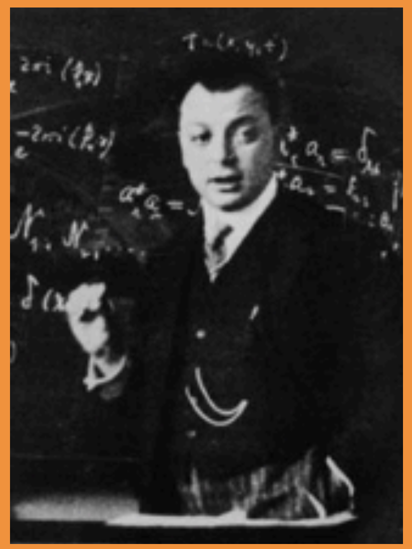
Spotify



Wolfgang Pauli Institute, Vienna

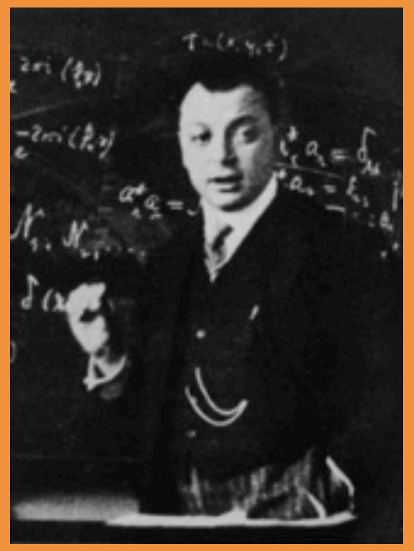
14th Plasma Kinetics Working Meeting

24 July - 4 August, 2023

Wrapped is here.

#WPIWRAPPED

Spotify



Wolfgang Pauli Institute, Vienna

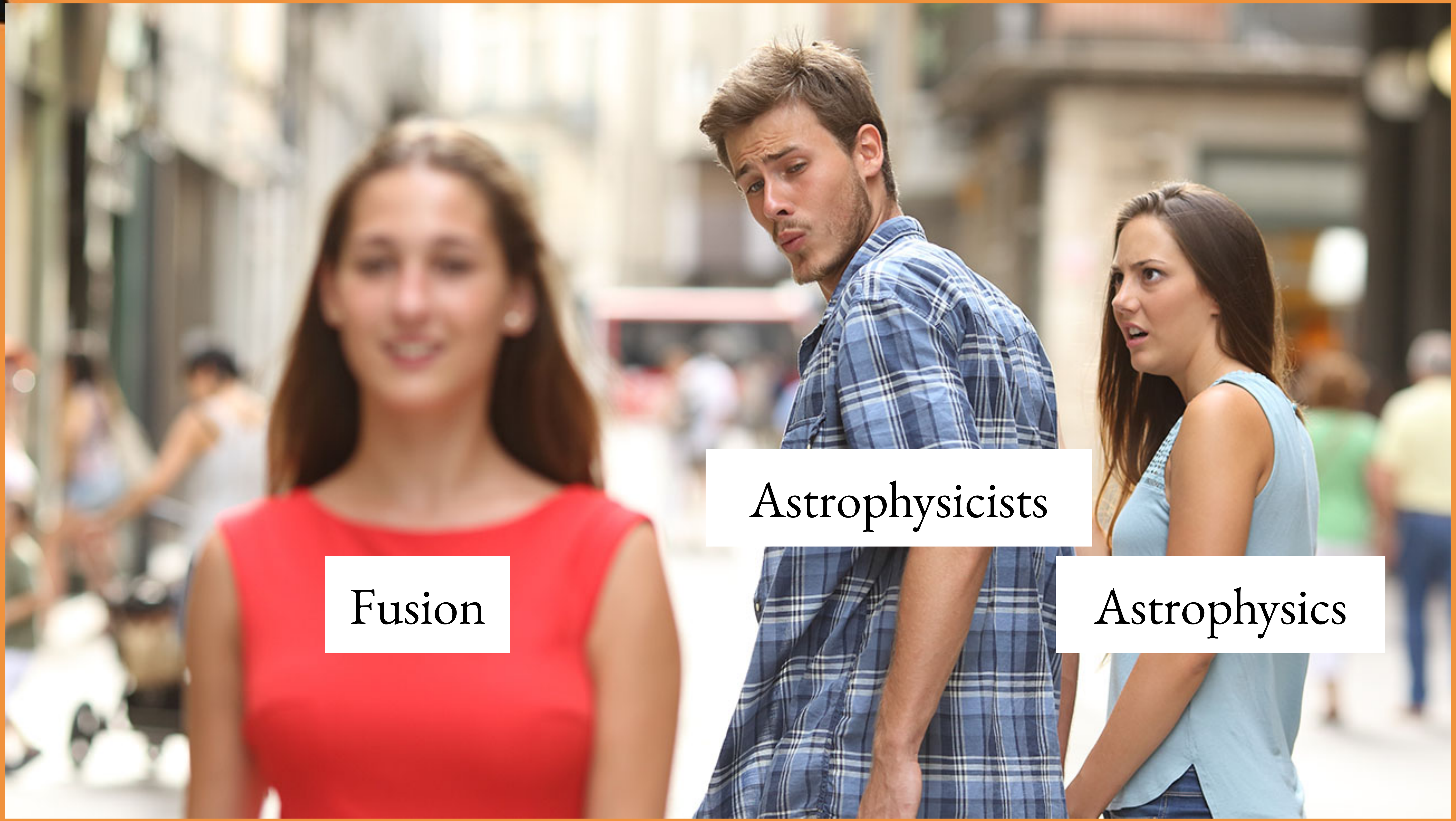
14th Plasma-Kinetics Working Meeting

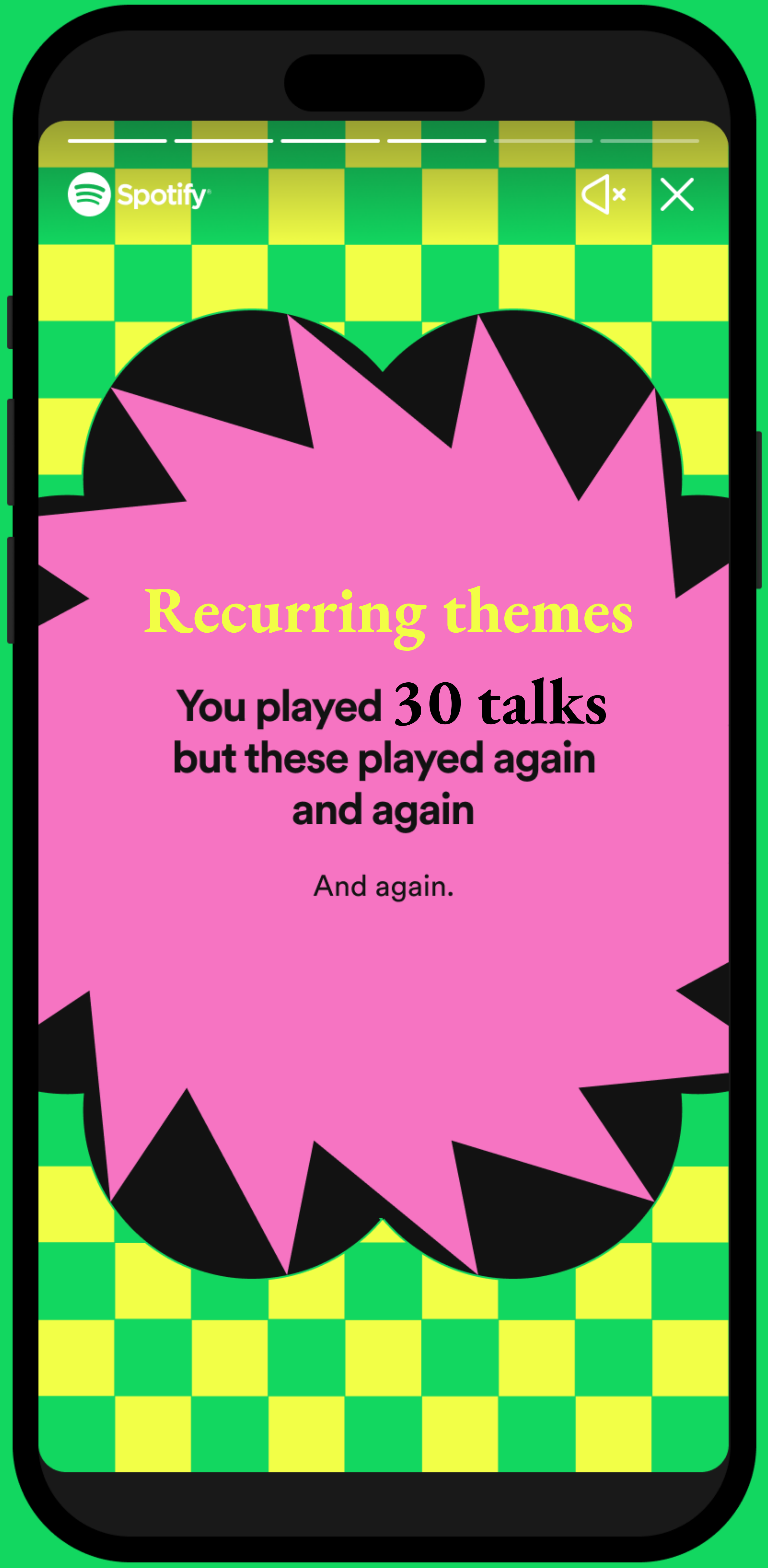
24 July - 4 August, 2023

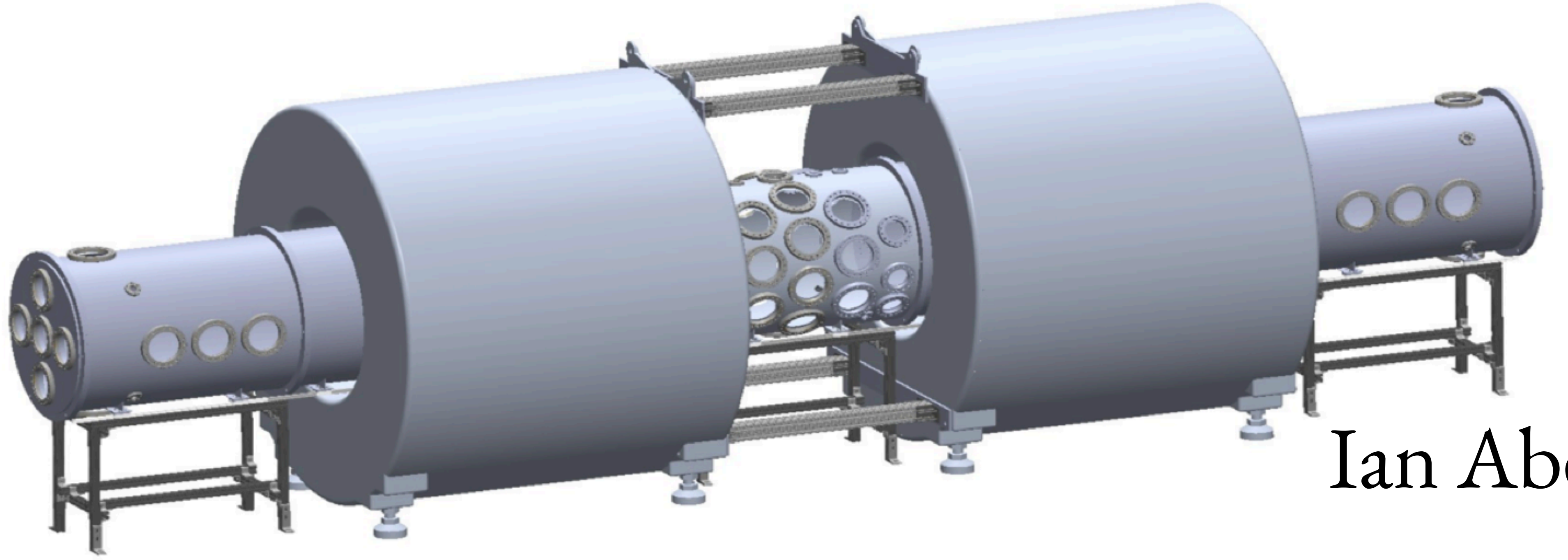
Wrapped is here.

#WPIWRAPPED

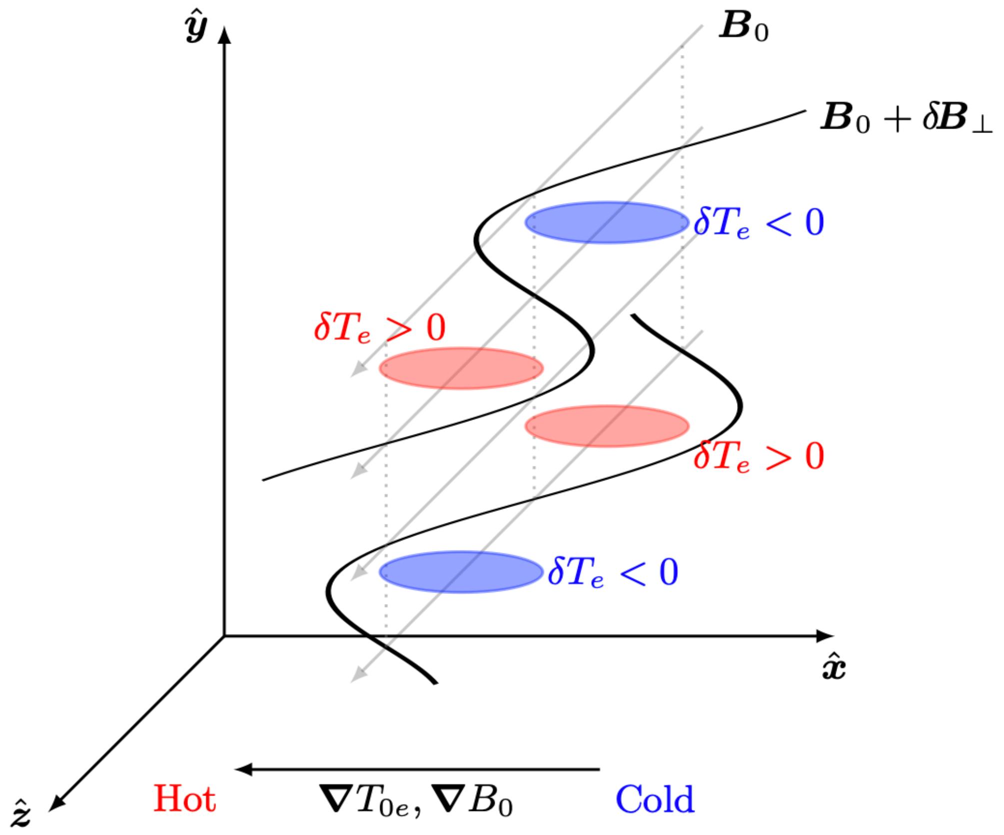

Ladies and gentlemen, it has been a very good year for the Society


Fusion
Astrophysicists
Astrophysics


Spotify
Recurring themes
You played 30 talks
but these played again
and again
And again.



Ian Abel



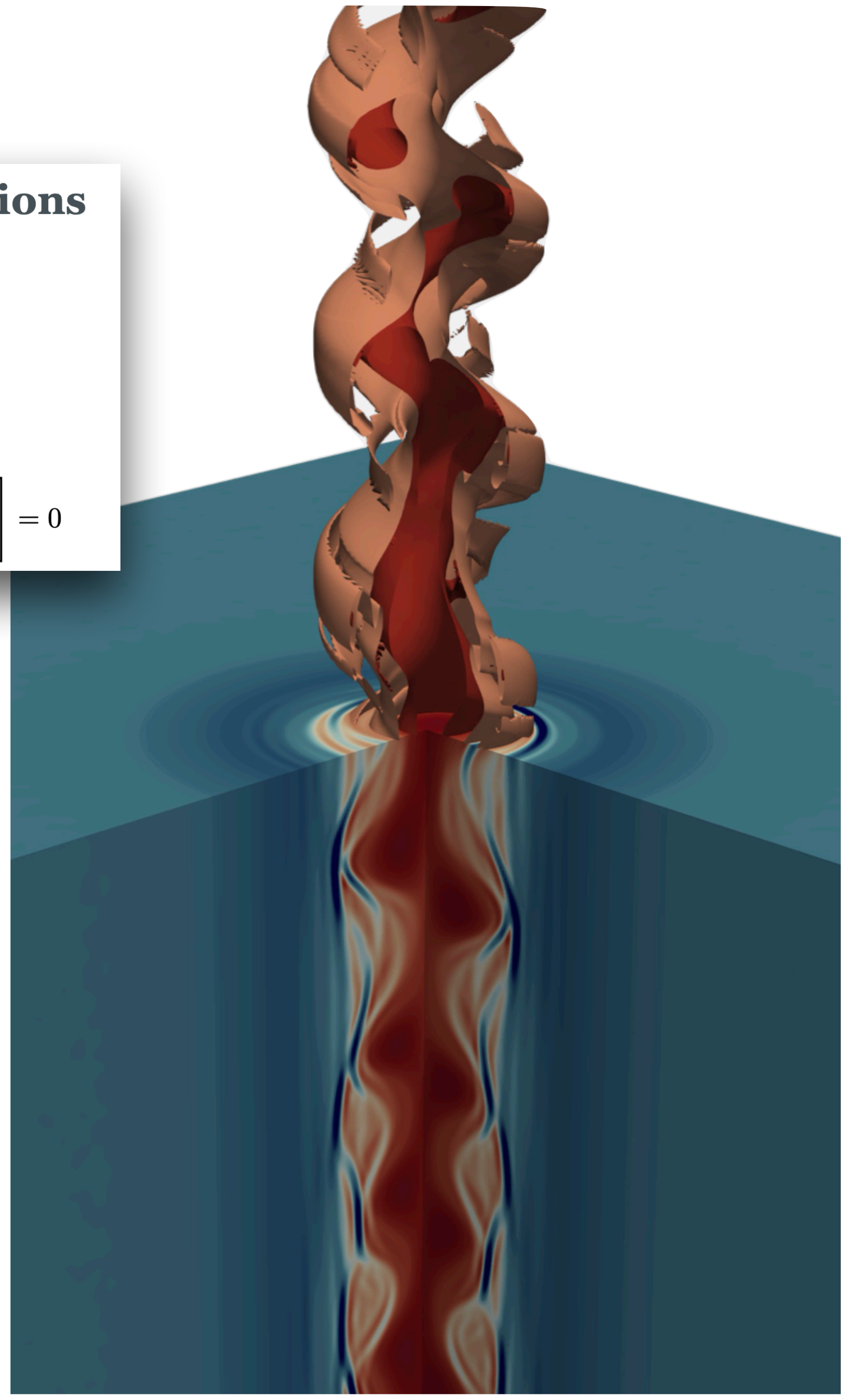
Toby Adkins

Summary of rational surface conditions

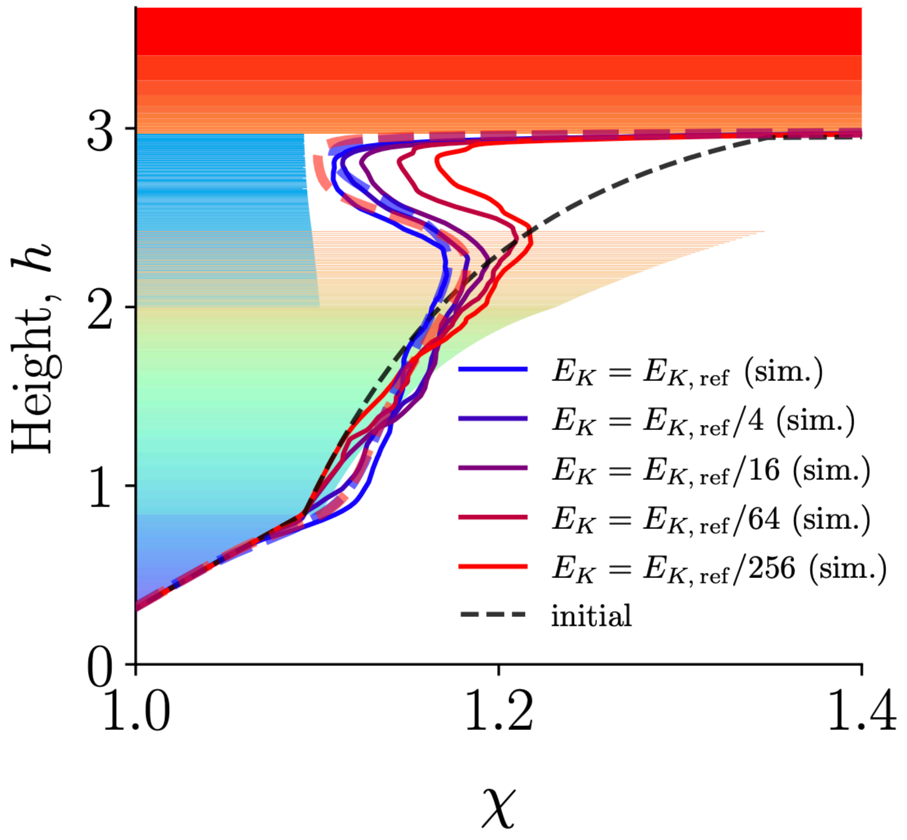
- Hamada condition: $P' \frac{\mathrm{d}}{\mathrm{d}\alpha}\left(\oint \frac{\mathrm{d}l}{B}\right) = 0$
- New condition

$$\frac{\mathrm{d}}{\mathrm{d}\alpha}\left[\left(\oint \frac{B}{|\nabla\rho|^2}\,\mathrm{d}l\right)^{-1}\left(\frac{c\iota'\Psi_t'}{4\pi}\oint \mathrm{d}v - \oint \frac{J_{PS}}{|\nabla\rho|^2}\,\mathrm{d}l + \frac{c}{4\pi}\oint \frac{[\mathbf{B}\cdot\nabla\hat{\mathbf{n}}\cdot(\mathbf{B}\times\hat{\mathbf{n}}) + (\mathbf{B}\times\hat{\mathbf{n}})\cdot\nabla\hat{\mathbf{n}}\cdot\mathbf{B}]}{B|\nabla\rho|^2}\,\mathrm{d}l\right)\right] = 0$$

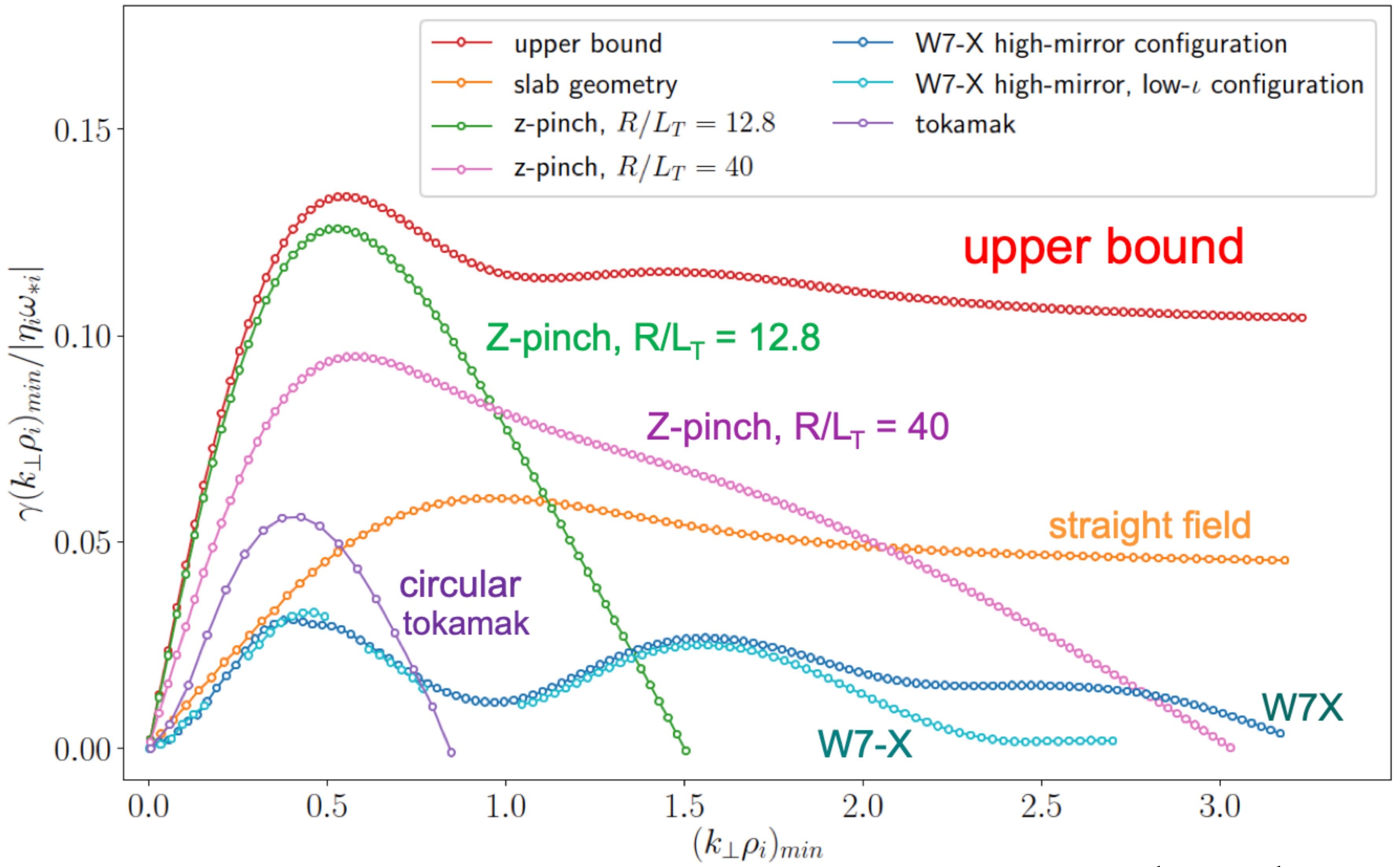
Felix Parra



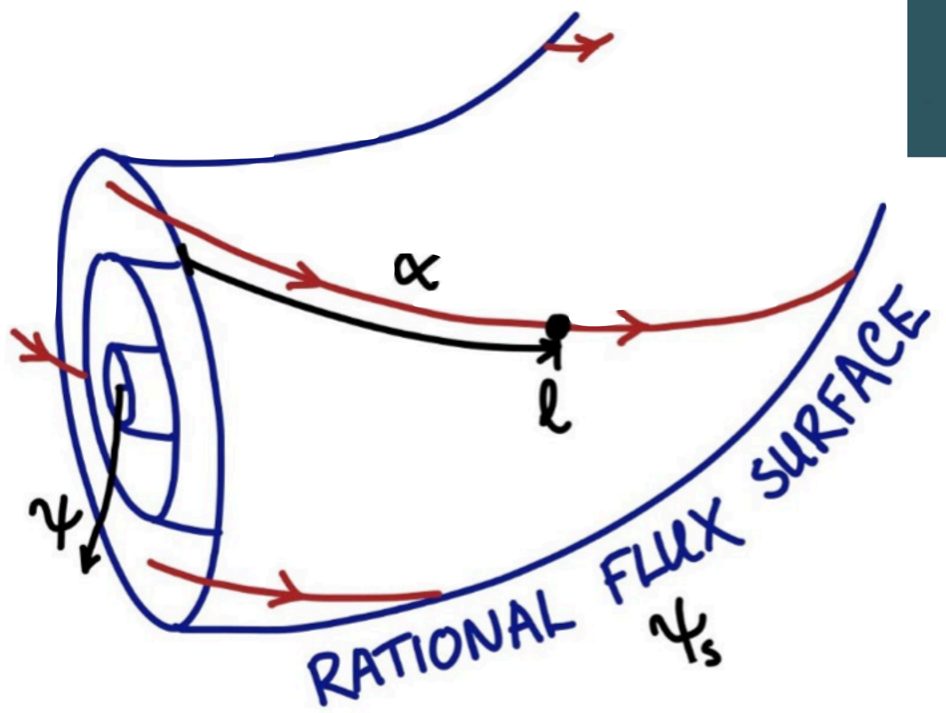
Alex Velberg



David Hosking

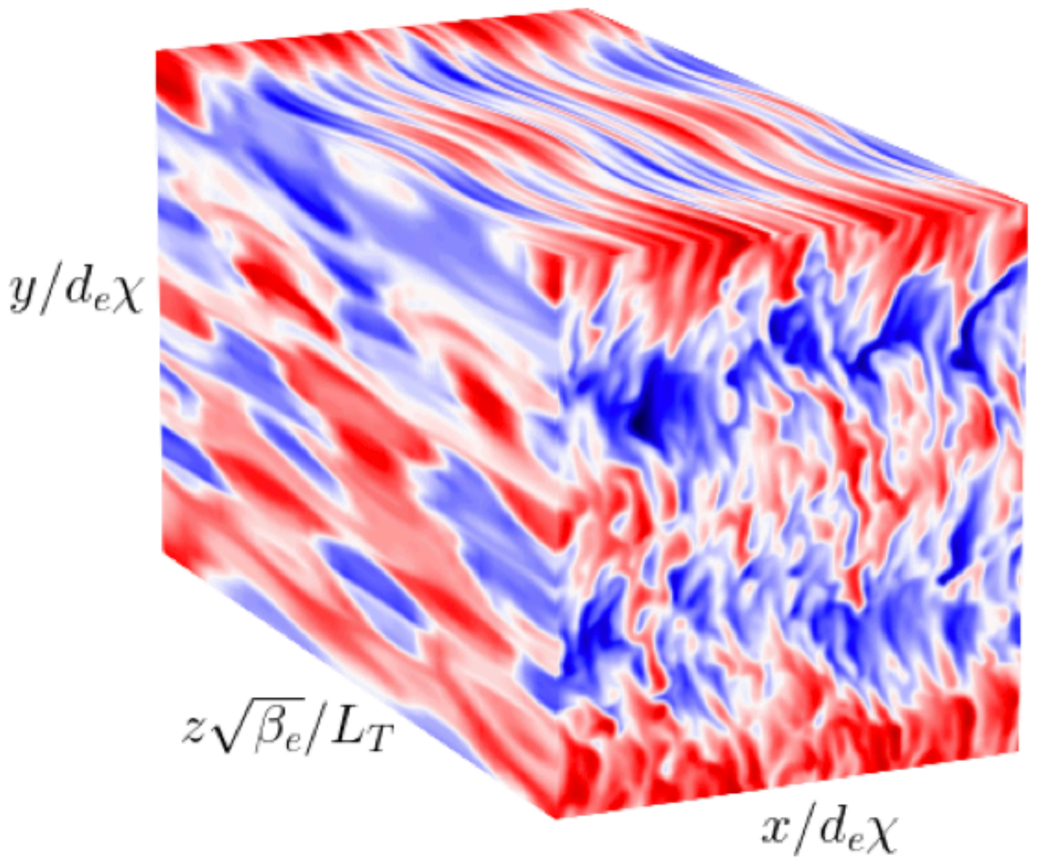


Per Helander

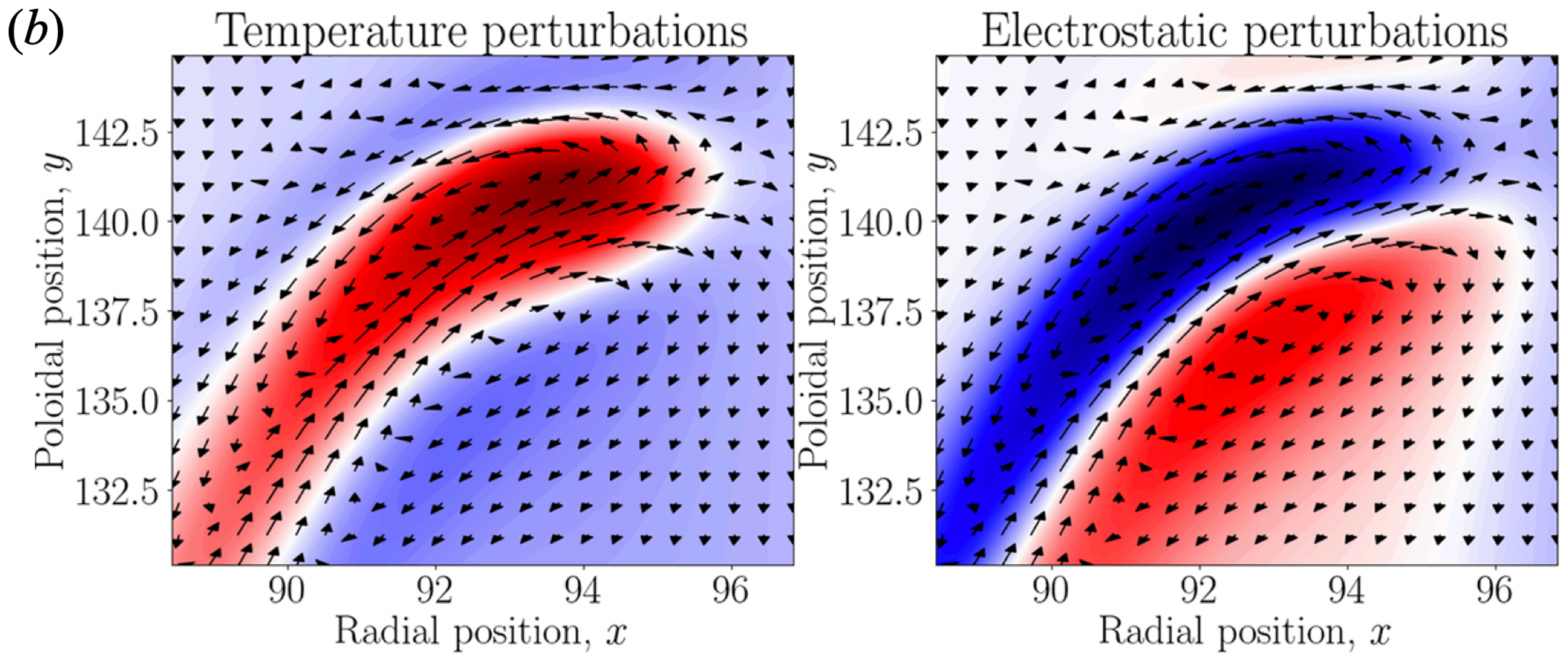


Thomas Foster

Equilibria and stability

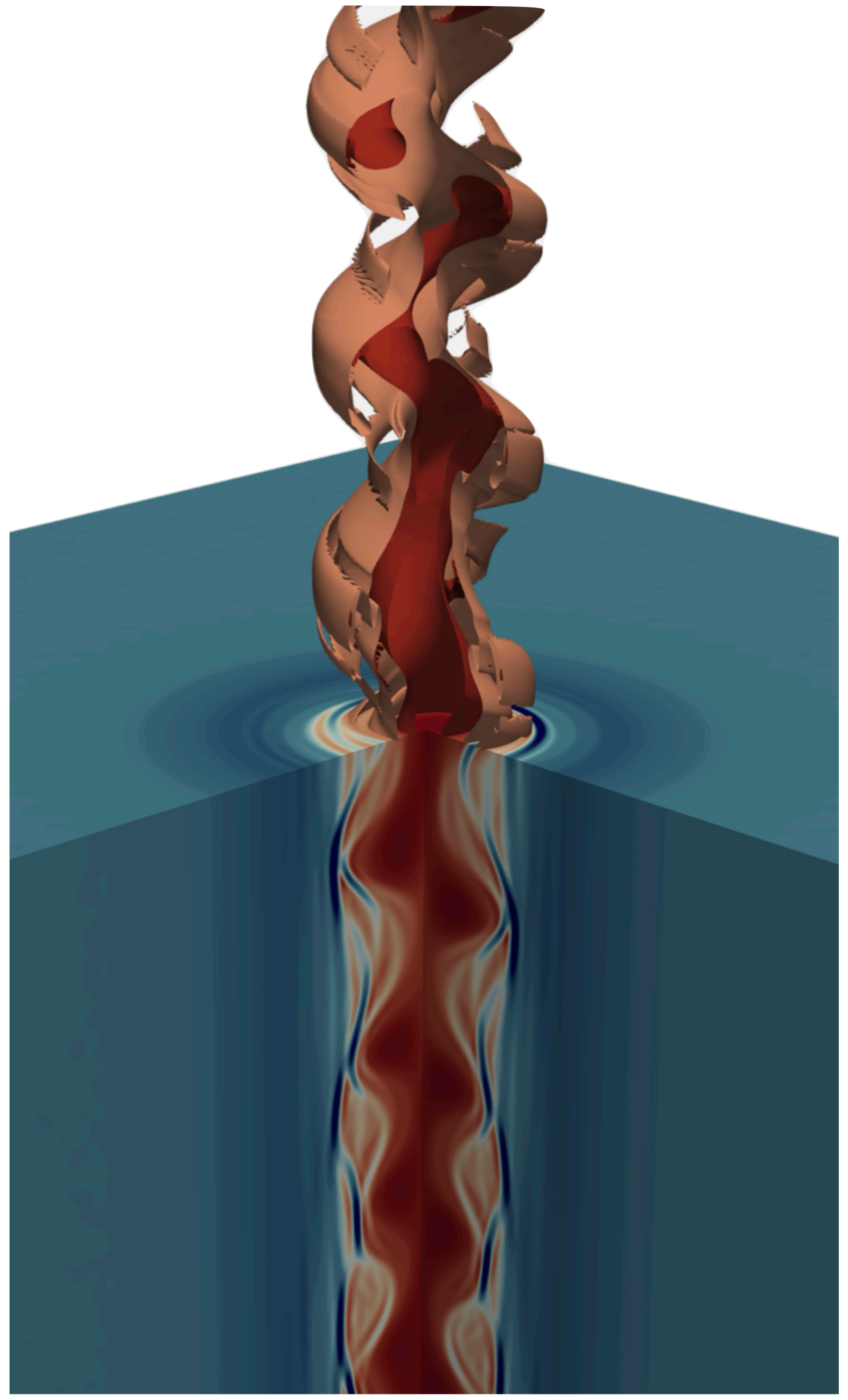


Toby Adkins

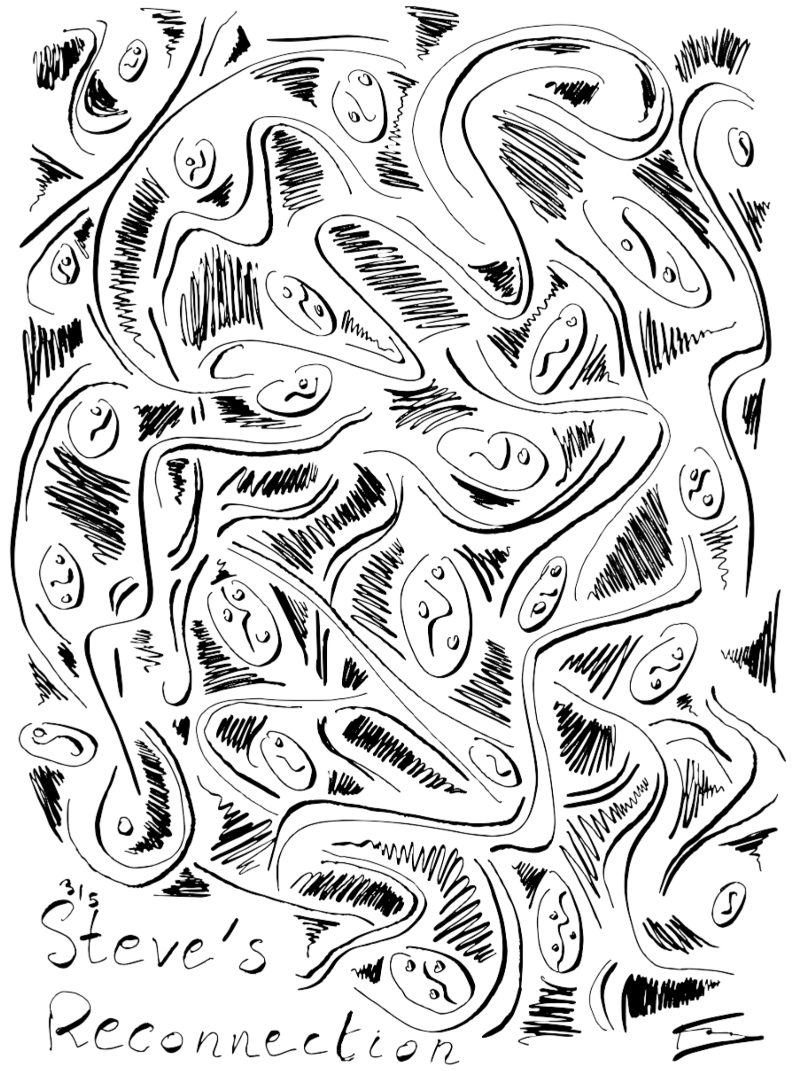


Plamen Ivanov

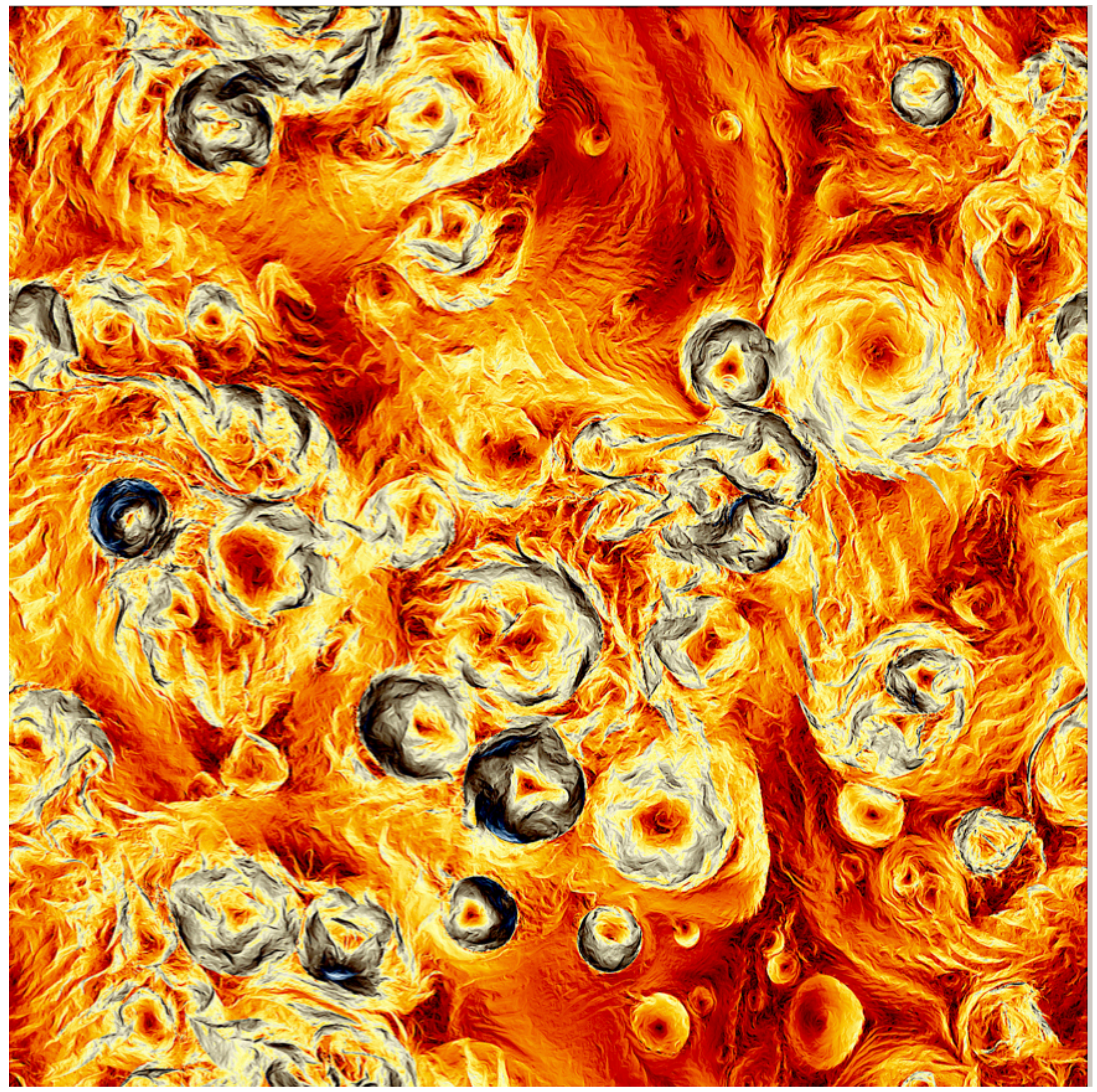
Nuno Loureiro



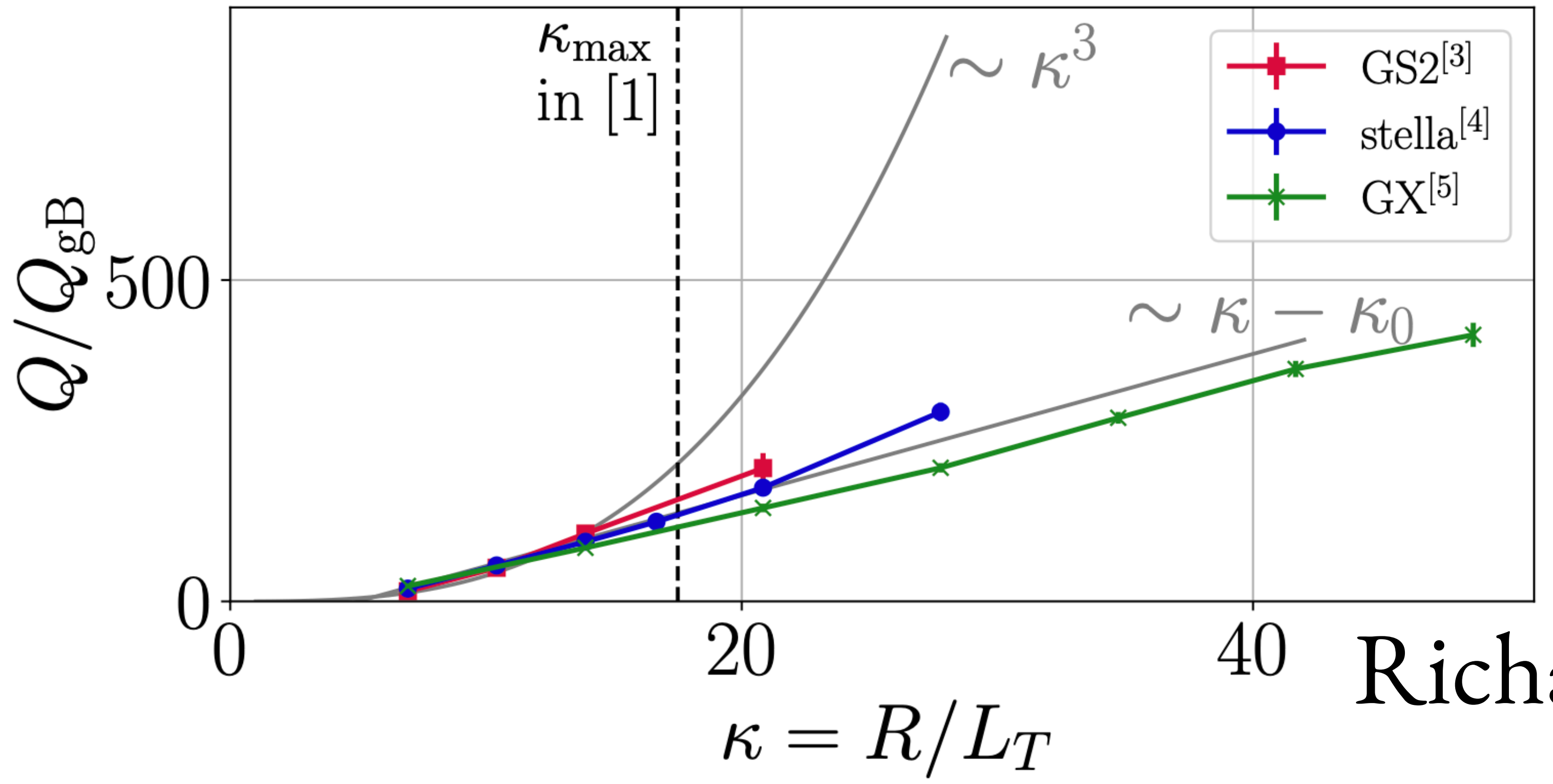
Alex Velberg



Steve Cowley



Romain Meyrand

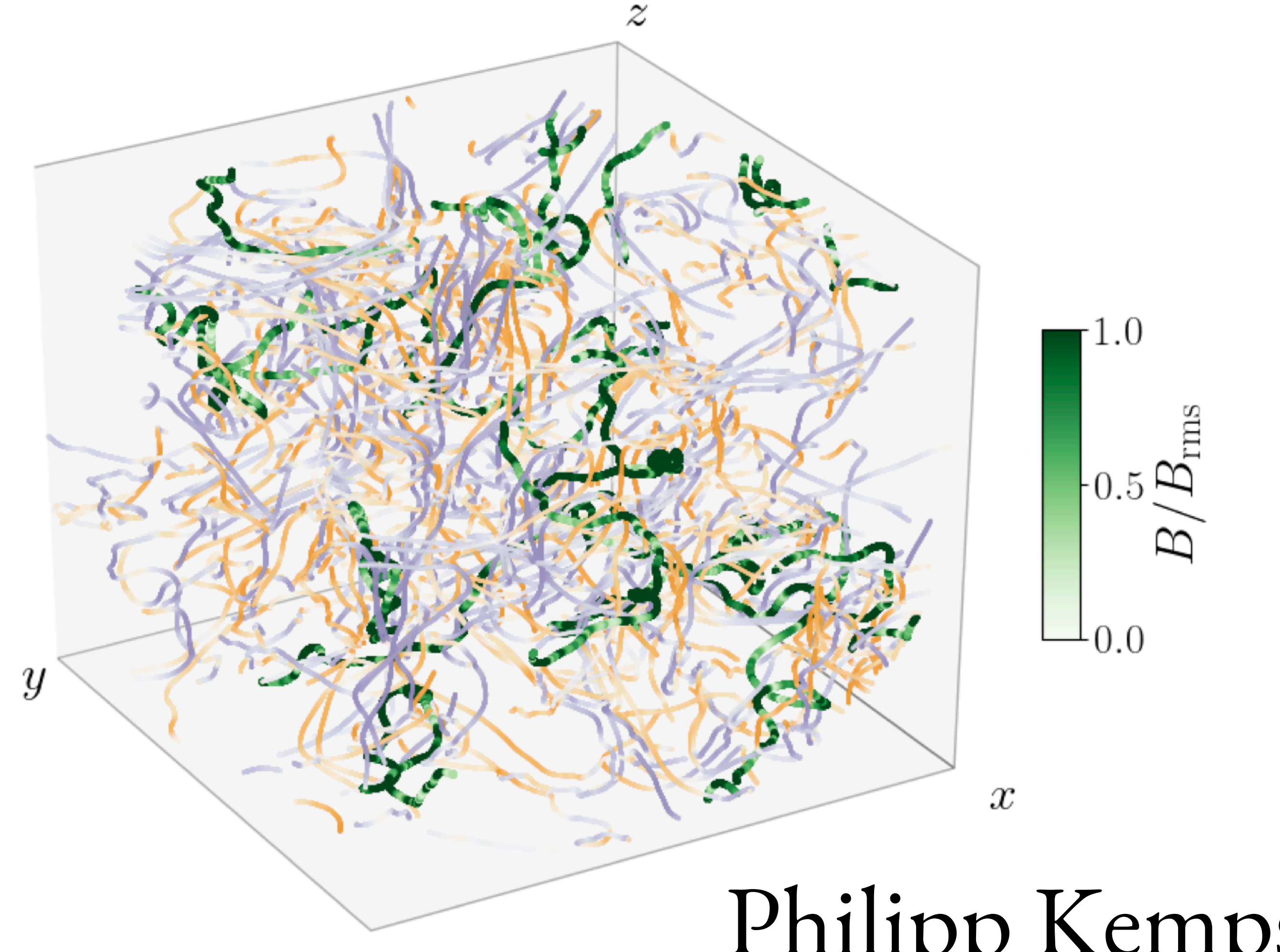


Richard Nies

$$\Delta\beta \sim 1 \quad \longrightarrow \quad \frac{\delta B_\parallel}{B_0} \sim \frac{\delta B_\perp}{B_0} \sim \frac{1}{\beta} \sim \Delta \sim \frac{\delta\rho}{\rho_0} \sim \frac{u_\perp}{v_A} \sim \frac{u_\parallel}{v_{th}} \sim \epsilon$$

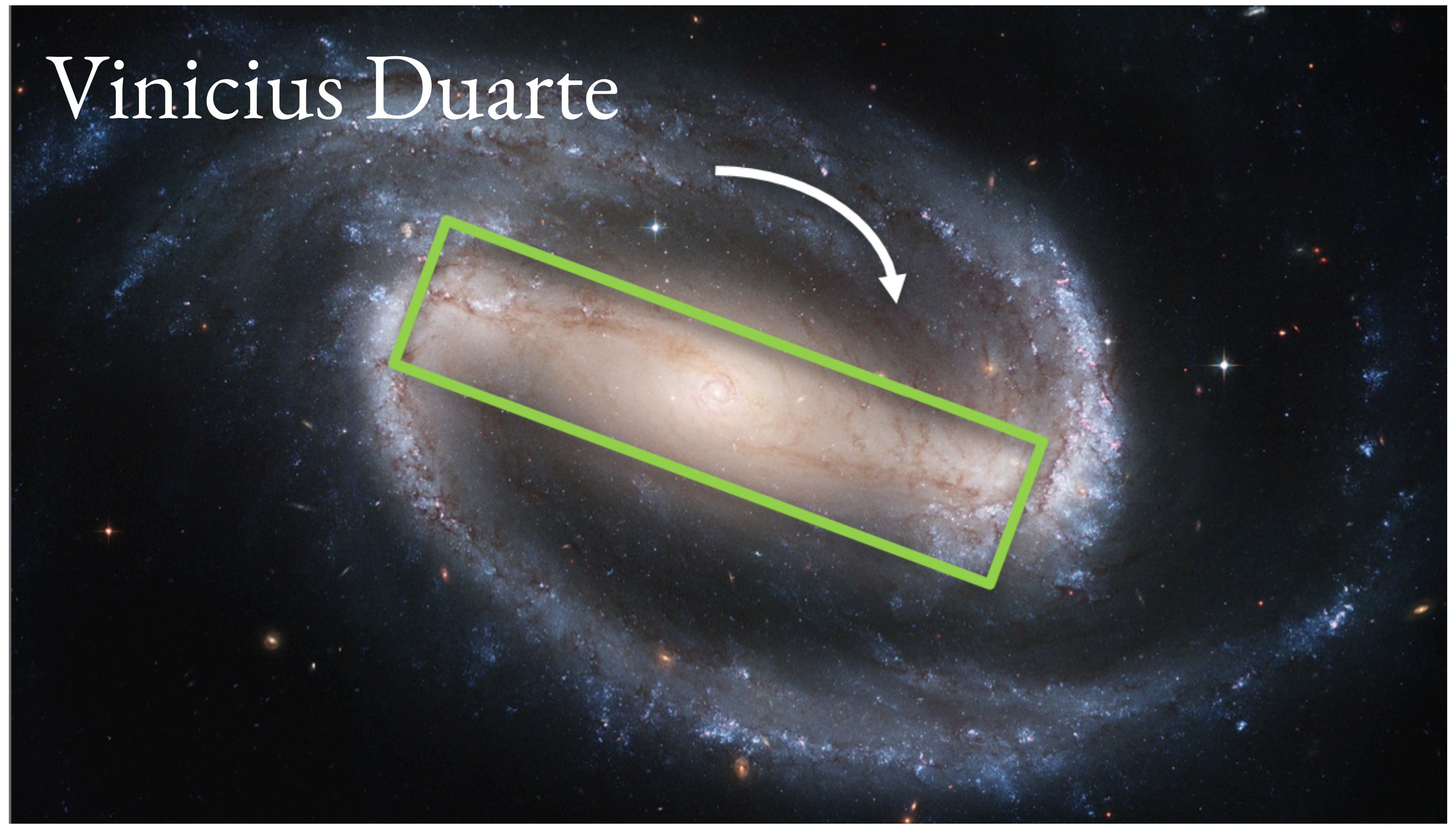
Steve Majeski

Magnetic reconnection and turbulence

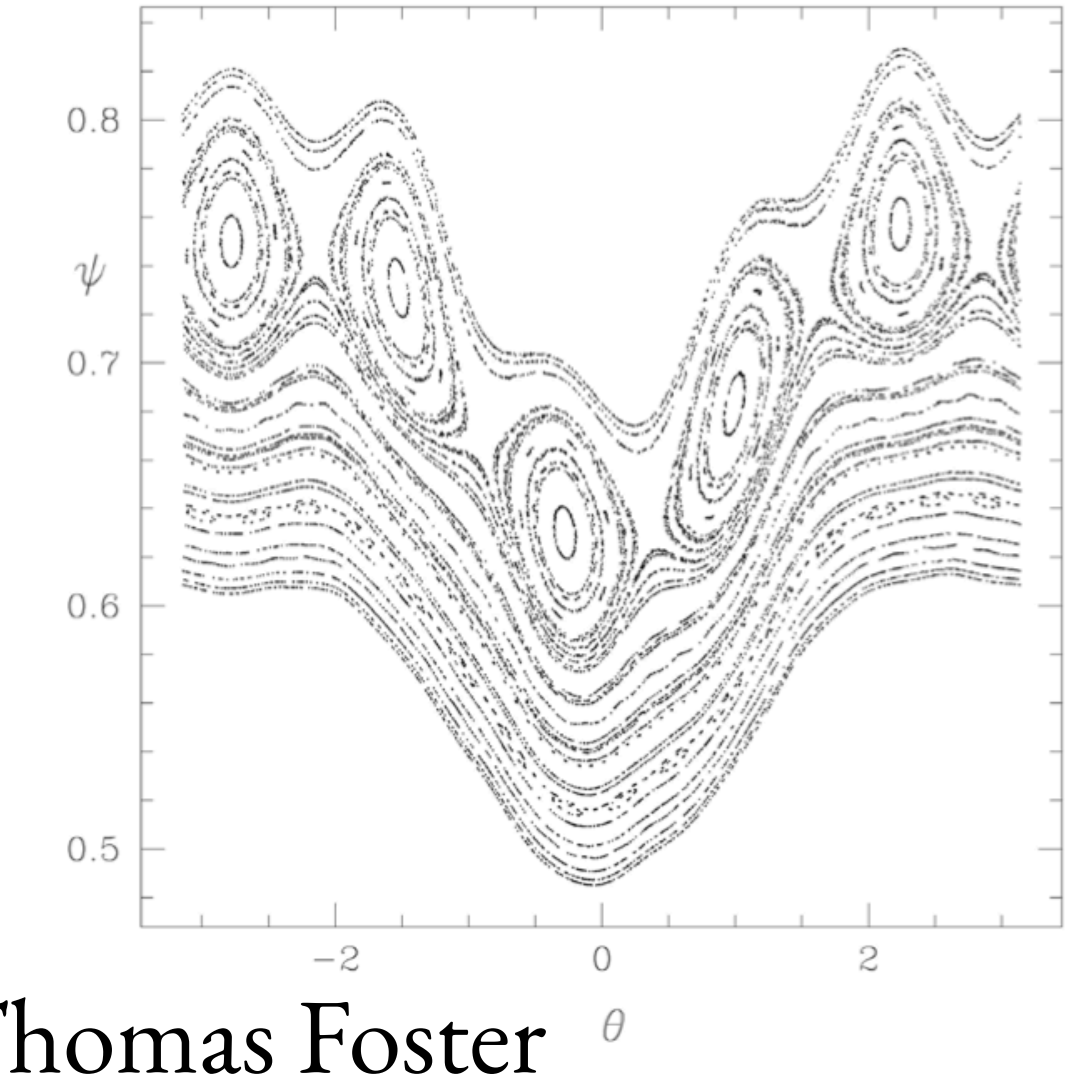


Philipp Kempskii

Patrick Reichherzer

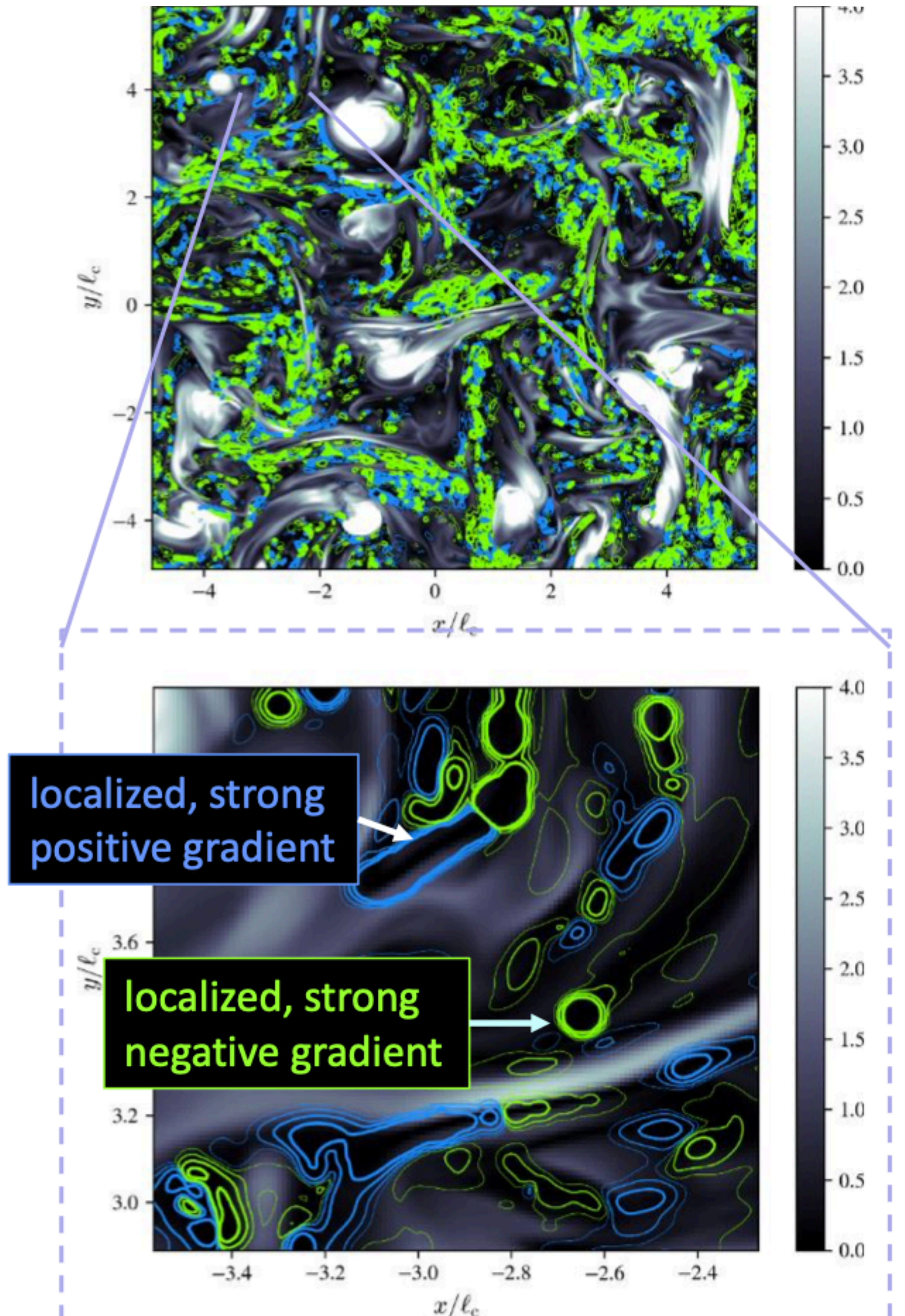


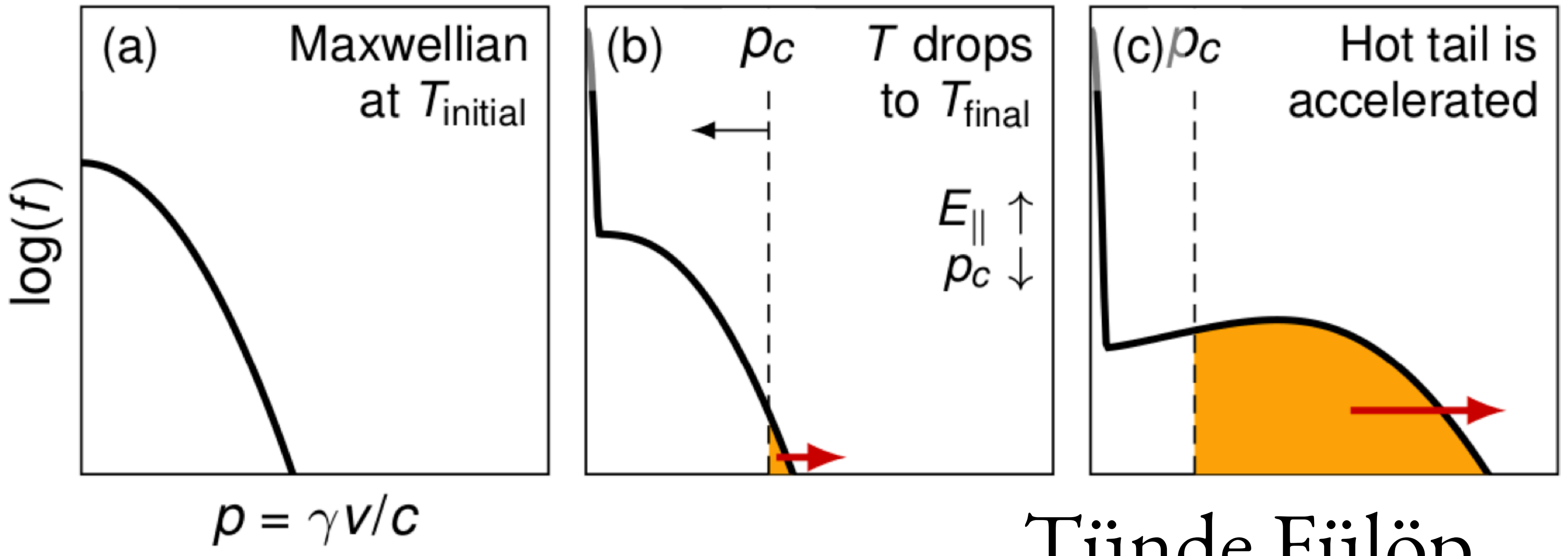
Vinicius Duarte



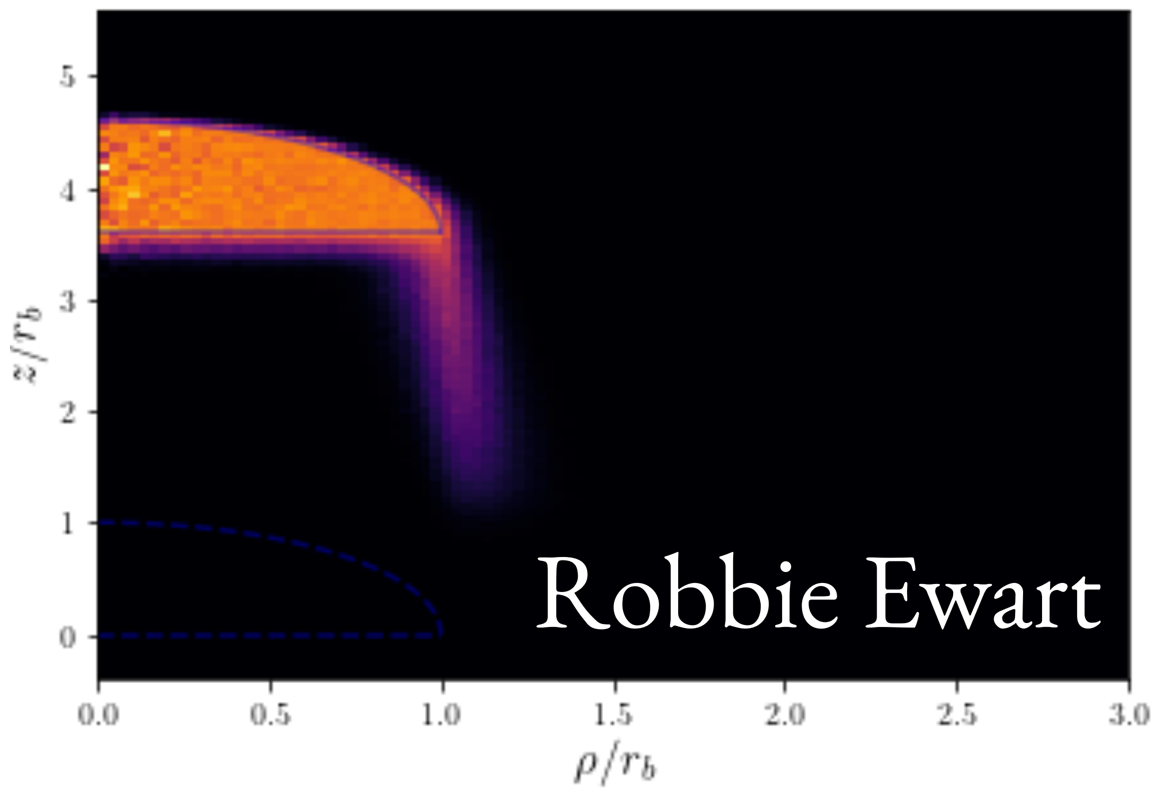
Thomas Foster

Martin Lemoine

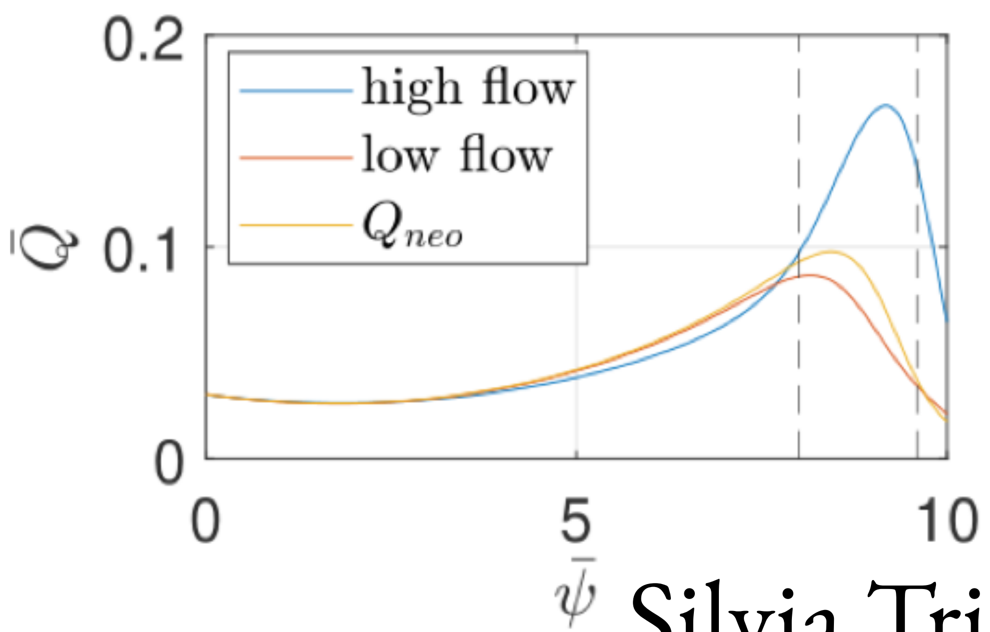




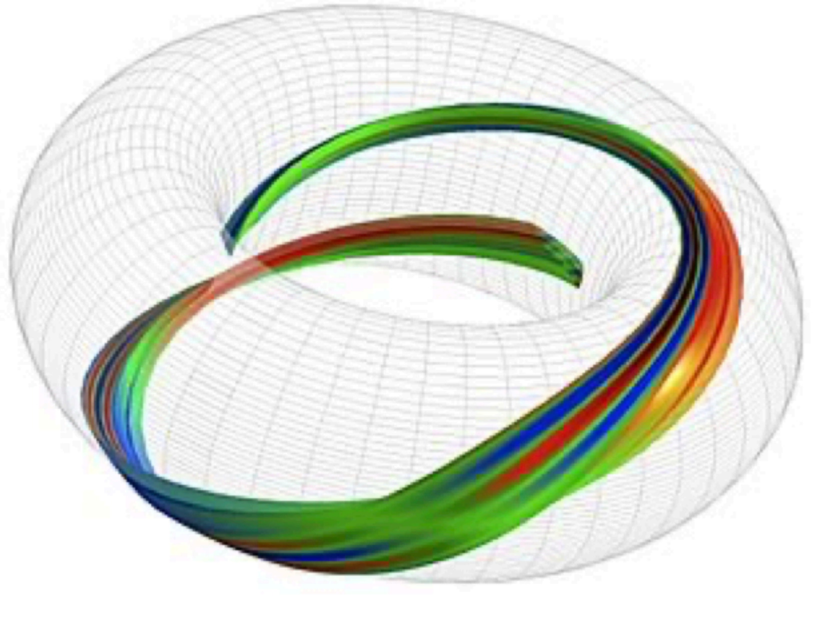
Tünde Fülöp



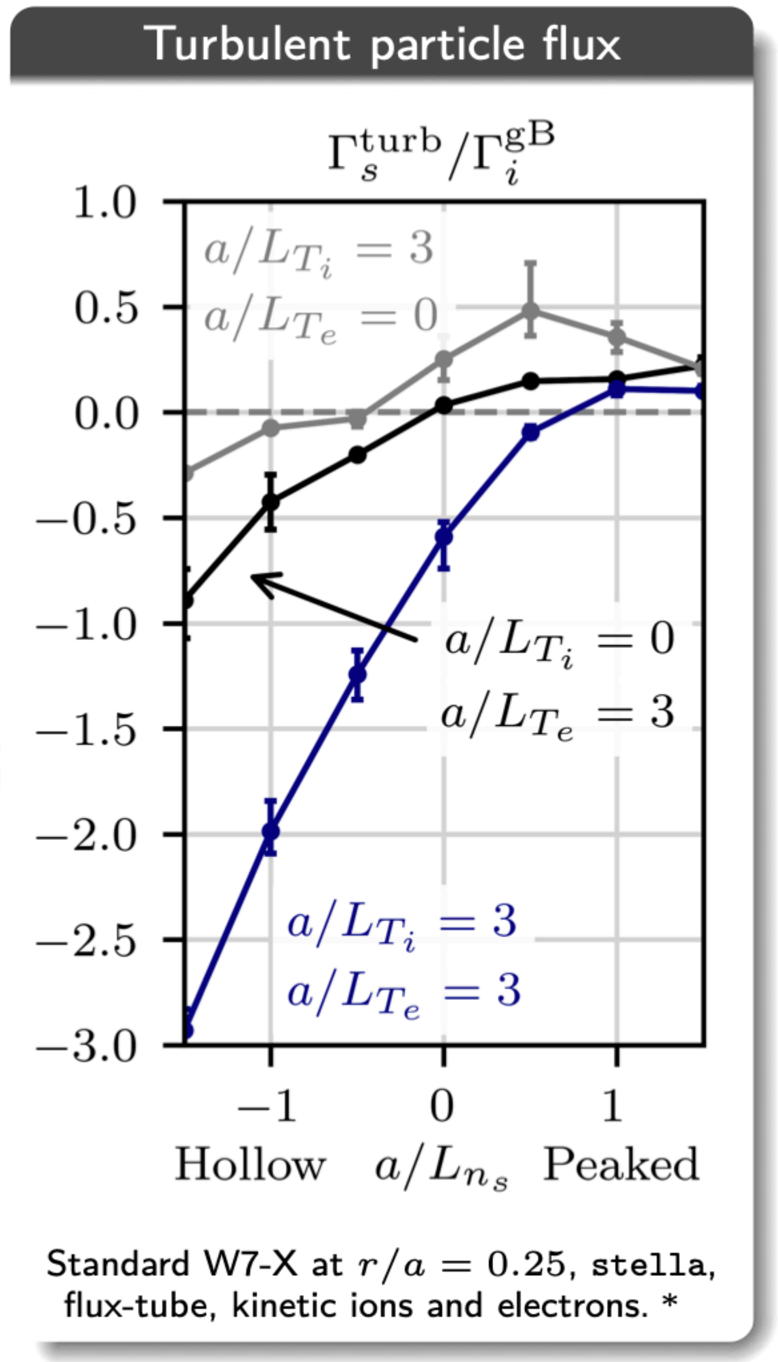
Robbie Ewart



Silvia Trinczek



Georgia Acton

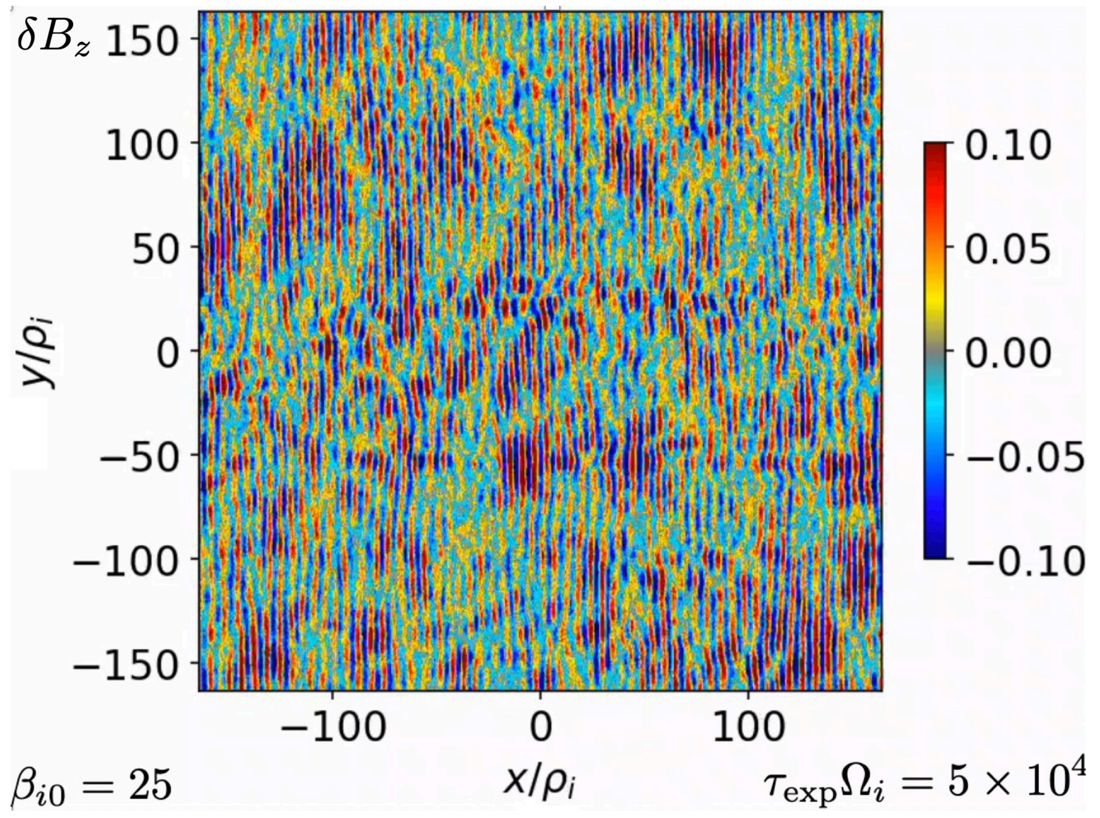


Hanne Thienpondt

Transport — particles + heat

Subgrid models and closures

Archie Bott



$$\mathfrak{C}_{\rm f}[f] = \frac{1}{2}\frac{\partial}{\partial \xi}\left\{(1-\xi^2)\nu_{\rm eff,pl}(v\xi)\left[\frac{\partial f_i}{\partial \xi} - \frac{2vv_{\rm wv,pl}(v\xi)}{v_{\rm thi}^2} f_{\rm M}\right] + (1-\xi^2)\nu_{\rm eff,ob}(v\xi)\frac{\partial f_i}{\partial \xi}\right\}$$

Lemma

The gyro-moment model writes

$$\partial_t \widetilde{U} + \sum_{i=1}^{3} \partial_{x_i}\left(\widetilde{A}_i(\mathbf{x},t)\widetilde{U}(\mathbf{x},t)\right) = \widetilde{B}(\mathbf{x})\widetilde{U}(\mathbf{x},t) \quad (1)$$

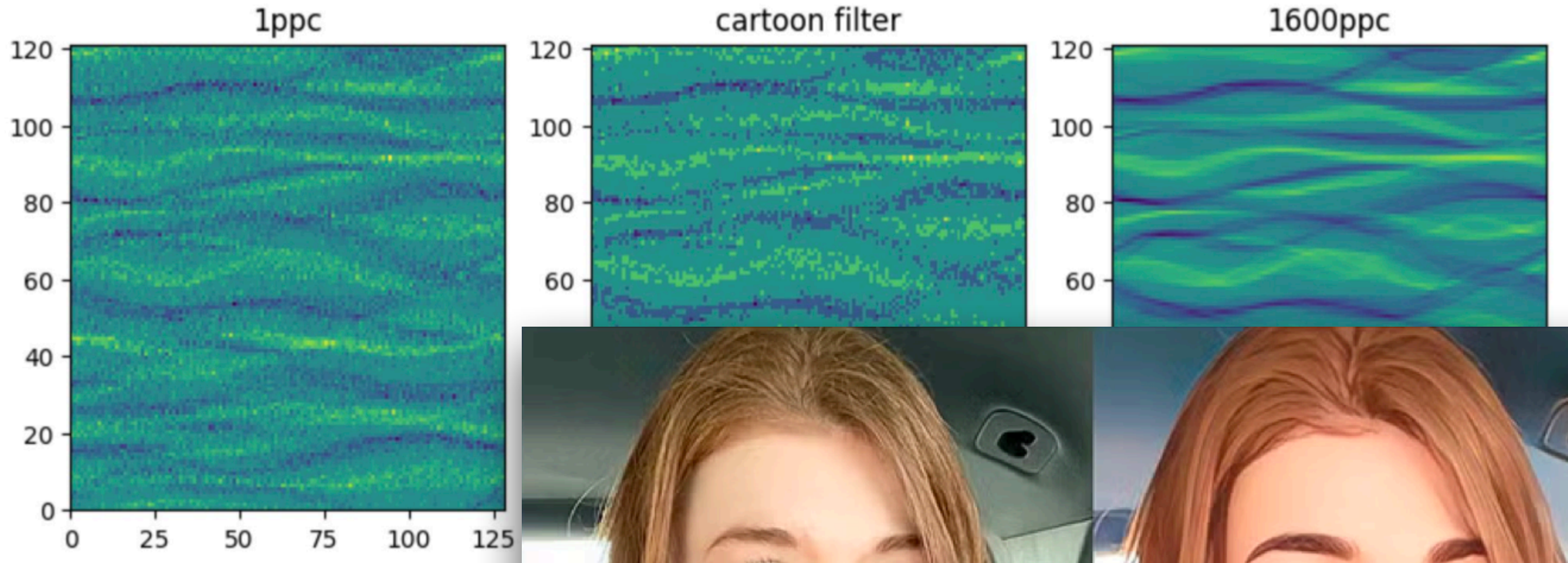
where

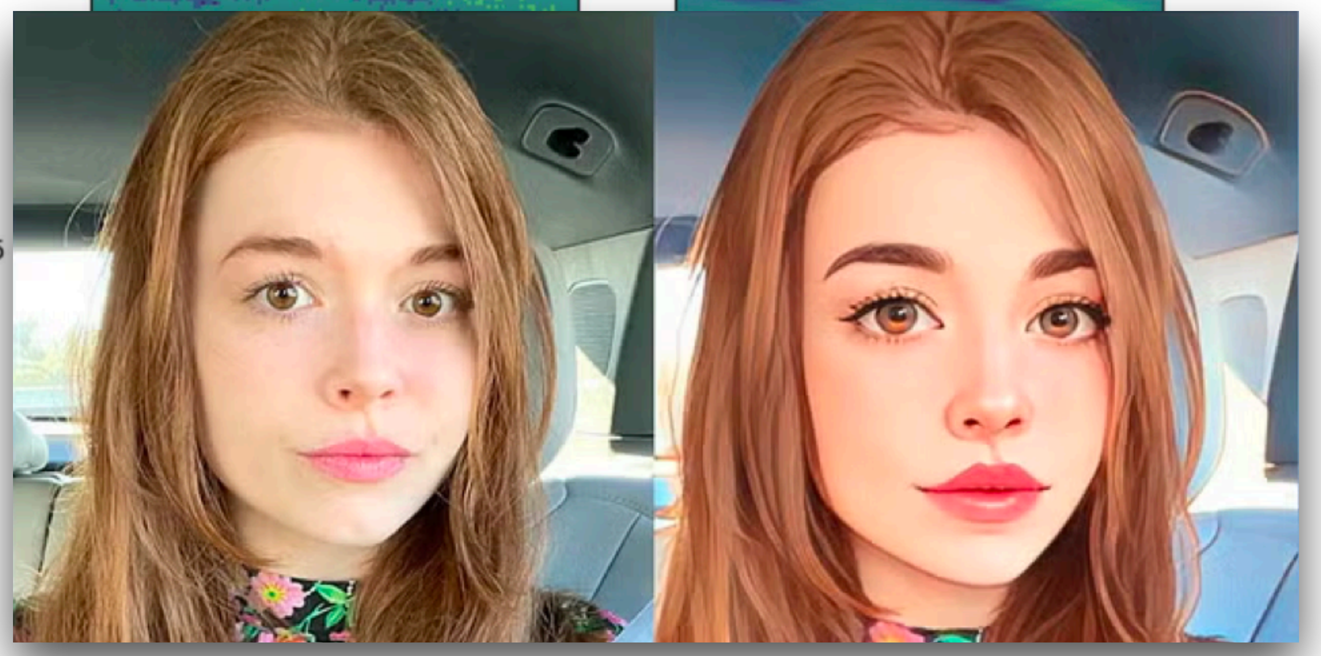
$$\widetilde{A}_i(\mathbf{x}) = P^t A_i(\mathbf{x}) P, \quad \widetilde{B}(\mathbf{x}) = P^t B(\mathbf{x}) P.$$

This numerical scheme works fine, but it is physically disgusting. Bruno Despres

Bruno Després

$\overline{\text{Nuno}} + \widetilde{\text{Loureiro}}$





Anatoly Spitkovsky

$$\Delta\beta \sim 1 \quad \longrightarrow \quad \frac{\delta B_\parallel}{B_0} \sim \frac{\delta B_\perp}{B_0} \sim \frac{1}{\beta} \sim \Delta \sim \frac{\delta\rho}{\rho_0} \sim \frac{u_\perp}{v_A} \sim \frac{u_\parallel}{v_{th}} \sim \epsilon$$

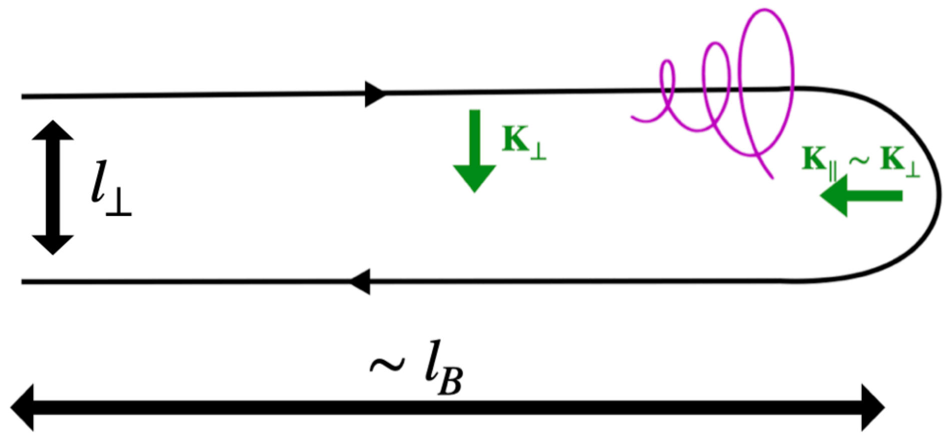
Ordering 1D CGL-MHD...

$$\frac{\partial z^\pm}{\partial t} \mp v_A \frac{\partial z^\pm}{\partial x} = v_A \frac{\beta}{4}\frac{\partial}{\partial x}\left[(z^+ - z^-)\Delta\right]$$

+ Linear ion acoustic waves

Steve Majeski

Nuno + Loureiro

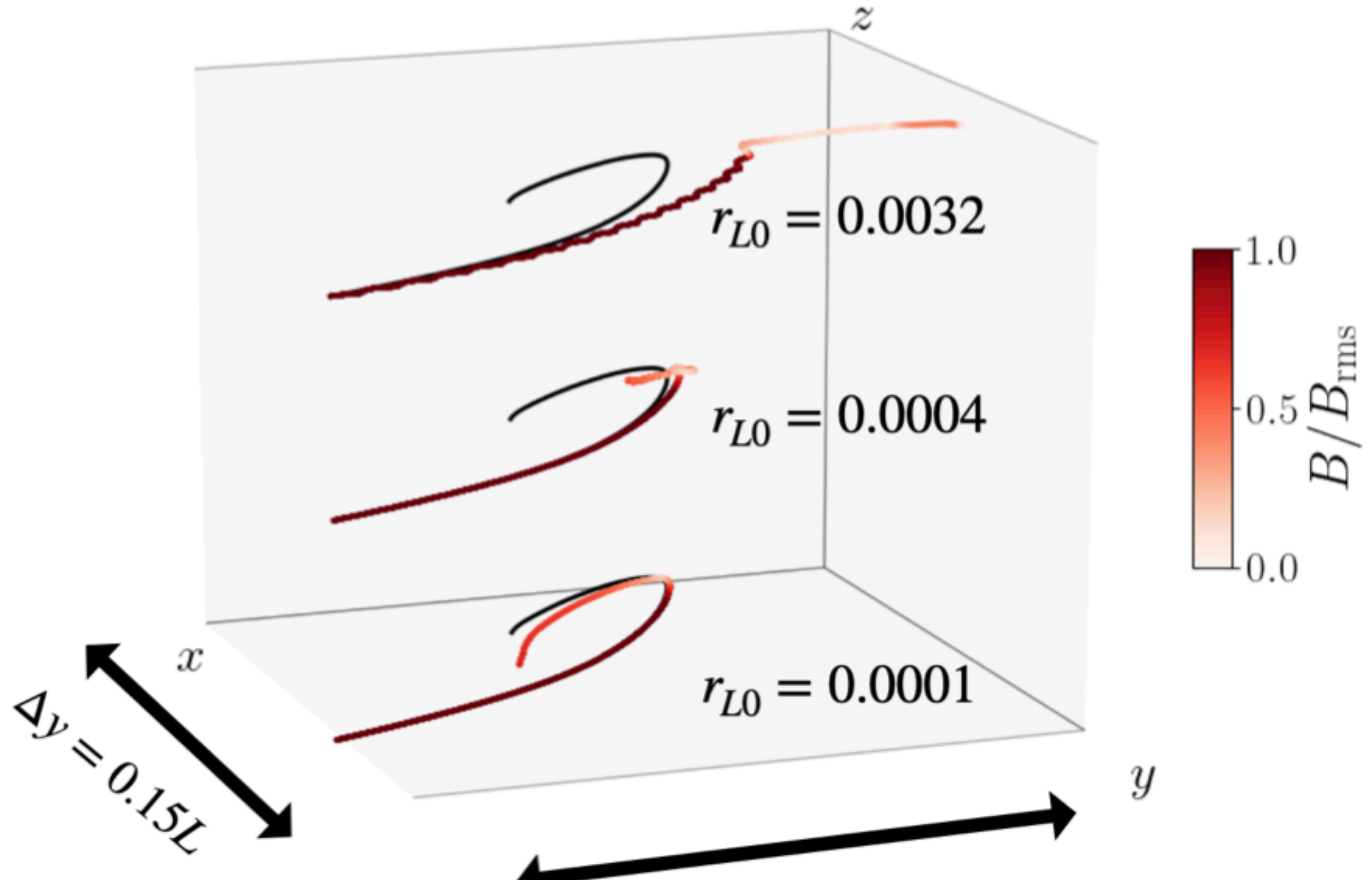


$K_\parallel = |\hat{\mathbf{b}} \cdot \nabla \hat{\mathbf{b}}|$

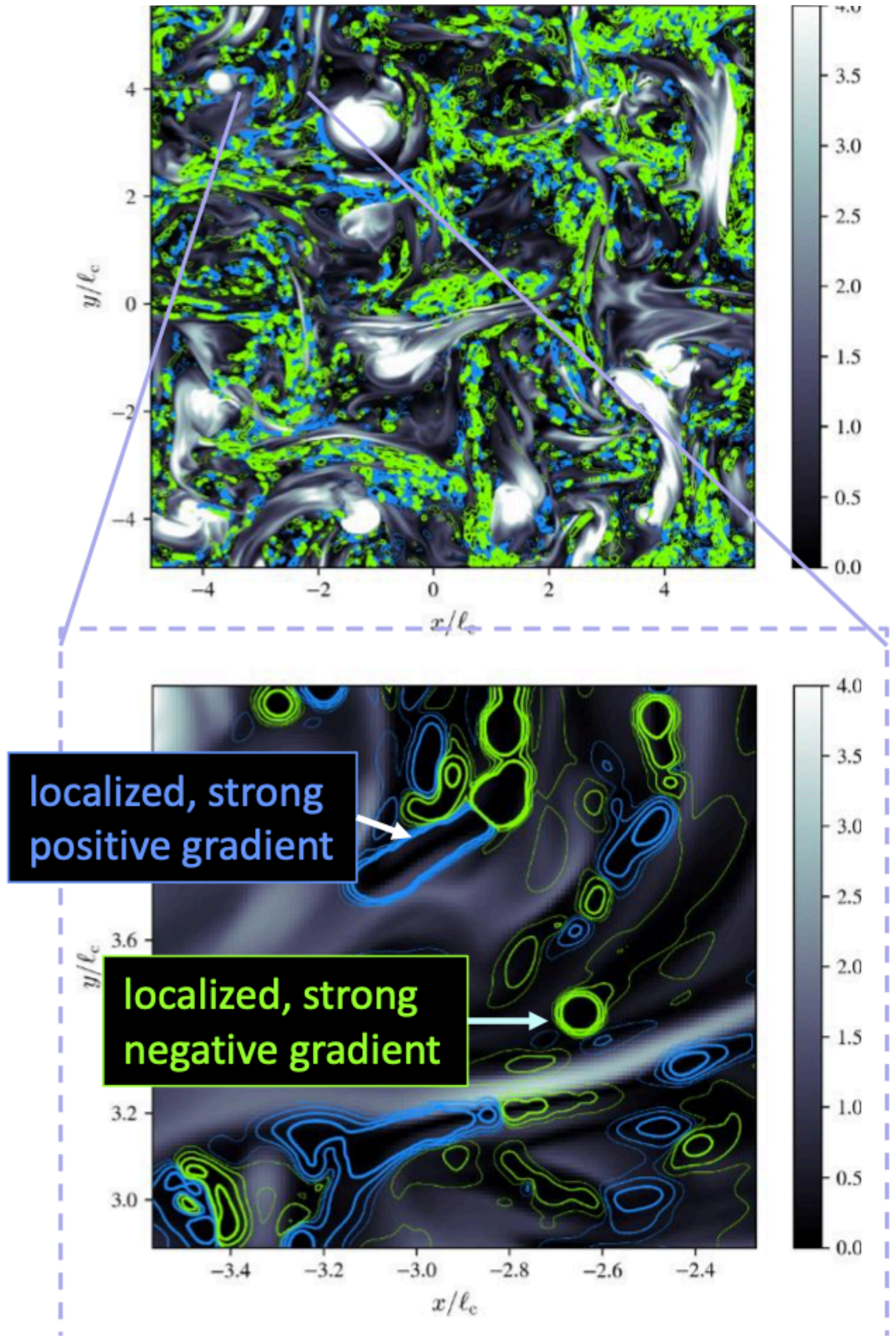
$K_\perp = \hat{\mathbf{b}} \times \hat{\mathbf{b}} \times \nabla \ln B$

$K_\perp = l_\perp^{-1}$

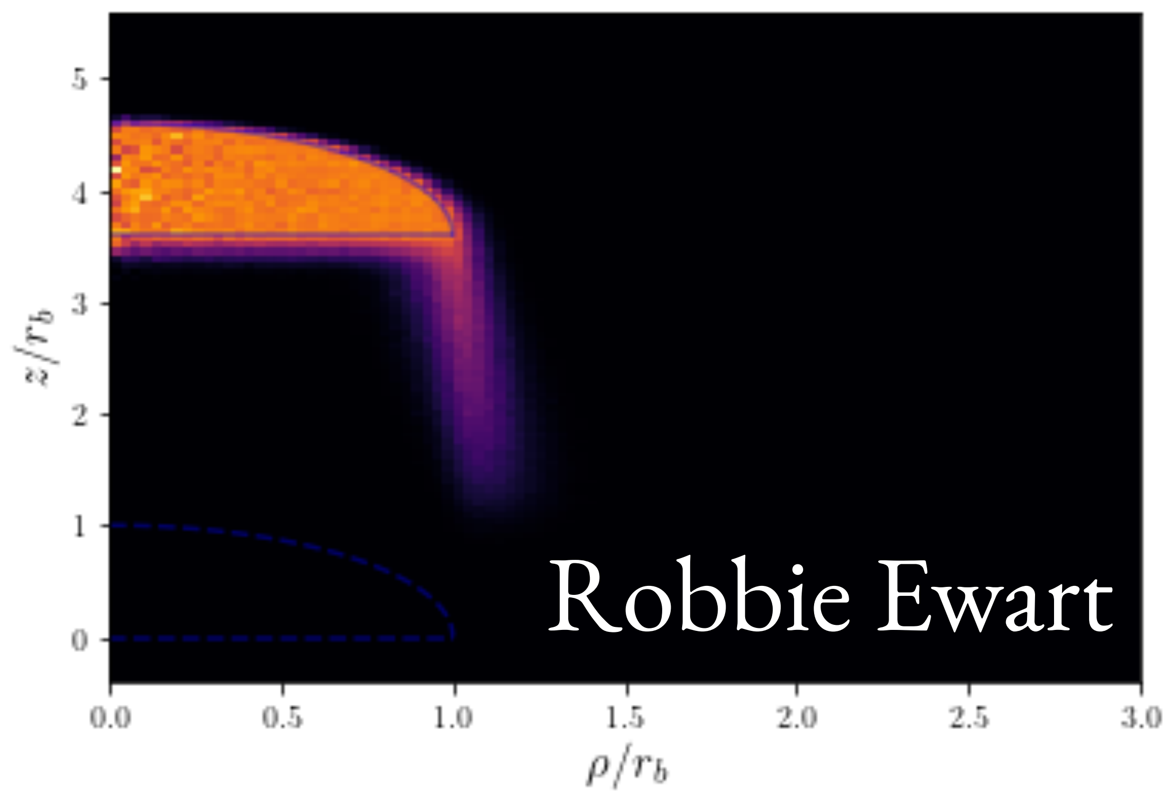
$B(K_\parallel) \propto K_\parallel^{-0.5}$



Philipp Kempskiii



Martin Lemoine



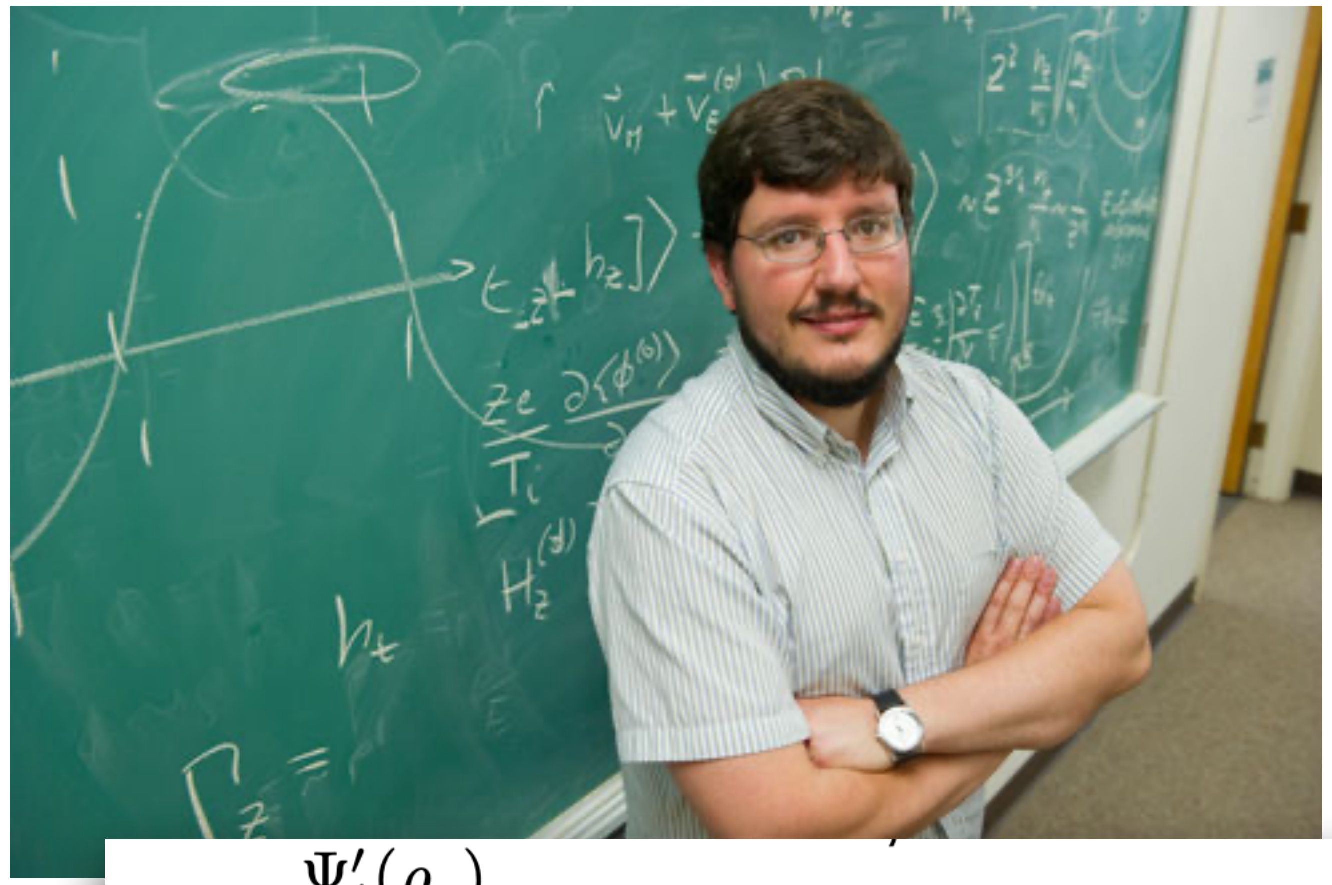
Patrick Reichherzer

Intermittent structures

Do we really need the torus? Lessons learned from the humble slab

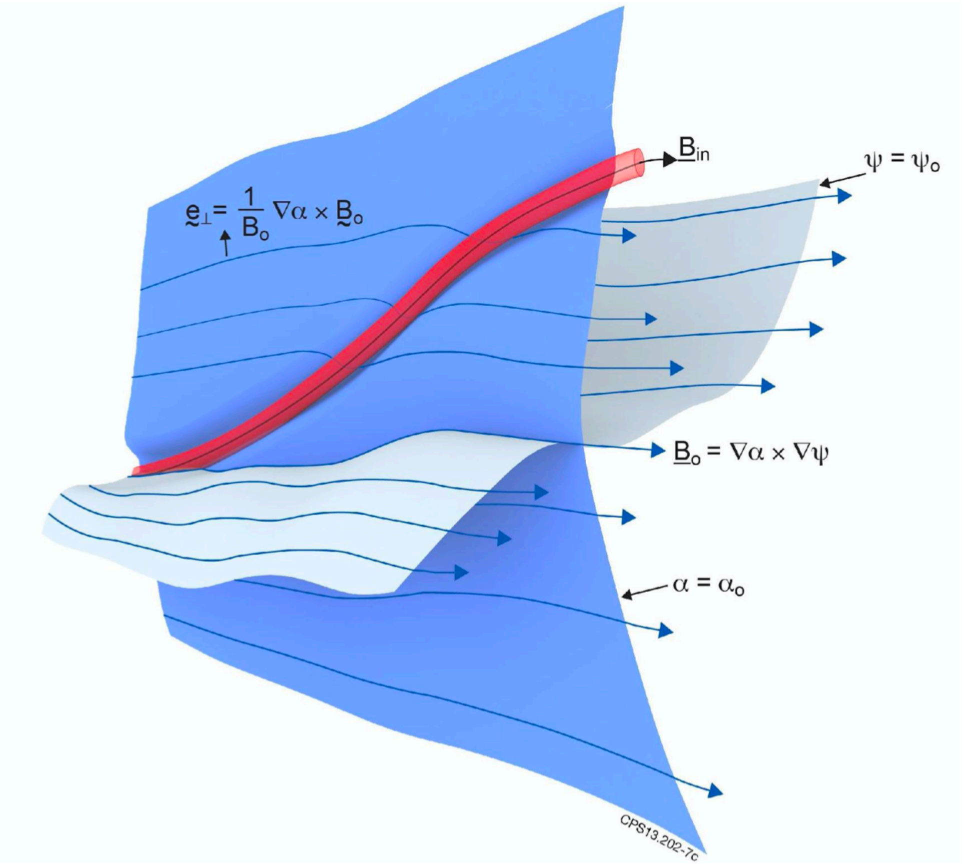
- It appears that the TAI instability mechanism appears to survive the transition to toroidicity. **Another win for the slab?**

Toby Adkins



Felix Parra

$$\mathbf{B}'_a = \frac{\Psi'_t(\rho_a)}{\mathcal{J}_a}\left[\partial_u \nu'_a\, \partial_v \mathbf{x}_a + (\iota'(\rho_a) - \partial_v \nu'_a)\, \partial_u \mathbf{x}_a\right] + \left(\frac{\Psi''_t(\rho_a)}{\Psi'_t(\rho_a)} - \frac{\mathcal{J}'_a}{\mathcal{J}_a}\right)\mathbf{B}_a + \mathbf{B}_a \cdot \nabla_S \left(\frac{\mathcal{J}_a}{|\partial_u \mathbf{x}_a \times \partial_v \mathbf{x}_a|}\hat{\mathbf{n}}_a\right)$$

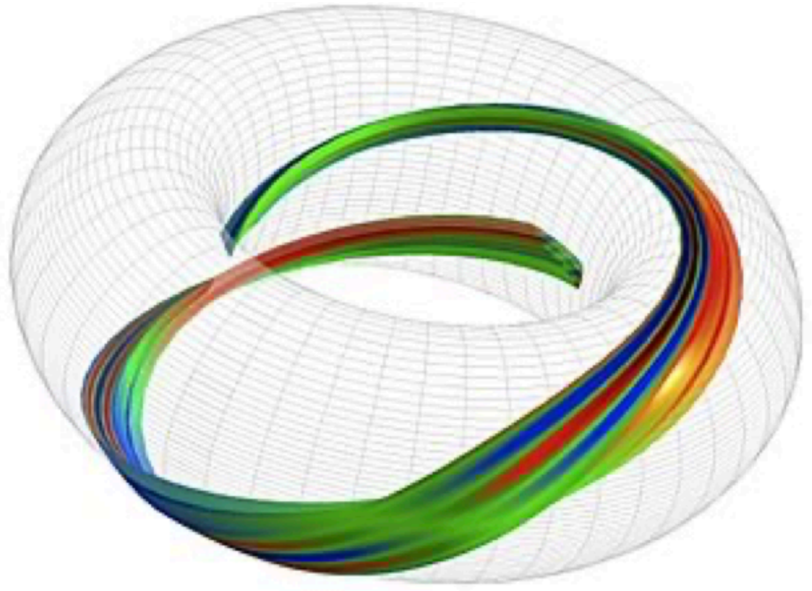


Steve Cowley

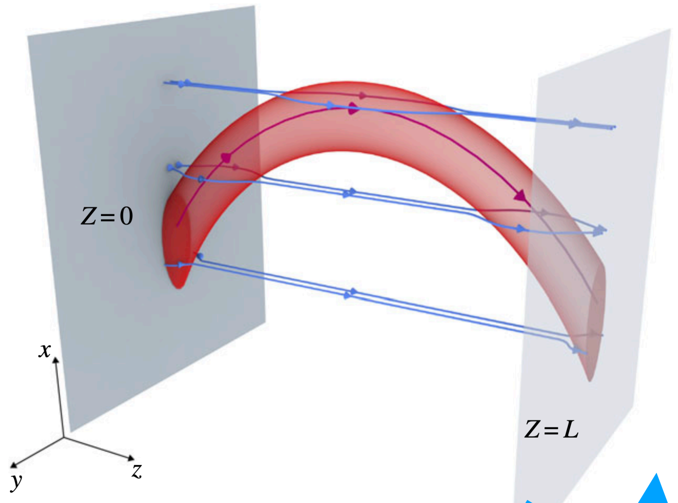
Where there is geometry there are problems

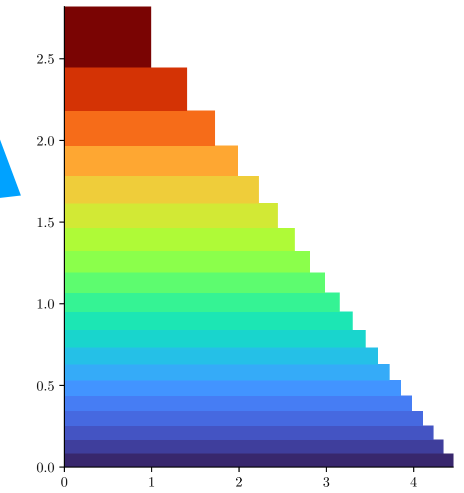
Geometry is at the root of all evil...

$$\frac{\partial g}{\partial t} = \underbrace{(\text{geometric factors})}_{\text{e.g } \hat{\boldsymbol{b}}\cdot\boldsymbol{\nabla} z} \cdot \left(\boldsymbol{\nabla} g + \boldsymbol{\nabla} \underbrace{\langle \phi \rangle_{\boldsymbol{R}}}_{J_{0,\boldsymbol{k}}\hat{\phi}_{\boldsymbol{k}}}\right)$$



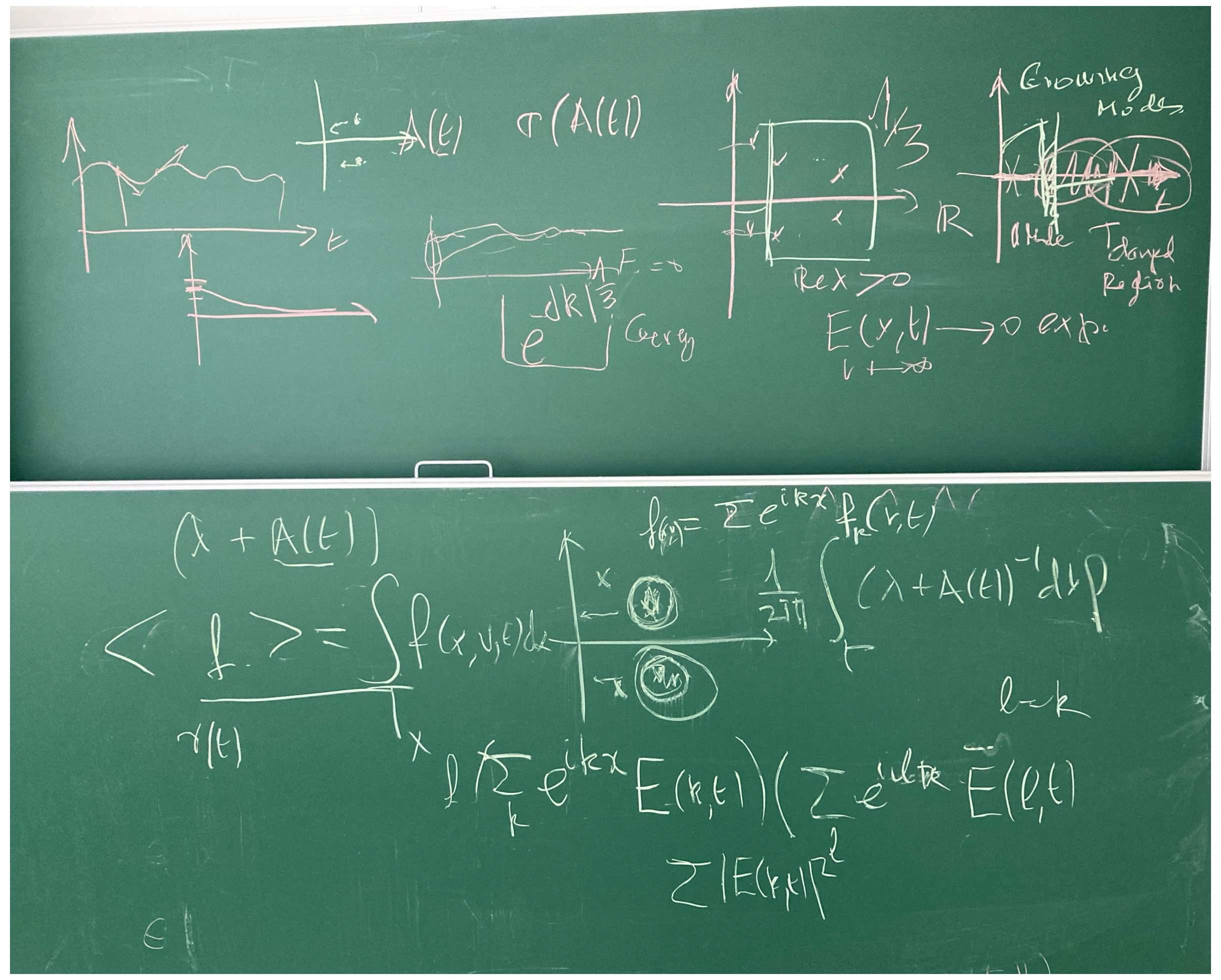
Georgia Acton





David Hosking

Geometry and whether it matters



Claude Bardos

Summary of rational surface conditions

- Hamada condition: $P' \frac{\mathrm{d}}{\mathrm{d}\alpha}\left(\oint \frac{\mathrm{d}l}{B}\right) = 0$
- New condition

$$\frac{\mathrm{d}}{\mathrm{d}\alpha}\left[\left(\oint \frac{B}{|\nabla\rho|^2}\,\mathrm{d}l\right)^{-1}\left(\frac{c\iota'\Psi_t'}{4\pi}\oint \mathrm{d}v - \oint \frac{J_{PS}}{|\nabla\rho|^2}\,\mathrm{d}l + \frac{c}{4\pi}\oint \frac{[\mathbf{B}\cdot\nabla\hat{\mathbf{n}}\cdot(\mathbf{B}\times\hat{\mathbf{n}}) + (\mathbf{B}\times\hat{\mathbf{n}})\cdot\nabla\hat{\mathbf{n}}\cdot\mathbf{B}]}{B|\nabla\rho|^2}\,\mathrm{d}l\right)\right] = 0$$

Felix Parra

Lemma

The gyro-moment model writes

$$\partial_t \widetilde{U} + \sum_{i=1}^{3} \partial_{x_i}\left(\widetilde{A}_i(\mathbf{x},t)\widetilde{U}(\mathbf{x},t)\right) = \widetilde{B}(\mathbf{x})\widetilde{U}(\mathbf{x},t) \qquad (1)$$

where

$$\widetilde{A}_i(\mathbf{x}) = P^t A_i(\mathbf{x})P, \quad \widetilde{B}(\mathbf{x}) = P^t B(\mathbf{x})P.$$

Bruno Després

$$\tilde{h}_s^{\mathrm{even}} = \lambda^2\, h_s^{\mathrm{even}}(x/\lambda^2, y/\lambda^2, z/\lambda^{2/\alpha}, t/\lambda^2),$$
$$\tilde{h}_s^{\mathrm{odd}} = \lambda^{2/\alpha}\, h_s^{\mathrm{odd}}(x/\lambda^2, y/\lambda^2, z/\lambda^{2/\alpha}, t/\lambda^2),$$
$$\tilde{\phi} = \lambda^2\, \phi(x/\lambda^2, y/\lambda^2, z/\lambda^{2/\alpha}, t/\lambda^2),$$

Toby Adkins

Mathematics and plasma physics

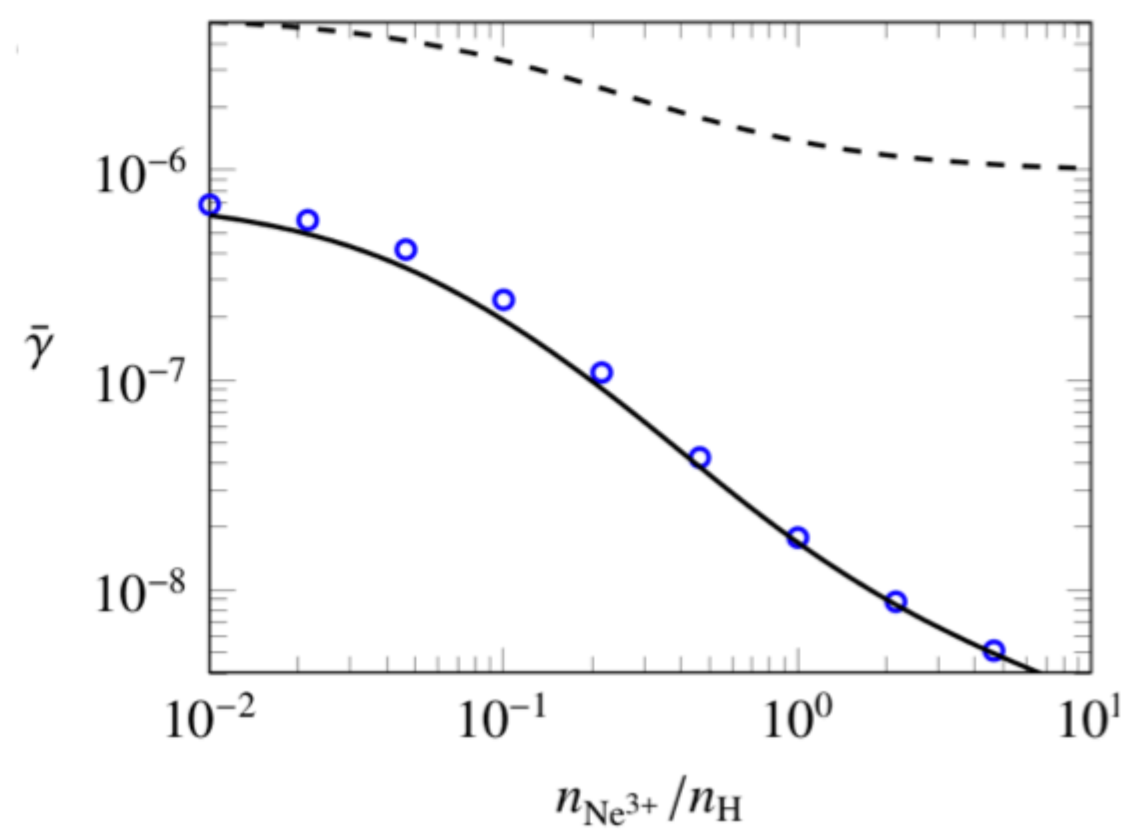
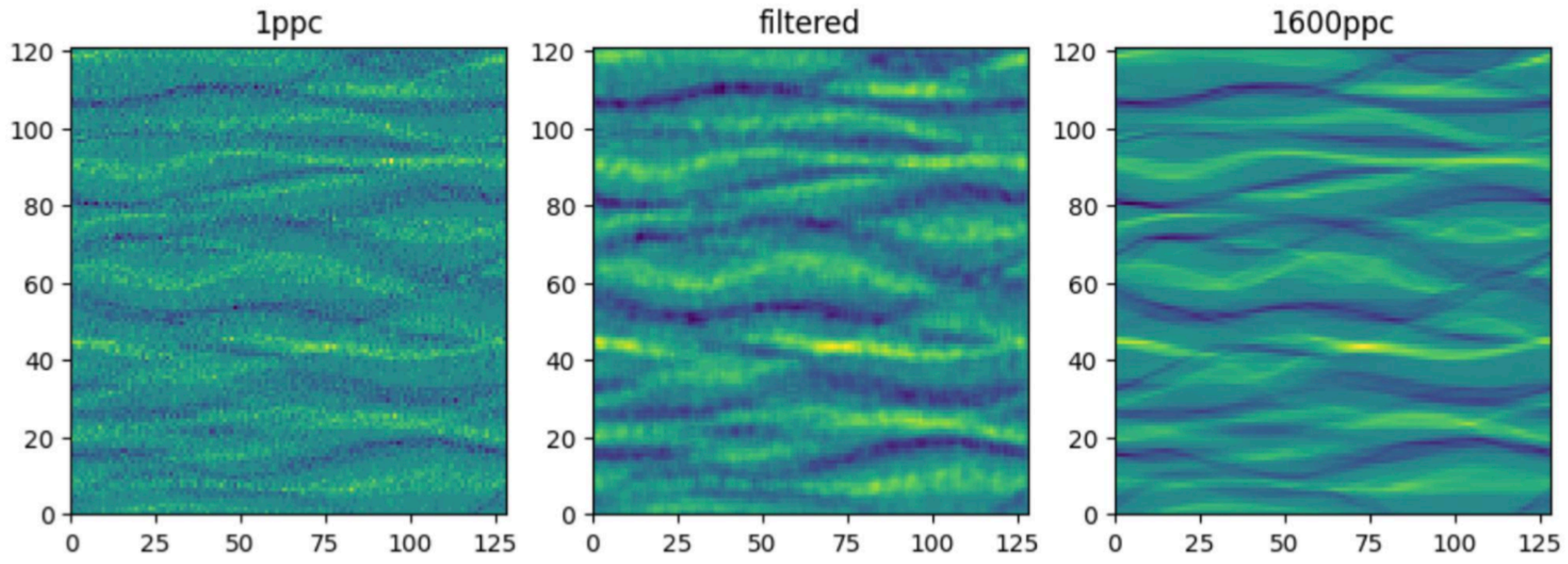


Figure shows the Dreicer generation rate in the presence of Ne^{3+}, obtained by neural network trained on kinetic simulations (solid), kinetic simulations (blue circles) and the Connor-Hastie formula (dashed)

Tünde Fülöp



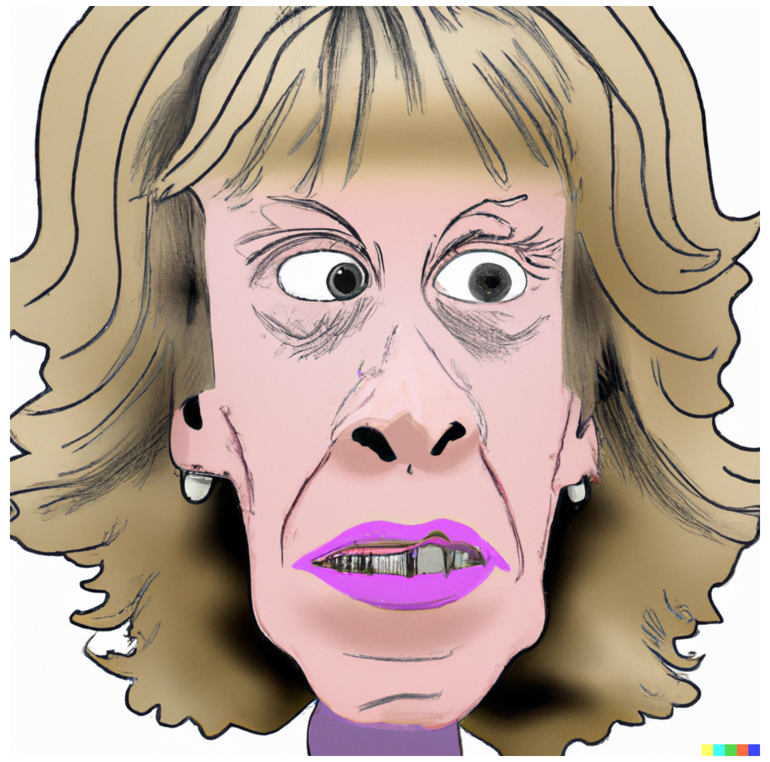
Anatoly Spitkovsky

Micromirrors mediating multiscale motions in magnetised megastructures

Patrick Reichherzer

Per Helander stepped up with rigorous bounds,
Gyrokinetic instabilities, no room for playgrounds.
The growth rates constrained, like children on a leash,
The plasma particles danced, within limits, they'd reach,
And the audience clapped, with their hands making sounds.

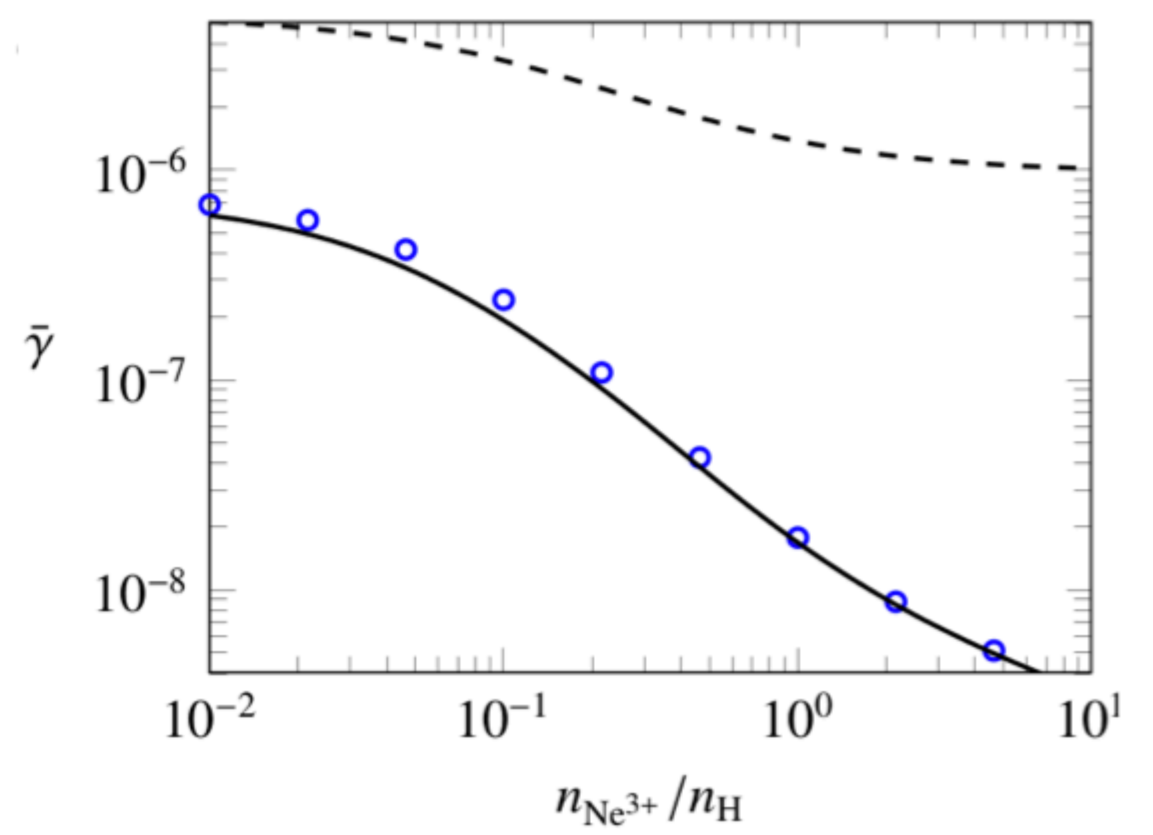
Matt Kunz



David Hosking

François Rincon

Artificial intelligence



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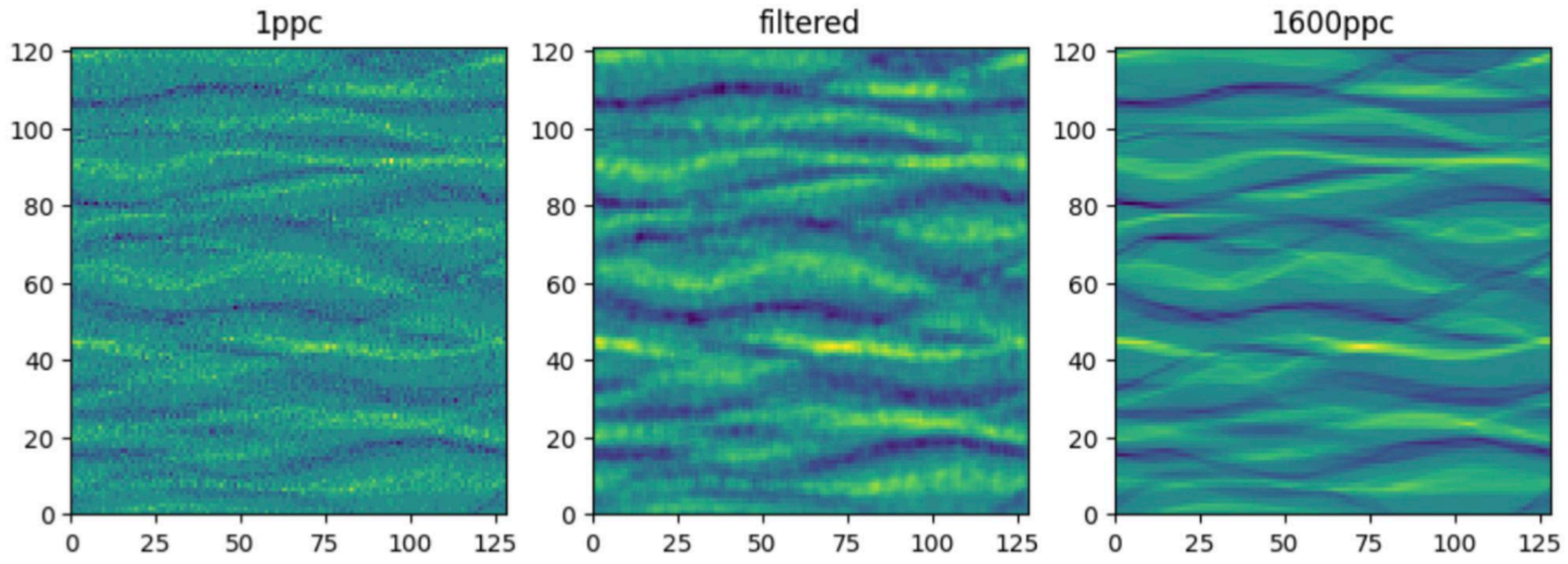
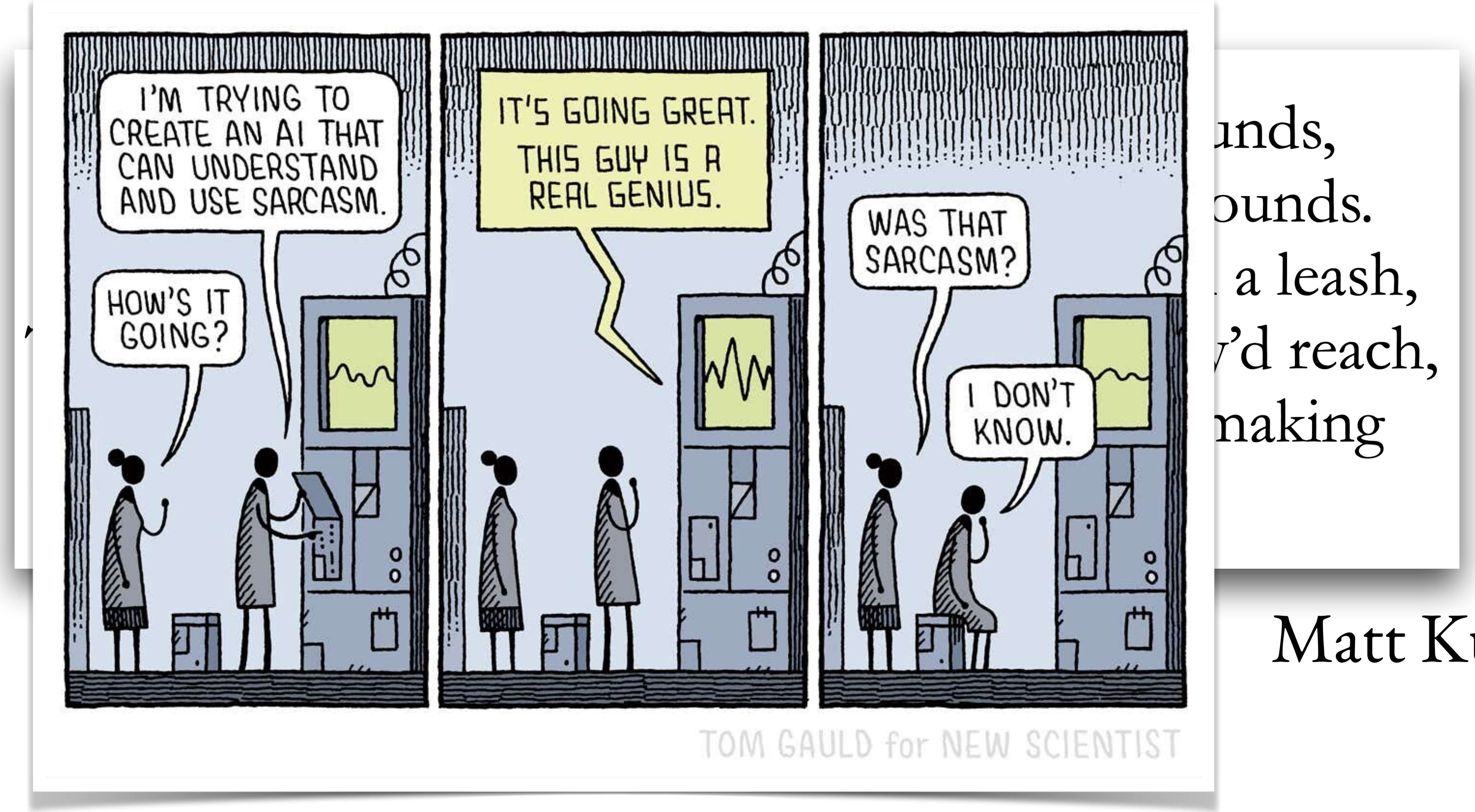


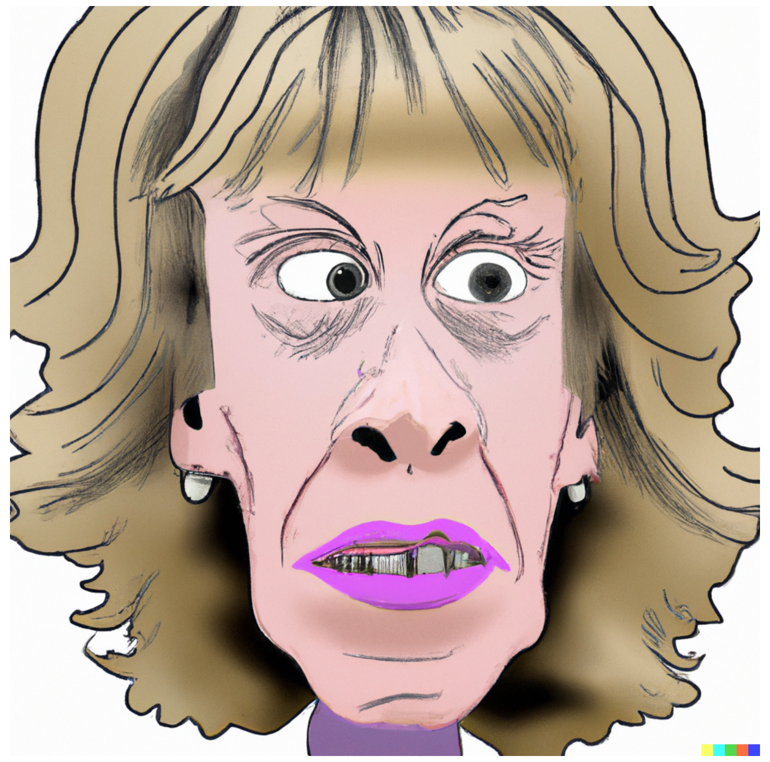
Anatoly Spitkovsky

Micromirrors mediating multiscale motions in magnetised megastructures

Patrick Reichherzer



Matt Kunz



David Hosking

François Rincon

Artificial intelligence