

Dynamo action sustaining turbulence: a subcritical transition

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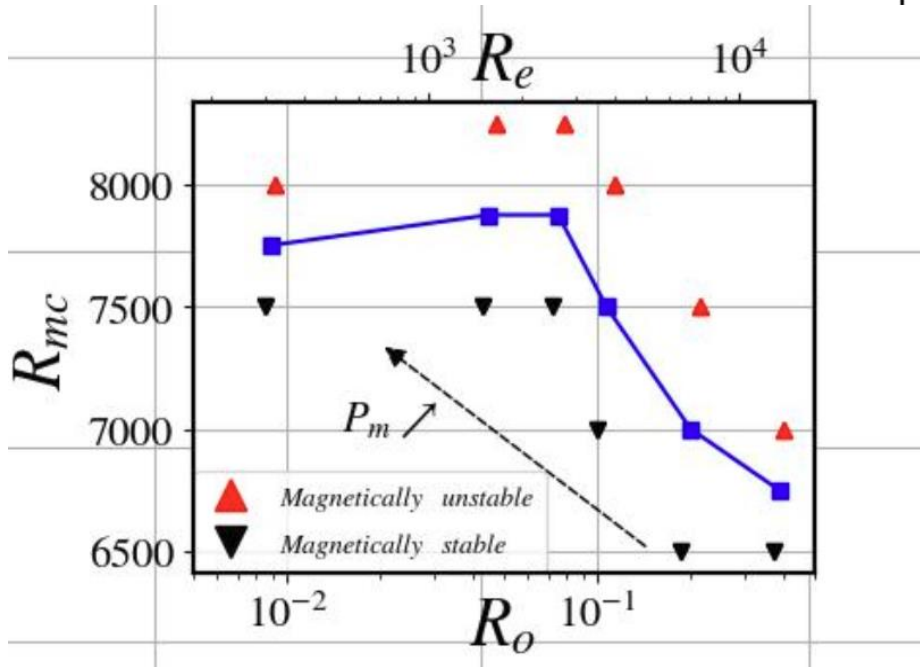
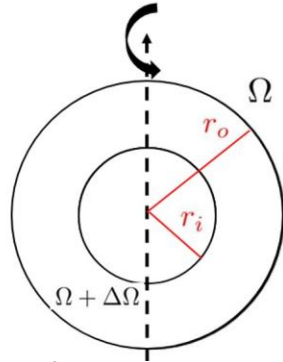


Figure 1: Critical magnetic Reynolds number for each Pm branch in Figure 2.

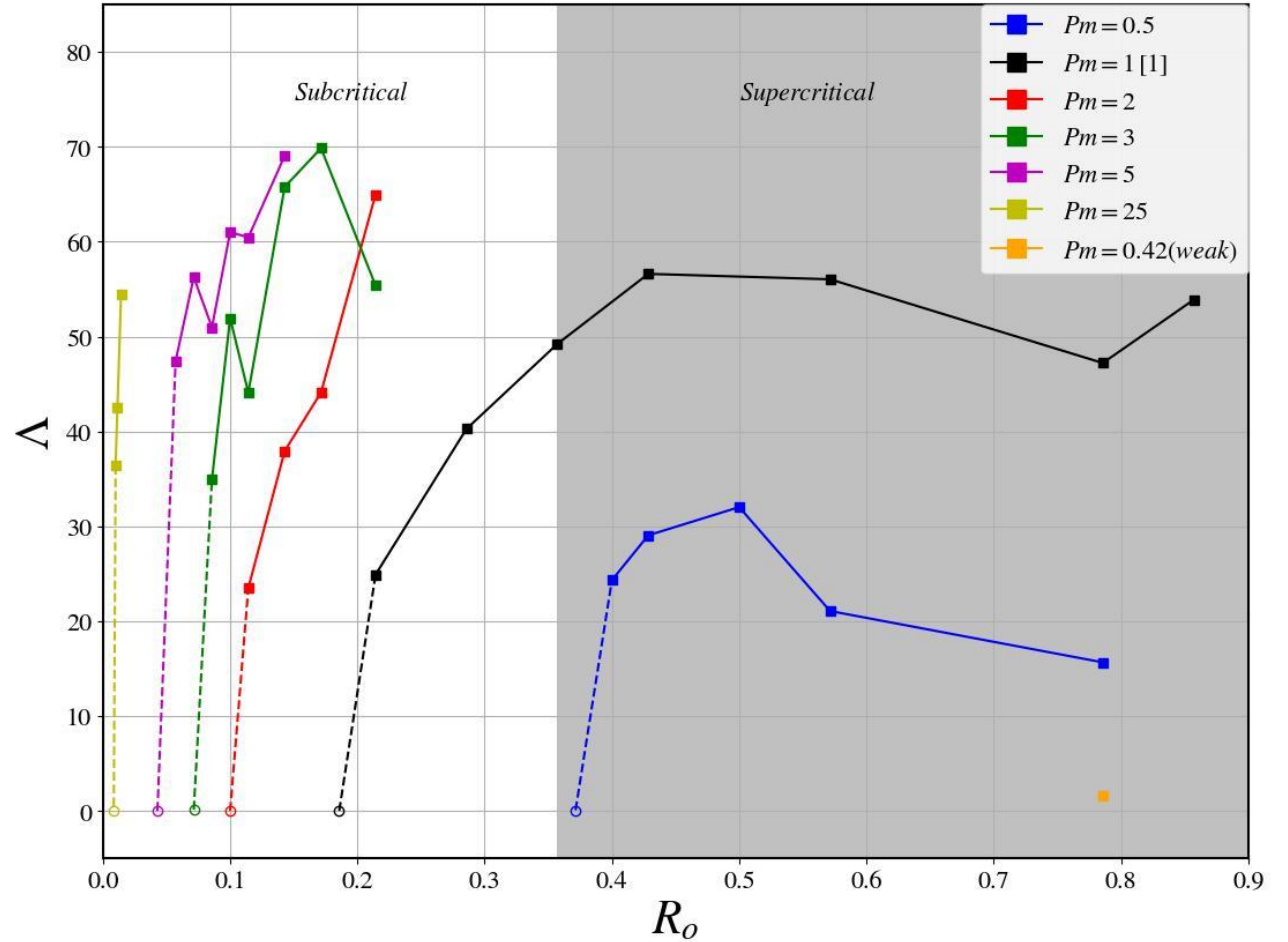


Figure 2: Bifurcation diagram in the (R_o, Λ) plane obtained by DNS. Coloured squares are for dynamos, while empty circles represent runs where the magnetic field could not be maintained anymore. The grey area corresponds to a hydrodynamically unstable profile, while the white one is stable.

A subcritical mechanism

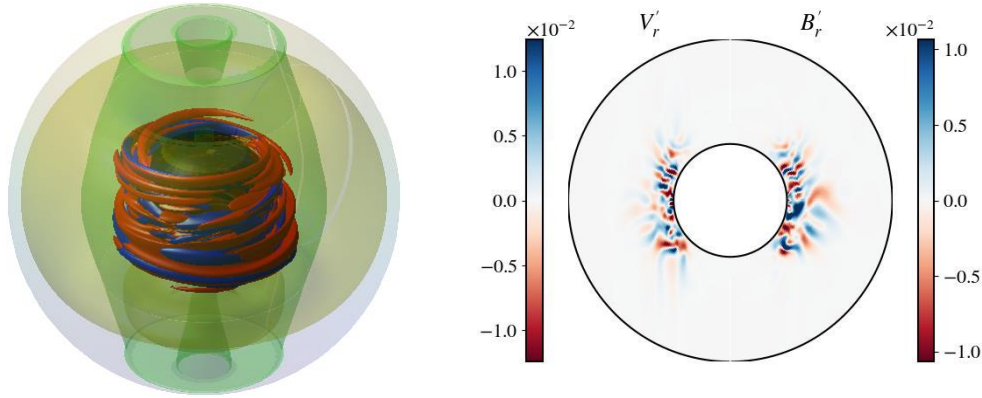


Figure 3: *Left*: Isolevel of the non axisymmetric magnetic (red) and kinetic (blue) energies corresponding to 5% of their maxima. Green and yellow, idem, but for the axisymmetric parts. *Right*: Meridional cuts of the non-axisymmetric parts of V_r and B_r .

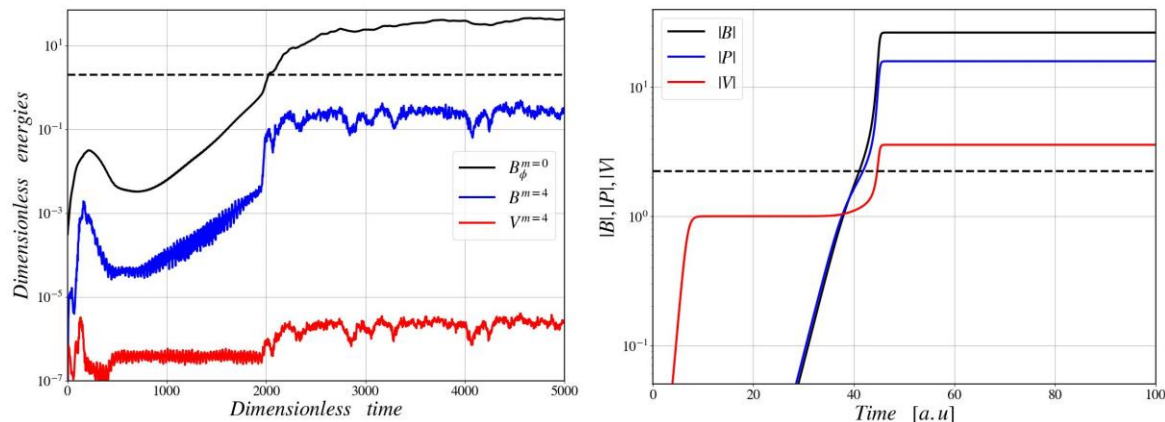


Figure 4: Comparison between DNS (left) and model (right) timeseries for the strong branch. The horizontal dashed lines corresponds to Taylor instability threshold.

Reduced model

$$\begin{cases} \dot{B} = (-\mu + |V|^2)B - \alpha_1 |B|^2 B \\ \dot{P} = (-\nu + \beta_2 |B|^2)P + VB - \beta_1 |P|^2 P \\ \dot{V} = \lambda V - |V|^2 V + \gamma_3 BP \end{cases}$$

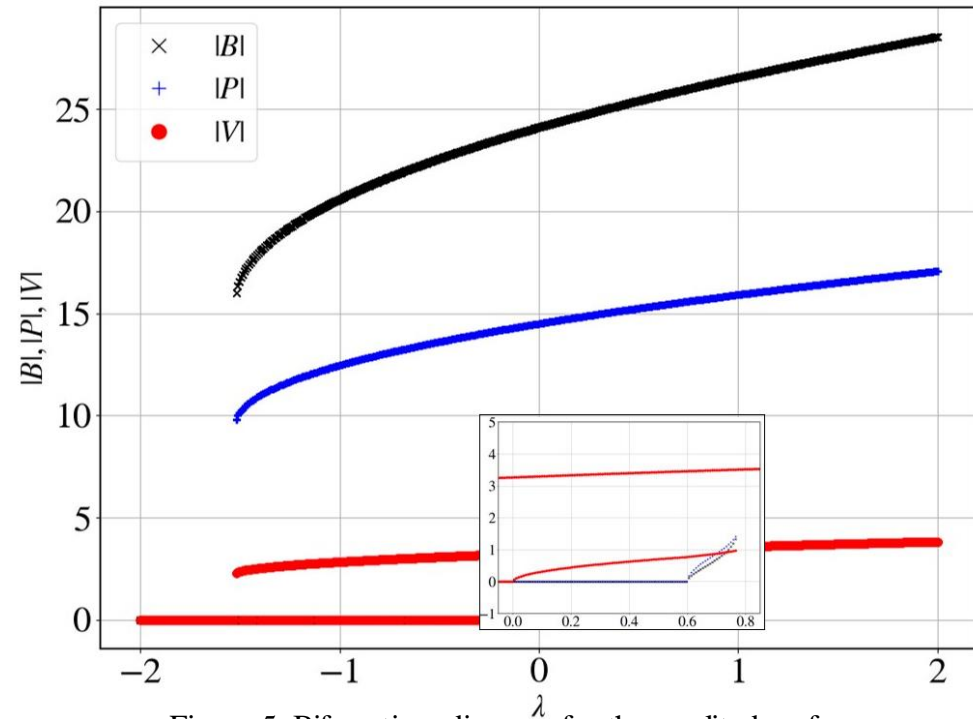


Figure 5: Bifurcation diagram for the amplitude of each mode as λ varies