

## SUN'S MAGNETIC FIELD

A magnetic field is a vector field that describes the magnetic influence on magnetic materials, electric currents, and moving electric charges. Magnetic fields are not represented by continuous lines of force as magnetic flux, which is the flux of a magnetic field through a surface. In fact, in the magnetic field, a transverse is called a field which is equivalent to the magnetic flux through a loop producing an electromotive force equal to the rate of change of magnetic flux in the loop. See also: magnetic induction of matter, a flux density, magnetic flux, flux (2)

**Abstract**

The Sun is a **magnetics star** due to magnetic field generated by the movement of **conductive plasma** in a part of the Sun called the convective zone. This motion is a result of convection, a form of energy transport that entails the physical movement of material. The convective motion of plasma creates the **dynamo** and it generates both a global and some localized magnetic fields. In addition the outflow of plasma destroys the star's primordial magnetic field and generates a global magnetic field. As the star's plasma with different velocities at various latitudes, the magnetism wraps itself around a **toroidal field of the sun** that surrounds the star.

[illegible]

There are two different diagonal orders in the initial matrix (left) to get better off-diagonal band structure.

Open-field regions, which connect the edge surface with the atmosphere, form part of the structure of the hot solar wind.

Closed-funnel regions, which occur up at higher altitudes and then connect to the lowlands.

The solar magnetic field **flips** its polarity about every 11 years, which brings a diminished magnetic field to the solar minimum time. During this, we have the maximum solar activity and massive eruptions of high energy plasma take place. It is during and in the intermediary space, the important thing is the solar field reversal is the heliospheric **current sheet** which is the surface separating outward from the north equator where a magnetic field (instead) flows. Each year some of the surface produces an electrical current and where the polarity of the Sun magnetic field varies from north to south, becoming very easy. The current itself is small and thick but extends billions of kilometers beyond Pluto, on the flanks of interplanetary space. This changing of polarity can cause stormy space weather around the Earth. In addition, the current sheet will act as a barrier to cosmic rays which this extends to our space the solar system.

The Earth's magnetic field stores a large amount of energy. This can be released in a period of explosive activity. Explosive changes between takes place through:

- **Flares**, that are powerful eruptions of radiation at all wavelengths that happen in the sun's atmosphere

**Coronal mass ejections (CMEs)** which are the result of plasma and magnetic field from the Sun's outer layer (corona) They happen in active regions of the solar surface (the groups of sunspots) which have closed magnetic field lines. When these field lines are broken they suddenly release energy, which causes a CME, usually accompanying a solar flare. CMEs travel towards Earth, some dangerously slowly.

Along the structure of the magnetic field lines, solar **prominences** (plasma) characteristically extend outward from the surface of the sun. The structure of a prominence lines itself when the structure gets unstable and turns outward, making plasma that is more luminous and dense than normal plasma.

[illegible]

The jury magnifies the fact  
is important for the jury  
evidence that shows **more**  
another 10 years.

When the food is eaten, it releases a small quantity of energy, stored as a hairpin. Many hairpins feed the same colony, resulting in the emission of long and abundant vibrations that can change the state of antennae and display communication, navigation, and surveillance behaviors.

The **solar wind** is generated in the solar corona. It is a continuous stream of charged particles accelerated away from the Sun. The solar wind carries the **interplanetary magnetic field (IMF)** while flowing through interplanetary space. When it meets Earth and other planet's atmospheres or surfaces, into a planet's magnetic field, it can cause the **magnetic reconnection**. That is a process where the field on the back side joins together. Charged particles then stream back to the planet's magnetic poles causing the aurora borealis in the upper atmosphere.

Other magnetic fields emerge through the photosphere from below.

- **Dipole magnets** which are dipoles which sit above or at the pole's surface. The reason why they are dipoles is that they are inherently linear because there the magnetic fields are particularly strong and because they have some of the heat within the fuel from reaching the surface.
- **Canted loops** which are tightly coiled structures above the pole's surface made of iron plating. They form around curving magnetic field lines and are usually associated with a source of constant magnetic polarity.

# Solar Magnetic Fields

**Wenbin Ji**

A decorative red circular graphic with a gradient, appearing as a partial arc on the right side of the light blue horizontal bar.

## **Solar Magnetic Fields:**

Magnetic Fields in the Solar System Hermann Lühr, Johannes Wicht, Stuart A. Gilder, Matthias Holschneider, 2018-01-10 This book addresses and reviews many of the still little understood questions related to the processes underlying planetary magnetic fields and their interaction with the solar wind With focus on research carried out within the German Priority Program PlanetMag it also provides an overview of the most recent research in the field Magnetic fields play an important role in making a planet habitable by protecting the environment from the solar wind Without the geomagnetic field for example life on Earth as we know it would not be possible And results from recent space missions to Mars and Venus strongly indicate that planetary magnetic fields play a vital role in preventing atmospheric erosion by the solar wind However very little is known about the underlying interaction between the solar wind and a planet's magnetic field The book takes a synergistic interdisciplinary approach that combines newly developed tools for data acquisition and analysis computer simulations of planetary interiors and dynamos models of solar wind interaction measurement of ancient terrestrial rocks and meteorites and laboratory investigations

**Solar Magnetic Fields** Jan Olof Stenflo, 1994-03-31 Magnetic fields are responsible for much of the variability and structuring in the universe but only on the Sun can the basic magnetic field related processes be explored in detail While several excellent textbooks have established a diagnostic foundation for exploring the physics of unmagnetized stellar atmospheres through spectral analysis no corresponding treatise for magnetized stellar atmospheres has been available The present monograph fills this gap The theoretical foundation for the diagnostics of stellar magnetism is developed from first principles in a comprehensive way both within the frameworks of classical physics and quantum field theory together with a presentation of the various solar applications This textbook can serve as an introduction to solar and stellar magnetism for astronomers and physicists at the graduate or advanced undergraduate level and will also become a resource book for more senior scientists with a general interest in cosmic magnetic fields

**Magnetic Fields in the Solar Atmosphere** Jacques Maurice Beckers, 1976 This paper describes the magnetic field configurations observed in the solar atmosphere including the corona and the solar wind The techniques for observing solar magnetic fields are briefly reviewed The significance of Alfvén waves in transporting energy is stressed

Author Solar Magnetic Fields R.F. Howard, 2012-12-06 This symposium was held at the Collège de France in Paris from August 31 to September 4 1970 The Organizing Committee consisted of V Bumba R Howard Chairman K O Kiepenheuer R Michard E N Parker A B Severny V E Stepanov and T Takakura The Local Organizing Committee consisted of Miss G Drouin Secretary R Michard Chairman J C Pecker and J Rayrole We are indebted to the Collège de France for their kind hospitality I wish to express my gratitude to members of the Organizing Committee for advice and assistance and to R Michard and the Local Organizing Committee who were responsible for the smooth running of the sessions the distribution and collection of the discussion sheets and for a delightful Wednesday afternoon excursion to Meudon It is a pleasure to thank J W Evans V E

Stepanov K O Kiepenheuer R G Giovanelli T G Cowling V Bumba W C Livingston and J M Wilcox who kindly served as session chairmen I also wish to thank Miss Judy Harstine and John M Adkins of the Hale Observatories for invaluable assistance in editing the proceedings This Symposium has been supported financially by the International Astronomical Union

Magnetic Fields in the Solar Atmosphere Jacques Maurice Beckers, 1976 This paper describes the magnetic field configurations observed in the solar atmosphere including the corona and the solar wind The techniques for observing solar magnetic fields are briefly reviewed The significance of Alfvén waves in transporting energy is stressed Author Studies of Solar Magnetic Fields During the Rise of Solar Cycle 22, 1991 New information about the solar cycle and the changing magnetic fields includes 1 Every solar cycle has a duration of 18-22 years even though the peak between successive cycles is approximately 11 years This means that there are two solar cycles on the sun nearly all of the time the exception is the few years preceding solar maximum 2 a large scale velocity field was discovered around the perimeter of one of the major active regions that developed during the rise of the current solar cycle If averaged over a several month interval the velocity would be of the same order of magnitude as the velocity pattern of the torsional oscillation signal that varies systematically over the solar cycle The newly discovered velocity pattern can be interpreted as either a severe contamination to the torsional oscillation signal or another way of observing the torsional oscillation velocity field 3 Our analyses of small scale magnetic fields on the quiet sun has shown that network magnetic fields are continuously being replaced by intranetwork magnetic fields The replacement occurs when intranetwork magnetic fields collide with network magnetic fields both polarities are observed to cancel each other at a mean rates of 10 to the 18th power Maxwells hour The non cancelling components of the intranetwork magnetic field replace the cancelled components of the network No net long term increases or decreases in magnetic flux occur as a consequence of these processes *Cosmic Magnetic Fields* Jorge Sánchez Almeida, María Jesús Martínez González, 2018-04-12 Magnetic fields pervade the universe and play an important role in many astrophysical processes However they require specialised observational tools and are challenging to model and understand This volume provides a unified view of magnetic fields across astrophysical and cosmological contexts drawing together disparate topics that are rarely covered together Written by the lecturers of the XXV Canary Islands Winter School it offers a self contained introduction to cosmic magnetic fields on a range of scales The connections between the behaviours of magnetic fields in these varying contexts are particularly emphasised from the relatively small and close ranges of the Sun planets and stars to galaxies and clusters of galaxies as well as on cosmological scales Aimed at young researchers and graduate students this up to date review uniquely brings together a subject often tackled by disconnected communities conveying the latest advances as well as highlighting the limits of our current understanding *Cosmic Magnetic Fields (IAU S259)* International Astronomical Union. Symposium, 2009-06-11 IAU Symposium 259 presents the first interdisciplinary comprehensive review of the role of cosmic magnetic fields involving astronomers and physicists from across the community Offering both theoretical

and observational topics ranging from Earth's habitability to the origin of the universe this is an invaluable summary for researchers and graduate students

**Solar System Magnetic Fields** E.R. Priest, 2012-12-06 In September 1984 a Summer School on Solar System Plasmas was held at Imperial College with the support of the Science and Engineering Research Council An excellent group of lecturers was assembled to give a series of basic talks on the various aspects of the subject aimed at Ph D students or researchers from related areas wanting to learn about the plasma physics of the solar system The students were so appreciative of the lectures that it was decided to write them up as the present book Traditionally different areas of solar system science such as solar and magnetospheric physics have been studied by separate communities with little contact However it has become clear that many common themes cut right across these distinct topics such as magnetohydrodynamic instabilities and waves magnetic reconnection convection dynamo activity and particle acceleration The plasma parameters may well be quite different in the Sun's atmosphere a cometary tail Jupiter's magnetosphere but many of the basic processes are similar and it is by studying them in different environments that we come to understand them more deeply Furthermore direct in situ measurements of plasma properties at one point in the solar wind or the magnetosphere complement the more global view by remote sensing of a similar phenomenon at the Sun

**Solar Magnetic Fields** André Balogh, Edward Cliver, Gordon Petrie, Sami Solanki, Michael Thompson, Rudolf von Steiger, 2018-06-06 This volume provides an in depth review of all aspects of solar magnetic fields Written by world leading experts these thirteen papers cover all regions of the subject from the solar interior photosphere chromosphere active regions and corona out to the solar wind The history of solar magnetic fields as well as the necessary instrumentation are also covered The volume serves as both a reference for researchers and a starting point for graduate students Originally published in Space Science Reviews Volume 210 Issue 1 4 September 2017

**Magnetic Fields of Celestial Bodies** Ye Shi-hui, 2012-12-06 Magnetism is one of the basic properties of matter Mankind has travelled a long road in discovering and utilizing magnetism and in this respect the ancient Chinese people have made outstanding contributions In the book Lu's Spring and Autumn written near the end of the Warring States Period i e in the third century B C there is a statement on the attraction of iron by lodestones So at that time it was known that magnets can attract ferromagnetic material At the beginning of the first century A D viz in the early years of the East Han Dynasty the famous scholar Wang Chong wrote in his masterpiece *Len Hien* that the handle of a magnetic dipper pointed to the south It was thus discovered at the time that magnets can point to the poles of the geomagnetic field At the beginning of the twelfth century during the reign of Emperor Hui of the Sung Dynasty in the two books written by Zhu Yo and Xu Jin respectively there are descriptions of the compass used in navigation This tells us that the application of compasses was rather widespread at that time The distinguished scientist Shen Kuo 1031-1095 discovered the declination of the terrestrial magnetic field This is four hundred and more years earlier than its discovery by Christopher Columbus in 1492 during his voyage across the Atlantic Ocean Such facts as these

manifest the important contributions of ancient China to global civilization

### **Solar Flare Magnetic Fields and Plasmas**

Yuhong Fan, George Fisher, 2012-03-28 This volume is devoted to the dynamics and diagnostics of solar magnetic fields and plasmas in the Sun's atmosphere. Five broad areas of current research in Solar Physics are presented: 1 New techniques for incorporating radiation transfer effects into three dimensional magnetohydrodynamic models of the solar interior and atmosphere; 2 The connection between observed radiation processes occurring during flares and the underlying flare energy release and transport mechanisms; 3 The global balance of forces and momenta that occur during flares; 4 The data analysis and theoretical tools needed to understand and assimilate vector magnetogram observations; and 5 Connecting flare and CME phenomena to the topological properties of the magnetic field in the Solar Atmosphere. The role of the Sun's magnetic field is a major emphasis of this book which was inspired by a workshop honoring Richard C. Dick. Canfield. Dick has been making profound contributions to these areas of research over a long and productive scientific career. Many of the articles in this topical issue were first presented as talks during this workshop and represent substantial original work. The workshop was held 9-11 August 2010 at the Center for Green campus of the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. This volume is aimed at researchers and graduate students active in solar physics, solar terrestrial physics, and magnetohydrodynamics. Previously published in *Solar Physics* journal Vol 277 1 2012.

### **Measurements of Solar**

**Magnetic Fields** N. R. Sheeley, California Institute of Technology. Division of Physics, Mathematics and Astronomy, 1965

The Earth's Magnetic Field : Its History, Origin, and Planetary Perspective McElhinny, 1984-01-04 The Earth's Magnetic Field: Its History, Origin, and Planetary Perspective

**The Strongest Magnetic Fields in the Universe** Vasily S. Beskin, A. Balogh, Maurizio Falanga, Maxim Lyutikov, Sandro Mereghetti, Tsvi Piran, R.A. Treumann, 2016-01-29 This volume extends the ISSI series on magnetic fields in the Universe into the domain of what are by far the strongest fields in the Universe and stronger than any field that could be produced on Earth. The chapters describe the magnetic fields in non-degenerate strongly magnetized stars in degenerate stars such as white dwarfs and neutron stars, exotic members called magnetars and in their environments as well as magnetic fields in the environments of black holes. These strong fields have a profound effect on the behavior of matter, visible in particular in highly variable processes like radiation in all known wavelengths including Gamma Ray bursts. The generation and structure of such strong magnetic fields and effects on the environment are also described.

*A Study on the Evolution of Solar Magnetic Field in the Heliosphere* Iren Sobia A, 2023-01-08 The closest star to the Earth, the Sun, is a large ball of ionized gas called plasma. The Sun has intense variable magnetic fields which are the drivers of most solar magnetic activity. An overview of the solar magnetic field, its most important properties, along with a description of the solar wind and solar transient events are presented in this chapter. The solar wind represents the medium by which the Sun extends its atmosphere swiftly into the vastness of the solar system. The solar wind in change carves out a region of interstellar space several times the orbit of the most distant planet known as the heliosphere. The

heliosphere is the region of space that is dominated by the solar magnetic field which is drawn out into space by the solar wind into a bubble in the space Solar maximum and solar minimum are phases through which the Sun's magnetic field has been found to repeat roughly every 11 years [Nuclear Science Abstracts](#) ,1975 **Solar Magnetic Fields** Jan Stenflo,2014-01-15

**Solar Magnetic Fields and Activities** Jack Ireland,Brigitte Schmieder,2007 [Literature 1992, Part 1](#) Astronomisches Recheninstitut,2013-11-11 Astronomy and Astrophysics Abstracts appearing twice a year has become one of the fundamental publications in the fields of astronomy astrophysics and neighbouring sciences It is the most important English language abstracting journal in the mentioned branches The abstracts are classified under more than a hundred subject categories thus permitting a quick survey of the whole extended material The AAA is a valuable and important publication for all students and scientists working in the fields of astronomy and related sciences As such it represents a necessary ingredient of any astronomical library all over the world

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