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ORIGINAL ARTICLE

MAGNETISM OF THE SUN

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Abstract:

The Sun is a magnetically active star. It supports a strong, changing magnetic field that varies year-to-year and reverses direction about every eleven years around solar maximum. The Sun's magnetic field leads to many effects that are collectively called solar activity, including sunspots on the surface of the Sun, solar flares, and variations in solar wind that carry material through the Solar System. For study of magnetism of the Sun i.e. Solar Magnetism. Magnetic fields are present almost everywhere on the Sun. Without these fields the Sun would have been a rather dull object.

KEYWORDS:

The Sun, Magnetic field, Layers, Magnetic flux, Solar cycle

INTRODUCTION:

The Sun is the star at the center of the Solar System. It is almost perfectly spherical and consists of hot plasma with magnetic fields. It has a diameter of about 1,392,684 km about 109 times that of Earth and its mass (about 2×1030 kilograms, 330,000 times that of Earth) accounts for about 99.86% of the total mass of the Solar System. All matter in the Sun is in the form of gas and plasma because of its high temperatures. The Sun is a magnetically active star. It supports a strong, changing magnetic field that varies year-to-year and reverses direction about every eleven years around solar maximum. The Sun's magnetic field leads to many effects that are collectively called solar activity, including sunspots on the surface of the Sun, solar flares, and variations in solar wind that carry material through the Solar System.

Magnetic fields are present almost everywhere on the Sun. Without these fields the Sun would have been a rather dull object. The history of terrestrial magnetism dates back to 2500 years ago when according to a Greek legend a shepherd in a region called Magnesia discovered a strange attracting object. By 11 A.D. sailors already started using magnetic compasses. But it was William Gilbert who set out the new science of electricity and magnetism through his famous book “De Magnete” published in 1600. About 150 years later Charles-Augustin de Coulomb presented the laws describing the electrostatic attraction between electric charges. These were followed by the pioneering works of Hans Christian Oersted, Ampere, Michael Faraday, Hendrik Antoon Lorentz and others. The relation between electricity and magnetism discussed in Gilbert's De Magnete was finally put on a firm basis by James Clerk Maxwell in his famous book A Treatise on Electricity and Magnetism published in 1873, starting the field of Electromagnetism. In 1896, Pieter Zeeman discovered the splitting of certain spectral lines under the influence of a magnetic field.

George Ellery Hale in 1909 gave the first observational evidencey of magnetic fields on the Sun. This extraterrestrial magnetism discovered using the Zeeman effect gave a boost to studies related to Sun and its magnetism. It took almost half a decade to come back and confirm this observation using a robust solar magnetograph developed by Babcock in 1953. The magnetograms revealed that magnetic fields

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existed outside sunspots.

EVOLUTION OF THE SOLAR MAGNETISM

Magnetic flux observed in the solar atmosphere is believed to be generated by a dynamo mechanism i.e. solar dynamo taking place somewhere in the lower part of the convection zone. The convection and the differential rotation is an essential ingredient for the solar dynamo. The magnetic field in the convective layers can be split into two components: poloidal i.e. field in the meridional planes and toroidal (directed east-west). Assuming a pre-existing poloidal field, in the first cycle of the dynamo, differential rotation generates a toroidal magnetic field by wrapping the north-south directed magnetic fields in the east-west direction. This is called the ω- effect. In the subsequent cycle, the convective motions under the influence of Coriolis force generate a poloidal field from the toroidal field by twisting the rising of east-west directed fields, a process called the α- effect. The full dynamo cycle is closed when a poloidal field has been generated. This mechanism can explain the periodicity of the solar cycle.

The solar cycle or solar magnetic activity cycle is the periodic change in the sun's activity including changes in the levels of solar radiation and ejection of solar material and appearance i.e. visible in changes in the number of sunspots, flares. Solar cycles have a duration of about 11 years. The generated field rises through the convection zone in the form of magnetic flux tubes. In the solar atmosphere, the emerging magnetic flux forms magnetically bipolar groups. Sunspots, the most conspicuous magnetic phenomena in the visible layers of the solar atmosphere are the manifestations of these bipolar fields. These active regions are responsible for the production of flares and coronal mass ejections(CMEs). CMEs are events where very large amounts of hot gas, trapped by the magnetic field of the active region, are released from the Sun's atmosphere and into space. Apart from these large scale fields, the atmosphere is inhomogeneously filled with smaller and smaller scales of magnetic flux.

The Sun emits radiation that ranges in wavelength that spans the entire electromagnetic spectrum, from very short-wavelength X-rays, to ultraviolet (UV), visible, infrared (IR) and very long-wavelength radio waves. Solar irradiance gives a measure of this radiation. The total solar irradiance (TSI) is the amount of solar radiative energy incident on the Earth's upper atmosphere. The Total Solar Irradiance (TSI) gives the total radiant energy per unit time (power) at all wavelengths that the Earth receives on unit area of its surface from the entire solar disk. The spectral irradiance gives the power per unit area in a particular wavelength range. It is seen that the solar irradiance is not constant. The TSI and the spectral irradiance fluctuate depending on the 11 year solar cycle, becoming stronger during the solar maxima and weaker during solar minima.

CONCLUSION:

The solar magnetic field extends well beyond the Sun itself. Magnetic fields are thought to play a very important role in the solar activity and solar irradiance variability. Without magnetic fields the Sun would have been a rather dull object.

REFERENCES:

1. Zeeman, P. (1897). 'On the influence of Magnetism on the Nature of the Light emitted by a Substance'.Phil. Mag. 43:226.
2. Babcock, H. W. & Babcock, H. D. 1958, Photospheric magnetic fields, Vol. 6, Electromagnetic Phenomena in Cosmical Physics, ed. B. Lehnert, 239
3. G.E. Hale, On the probable existence of a magnetic fields in sunspots. Astrophys. J. 28, 315343
4. Woolfson,M (2000). "The origin and evolution of the solar system". 41-47