Vortex magnetic field solar container

Do solar cycle magnetic fields provide a plausible mechanism for polar vortices?
Here,we show that solar cycle magnetic fields provide a plausible mechanismfor the formation of polar vortices in the Sun. Observing polar regions of the Sun could provide important clues for understanding the origin of solar magnetism as well as its cyclic behavior.

How do vortex flows interact with magnetic flux tubes?
In combination with magnetic fields,they can excite,transmit,and convert various types of MHD waves and act as a waveguide,carrying motions and energy upwards. The interaction of vortex flows with magnetic flux tubes is a subject of intensive research in solar physics and maybe key to understanding the energy budget of the solar atmosphere.

How would a polar vortex affect the solar cycle?
The presence of a polar vortex in the Sun would impact the understandingof the solar cycle. Different morphologies of the vortices would imply differences in the poleward advection of magnetic fields influencing the evolution of the magnetic cycle.

Does a solar box code reduce temperature and density in vortex regions?
Similar findings,namely strong decreasesof temperature,density,and pressure in the surface layers of vortex regions were also reported by Kitiashvili et al. (2011) resulting from non-magnetic simulations with the "SolarBox" code (Wray et al. 2015).

How do magnetic fields affect polar vortices?
Near the surface, however, the dynamics is affected by magnetic fields. Currently, it's not known whether or how the dynamics of this thin subsurface layer as well as the Sun's magnetic cycle influence the formation of vortices in the polar region of the Sun.

Do small-scale vortex tubes play a role in the solar atmosphere?
High-resolution observations (Sect. 6) and realistic numerical simulations (Sect. 7),suggest ubiquitous small-scale vortex tubes to play a substantial rolein the dynamics of the solar atmosphere from the turbulent convective layers up to the low corona (Sect. 5).

Abstract Magnetic flux tubes in the presence of background rotational flows, known as solar vortex tubes, are abundant throughout the solar atmosphere and may act as conduits for MHD waves to ...

Vortex pairs have been known to break the symmetry of the disk so that the polarity and chirality of the vortex can be easily manipulated. In our work, we demonstrate that the polarity ...

Using high-resolution spectropolarimetric data recorded with the Swedish 1 m Solar Telescope, we have

identified several instances of granular lanes traveling into granules. These are ...

Silva et al. (2024b) identified that solar tornadoes are, in fact, composed of three co-spatial vortices: a classical flow vortex (the kinetic vortex Silva et al. (2021)), a magnetic vortex consisting of coherent ...

Like the Earth, the Sun likely has swirling polar vortices, according to new research led by the U.S. National Science Foundation National Center for Atmospheric Research (NSF ...

The vortices impact the magnetic field as they help to intensify the magnetic field at the sinking points, and in turn, the magnetic field ends up playing an essential role in the vortex ...

The magnetic vortices locally concentrate the magnetic field"s vertical components and current, lasting on average around a minute. Two types of magnetic vortices are introduced based on their magnetic ...

Vortex-magnetic interactions shape magnetohydrodynamic (MHD) turbulence, influencing energy transfer in astrophysical, geophysical, and industrial systems. On the Sun, granular-scale vortex flows ...

several instances of granular lanes traveling into granules. These are believed to be the observational signature of underlying tubes of vortical ow with their axis oriented parallel to the solar surface. ...

We introduce two theorems and two corollaries, which may be applicable to any non-collisional plasma system, that relate the vorticity to electromagnetic variables such as the magnetic field and the ...

1 Fundamentals of Orbital Angular Momentum Beams: Concepts, Antenna Analogies, and Applications 3 Anastasios Papathanasopoulos and Yahya Rahmat-Samii 1.1 Electromagnetic Fields Carry Orbital ...

We thus witness a mechanism capable of transporting magnetic flux to the solar surface within granules. This mechanism is probably an important component of the small-scale ...

We investigate vortex dynamics in three magnetic regions, viz., Quiet Sun, Weak Plage, and Strong Plage, using realistic three-dimensional simulations from a comprehensive radiation ...

The solar magnetic field, coupled with dynamical plasma motions at the photosphere are known to play a major role in the transport of energy to the solar corona which is ultimately responsible for heating ...

The origin of a robust magnetic signal lies in polar vortex structures induced by moving domain walls, e.g., near the tips of needle domains and near domain wall kinks.

Abstract Vortex-magnetic interactions shape magnetohydrodynamic (MHD) turbulence, influencing energy transfer in astrophysical, geophysical and industrial systems. In the ...

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We investigate vortex dynamics in three magnetic regions, viz., Quiet Sun, Weak Plage, and Strong Plage, using realistic three-dimensional simulations from a comprehensive ...

Abstract This study aims to investigate the intricate interaction between fluid flow and magnetic fields, known as magnetohydrodynamic (MHD) phenomena, within a hemispherical ...

Additionally, the stabilizing effects of magnetic fields on current vortex sheets have been shown in the incompressible case as well. Under the Syrovatskij stability condition [26], Morando-Trakhinin ...

The physics of coherent beams of photons carrying axial orbital angular momentum (OAM) is well understood, and such beams, sometimes known as vortex beams, have found ...

Abstract In this article, we study the effects of the pair creation in the vortex-driven magnetic field on the radiation pattern of giant black holes. In particular, for a sufficiently wide ...