NORDITAS, Stockholm, Sweden

Resonances for activity waves in spherical mean field dynamos

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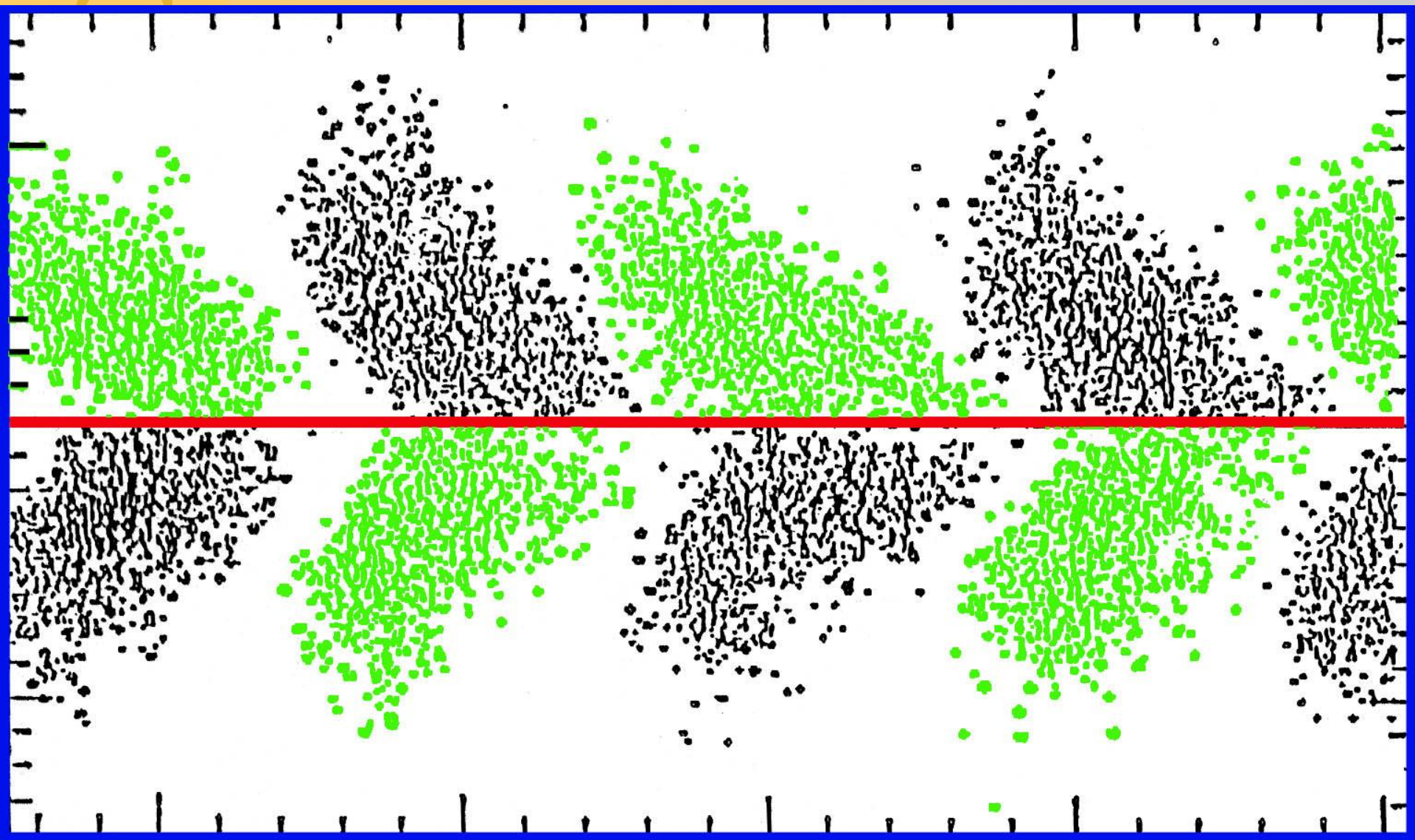
A&A, accepted

Normal cycle



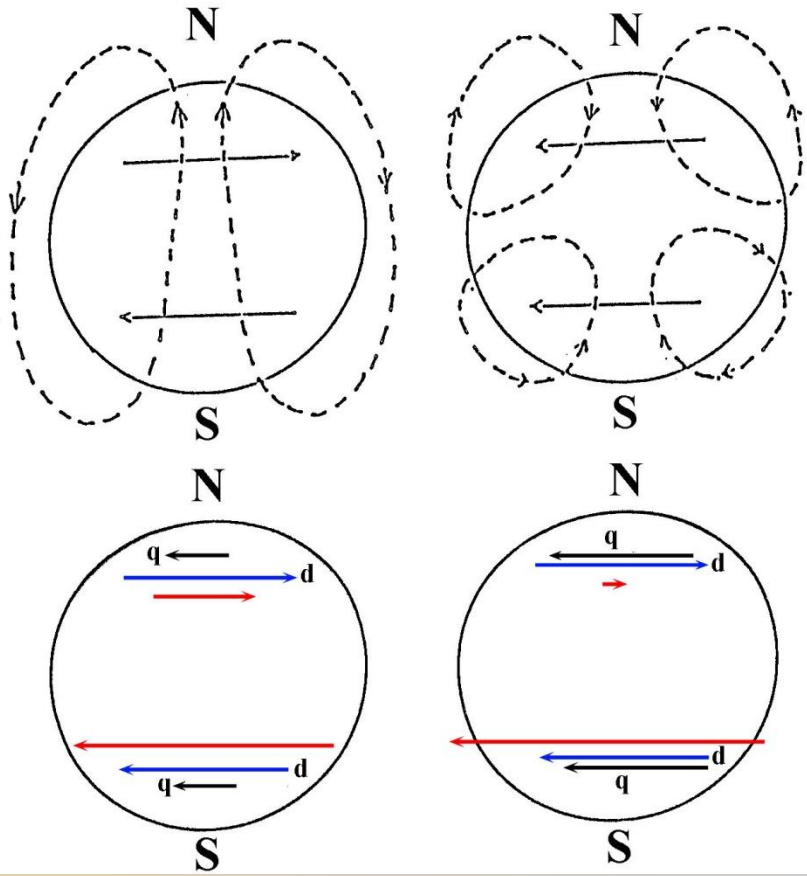
Parker Dynamo

$$B_P \xrightarrow{\Omega} B_T$$

Differential rotation

$$B_T \xrightarrow{\alpha} B_P$$

Mirror asymmetry



Dynamo waves in Sun and in dynamo experiments. What about resonances?

Yes, …. however……

We can get equal frequences of two ways. Why not to get resonances?

Dynamo in two spherical layers. Coupling via poloidal fields.

Playing with parameters we can tune frequencies.

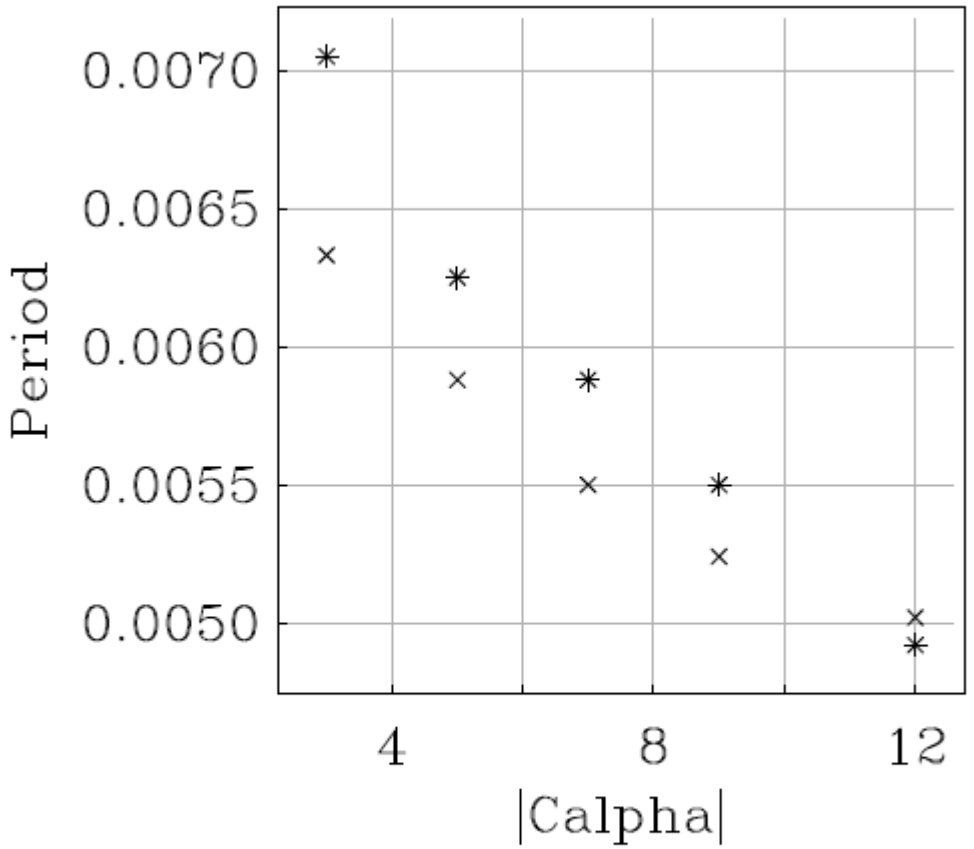
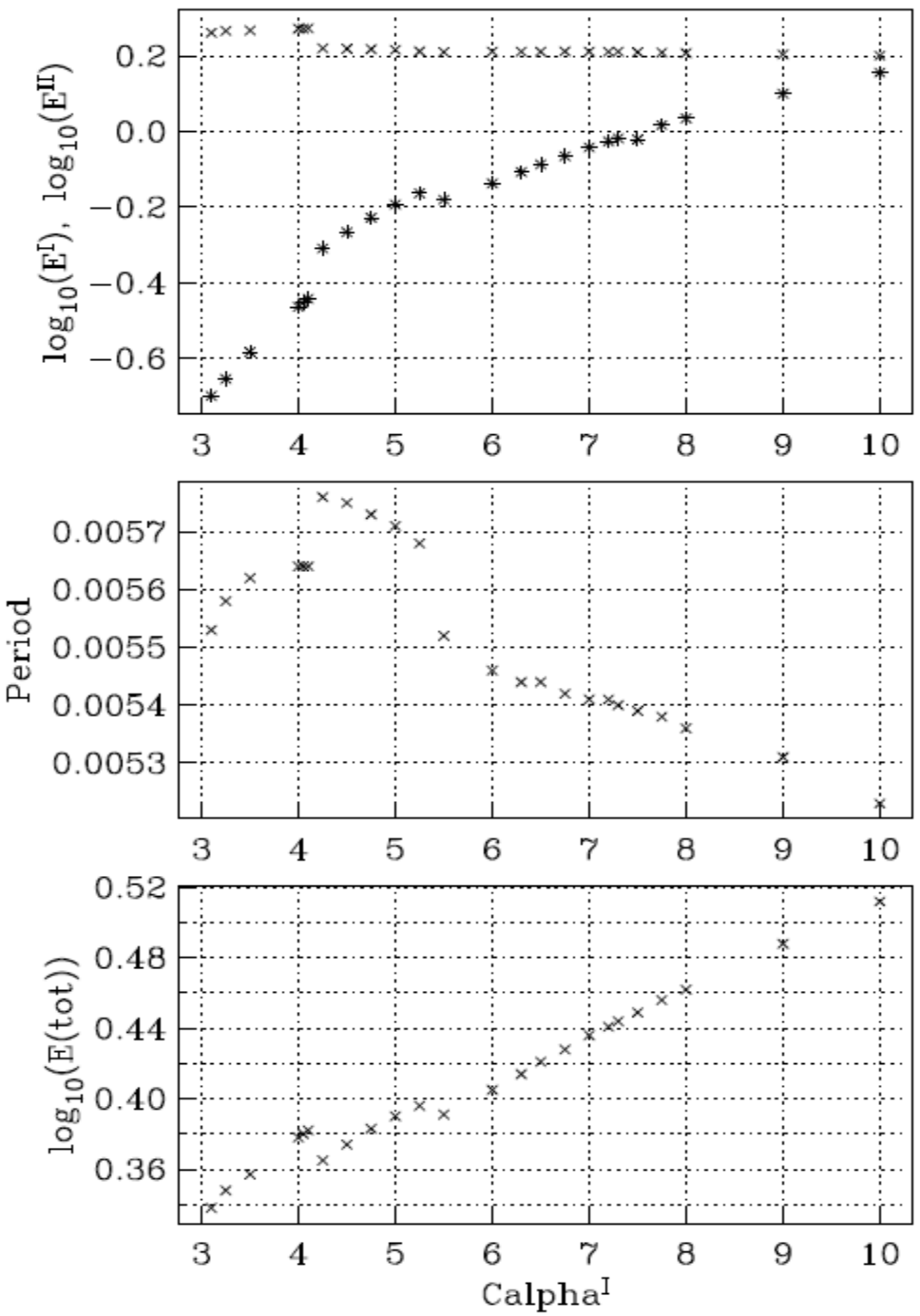


Fig. 1. Periods of oscillation in energy when dynamo action occurs in a single layer. Crosses: $C_\alpha^I = 0$, C_α^{II} varies; asterisks: $C_\alpha^{II} = 0$, C_α^I varies .

Something similar to a resonance?

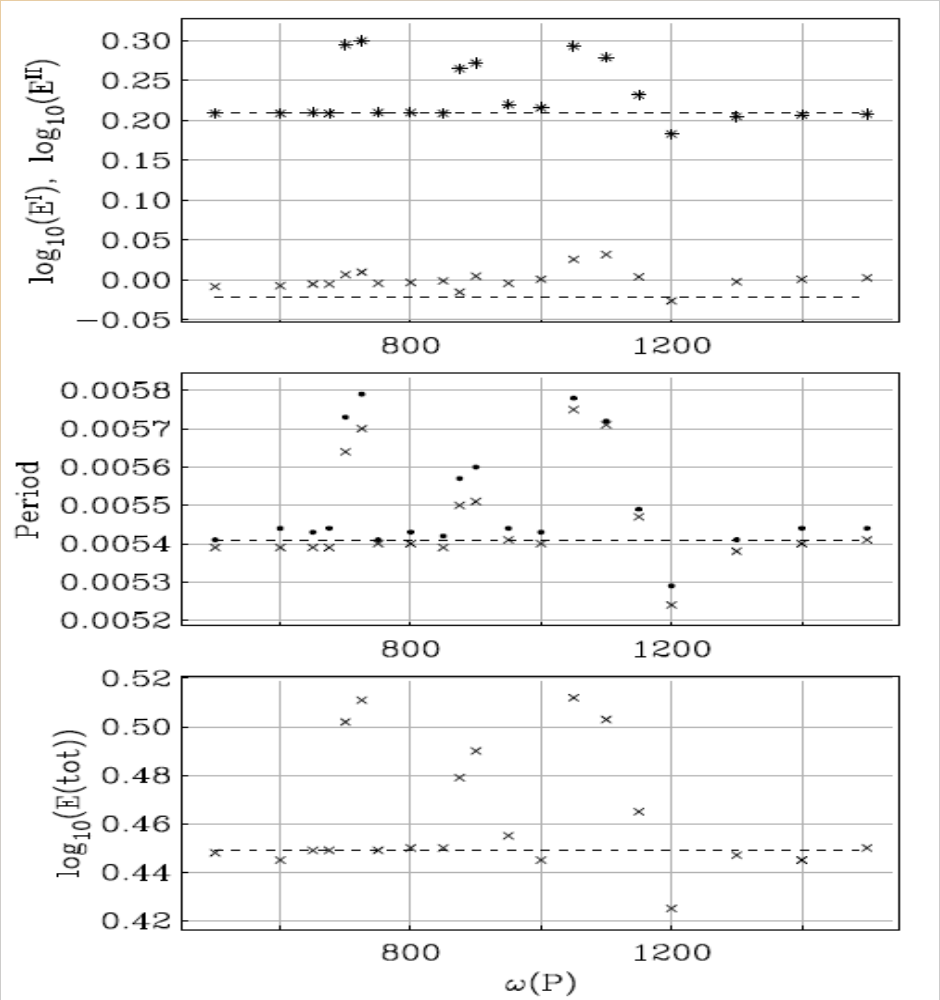


What about parametric resonance?

Better however not fully clear. Apart from a standard excitation condition,

$$\omega_P \approx \omega(E) = 2\omega(B)$$

we see 2 additional peaks…



Why so?

- Usually propagation is separated from excitation.
- For dynamo waves propagation is strongly coupled with excitation.
- Possibly, resonances are weaker rather excitation effects?

Is Mathieu equation a bad model for dynamo resonances? An adequate model give nonstandard excitation conditions?

Minimal relevant dynamical system is 4^{th} order one rather 2^{nd} order as for Mathieu equation.

The problem looks attractive!