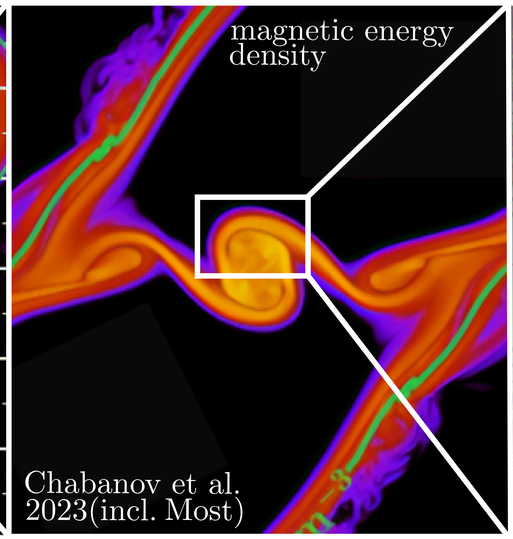
Merging compact bodies excite a strong $\boldsymbol{\nabla} \otimes \boldsymbol{u}$ layer between one another. Through

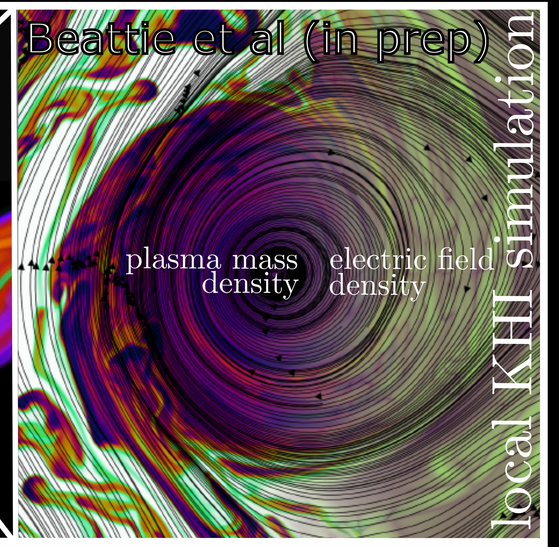
$$\partial_t B_i B^i/2 \propto B_i B^j \partial_j u^i$$

the $\boldsymbol{\nabla} \otimes \boldsymbol{u}$ couples the kinetic reservoir to the $\partial_t B_i B^j$ generation, creating a dynamo. Dynamos come in many different flavours, e.g., small-scale, large-scale dynamo, raising the questions:

1) What kind of dynamo is the KHI?
2) Is it possible to seed large-scale poloidal fields with KHI, facilitating a BZ jet formation path?

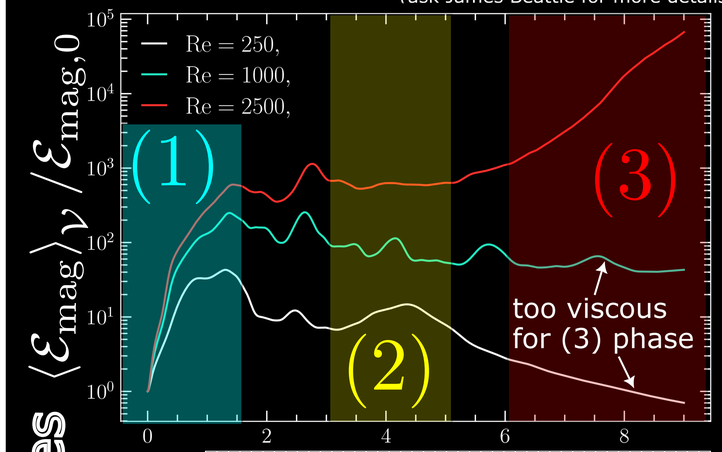


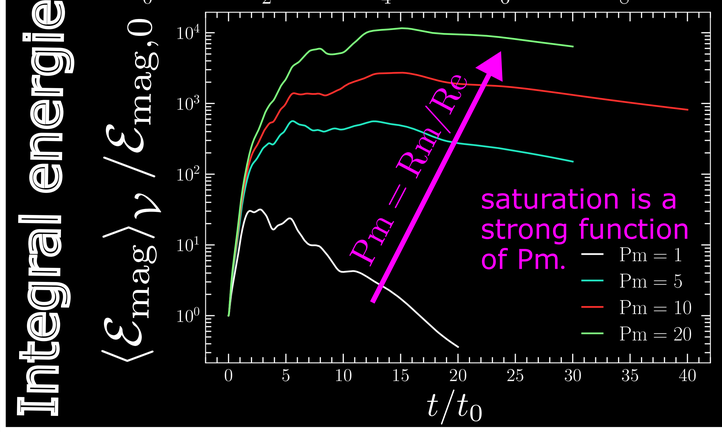


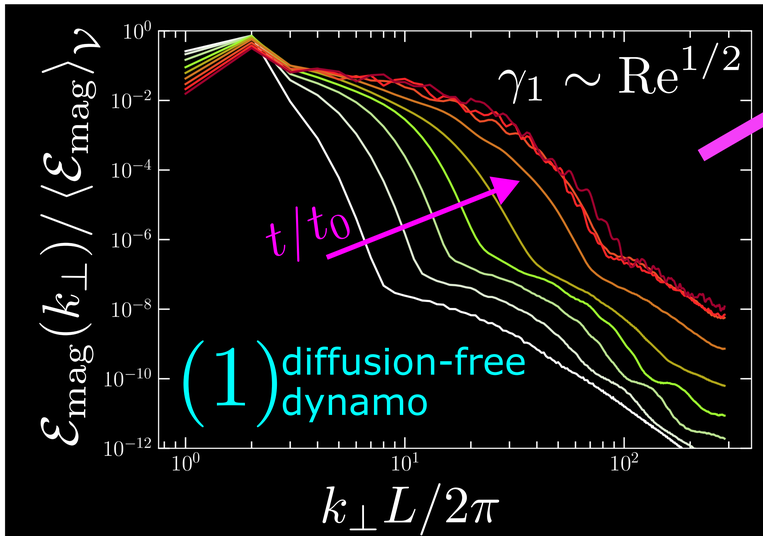


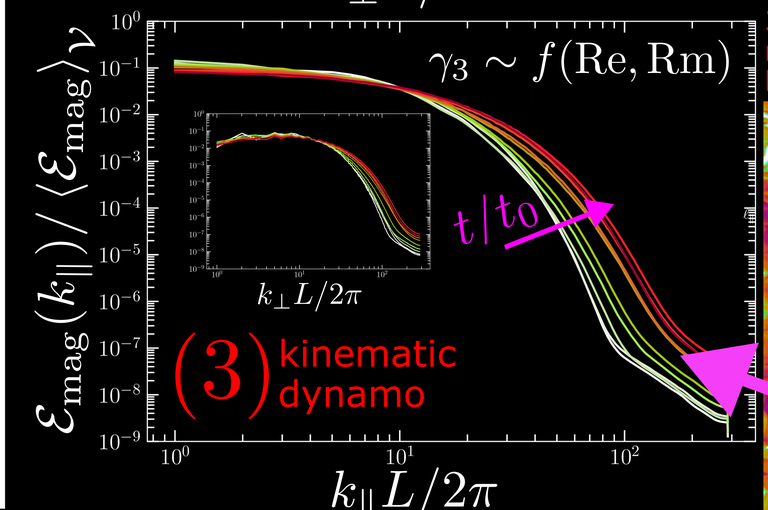
Local KHI dyn. simulations

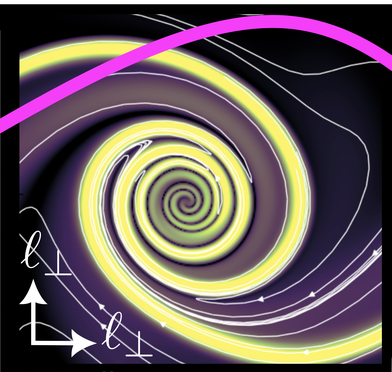
3D Newtonian visco-resistive MHD KHI initialized with weak, Gaussian B-field
(ask James Beattie for more details)





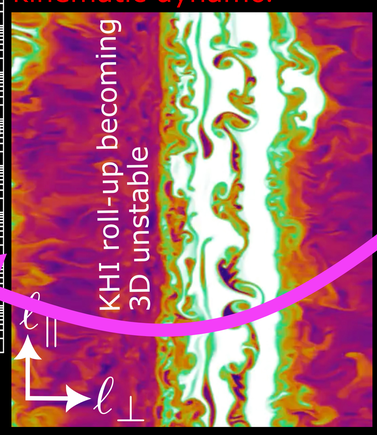






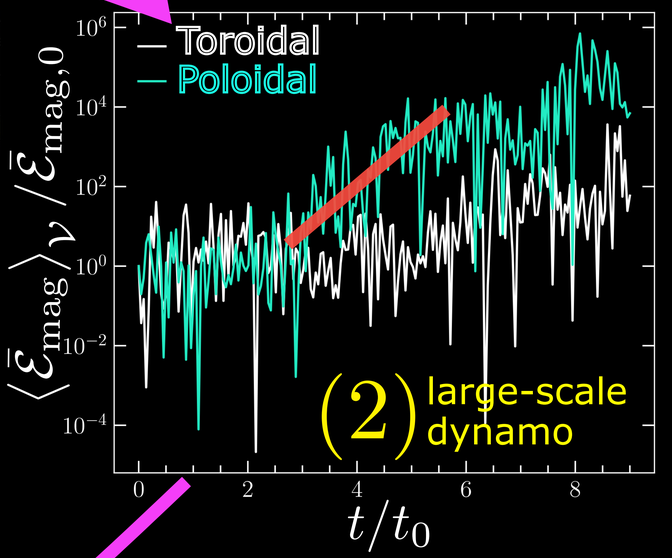
KHI roll-up causes extremely, high-k, folded magnetic field geometry and diffusion-free style fast dynamo.

3D-modes go unstable, resulting in a second fast, kinematic dynamo.



The Three Phases

Total volume-integral energy becomes stationary, but large-scale poloidal field grows exponentially.



Conclusions

KHI dynamo is multi-phase, with both large-scale and small-scale components. Both Pm and Re change saturation and growth rates of the dynamos. More soon!