# Origin of large scale magnetic field

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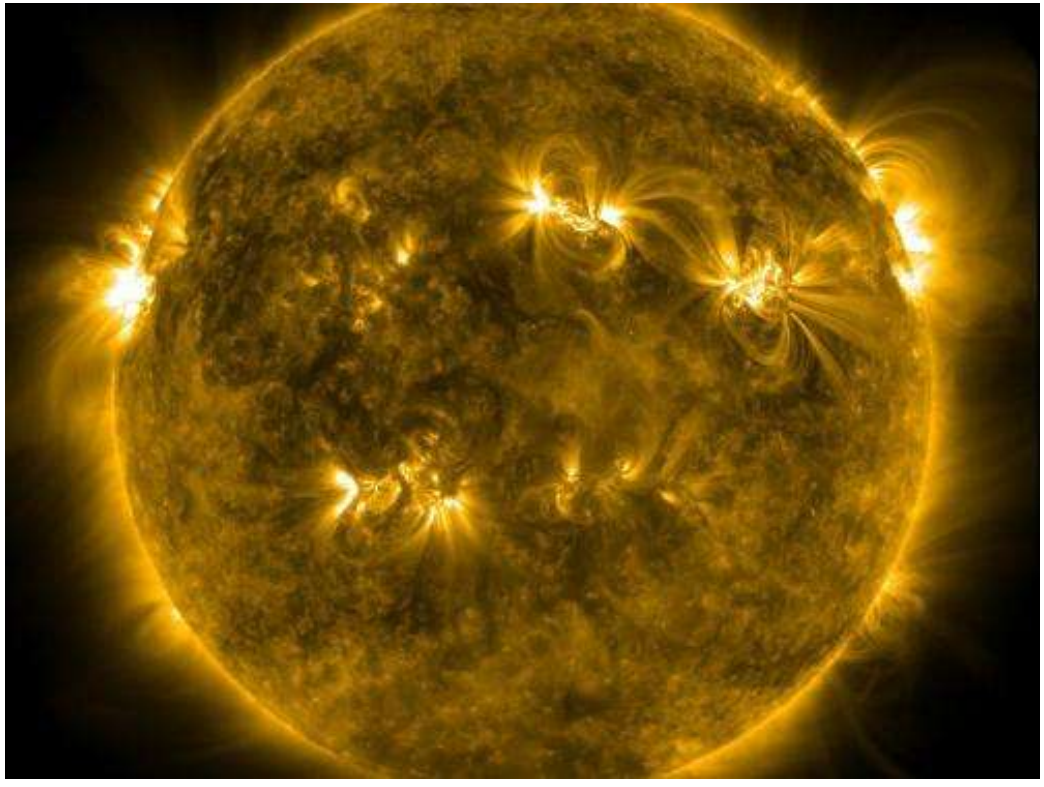
# What is the physical phenomenon related to $\alpha$-dynamos?



## The state of the art

The induction equation governing the evolution of magnetic field:

$$\partial_t \mathbf{B} = \nabla \times (\mathbf{u} \times \mathbf{B}) + \eta \nabla^2 \mathbf{B}\,. \tag{1}$$

Mean field theory decomposition: $\mathbf{B} = \langle \mathbf{B} \rangle + \mathbf{b}$

$$\partial_t \langle \mathbf{B} \rangle \quad -\eta \nabla^2 \langle \mathbf{B} \rangle \quad = \nabla \times \mathcal{E}\,, \qquad \mathcal{E} = \langle \mathbf{u} \times \mathbf{b} \rangle\,, \tag{2}$$

$$\partial_t \mathbf{b} \quad -\eta \nabla^2 \mathbf{b} \quad = \nabla \times (\mathbf{u} \times \langle \mathbf{B} \rangle) + \nabla \times \mathbf{G}\,, \quad \mathbf{G} = \mathbf{u} \times \mathbf{b} - \langle \mathbf{u} \times \mathbf{b} \rangle\,. \tag{3}$$

When $\mathbf{G}$ can be neglected:

$$\mathcal{E}^i = \alpha^{ij} \langle B \rangle^j + \beta^{ijk} \nabla^j \langle B \rangle^k + \ldots\,. \tag{4}$$

## Our last result

Use of Floquet transform:

$$\partial_t \tilde{\mathbf{b}} = i\mathbf{q} \times (\mathbf{u} \times \tilde{\mathbf{b}}) + \nabla \times (\mathbf{u} \times \tilde{\mathbf{b}}) + \eta(\nabla + i\mathbf{q})^2 \tilde{\mathbf{b}}\,. \tag{5}$$

Clear separation between to large and small scale dynamos.

Thank you for your attention !