

Solar Physics, Exercise 5

22 February 2017 at 14-16 in D116

Submit by 21 February 2017 12:00

1. Consider the dynamo equation

$$\frac{\partial \langle \mathbf{B} \rangle}{\partial t} = \nabla \times (\langle \mathbf{v} \rangle \times \langle \mathbf{B} \rangle + \alpha \langle \mathbf{B} \rangle - \eta_t \nabla \times \langle \mathbf{B} \rangle).$$

Set $\langle \mathbf{v} \rangle = 0$ (pure α effect) and assume that $\langle \mathbf{B} \rangle$ represents a force-free solution of the equation. What is the condition for exponential growth of the magnitude of $\langle \mathbf{B} \rangle$?

2. HMI instrument onboard SDO spacecraft, MDI instrument onboard SOHO as well as GONG network of ground-based observatories are used to measure solar magnetic field in the form magnetograms. Investigate the information about these instruments and describe how they are used to estimate magnetic field. Describe the physical phenomenon behind these measurements.
3. Cowling's antidynamo theorem states that axisymmetric magnetic field cannot be maintained by dynamo process. Prove this statement.