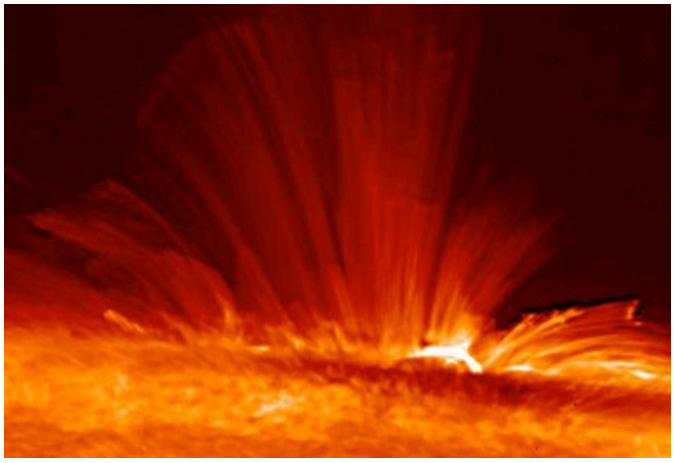
News archive

- 2010
  - December 2010
  - November 2010
  - October 2010
  - September 2010
  - August 2010
  - July 2010
  - June 2010
  - May 2010
  - April 2010
  - March 2010
  - February 2010
  - January 2010
- 2009
- 2008
- 2007
- 2006
- 2005
- 2004
- 2003
- 2002
- 2001
- 2000
- 1999
- 1998
- 1997

The Sun's magnetic field warps its environment

Sep 2, 2010 4 comments



Plasma emerging from the solar surface along magnetic field lines

The Sun's extended magnetic field provides a vital shield for astronauts; without it they would be left exposed to potentially deadly cosmic rays entering in from outside the solar system. Now, a group of researchers in the UK and the US offers an explanation of how this protective field is generated and sustained by violent processes at the surface of the Sun. The findings provide another insight into the solar magnetic field – an incredibly complicated physical system.

Like the Earth, the turbulent motion of the Sun's interior generates a large-scale magnetic field whose main component is a dipole. But whereas the Earth's dipole field reverses its polarity roughly once every million years, the Sun's field is far more dynamic, with its north and south poles flipping roughly every 11 years.

The presence of the Sun's magnetic field also creates the heliosphere, an immense bubble-like structure surrounding the Sun. The heliosphere is controlled and maintained by the solar wind, which emerges as a constant stream of charged particles from the Sun's upper atmosphere. Magnetic flux is also dragged into the heliosphere with the solar wind, creating what astrophysicists refer to as the Sun's "open" magnetic field.

Pattern-searching

For more than 50 years spacecraft have been able to directly observe the open magnetic field, enabling solar physicists to search for patterns in its variation. Researchers have been looking, in particular, for a link between the changing magnetic flux and the 11-year solar cycle. Over the course of the solar cycle, the amount of radiation emitted by the Sun varies from a quiet period to a spell of increased activity, at the height of which the Sun's magnetic field is observed to reverse its polarity.

Now, a team led by Mathew Owens at the University of Reading in the UK has taken a step towards this goal by establishing a link between the emerging magnetic flux and the prevailing conditions at the surface of the Sun. They approached the problem by combining a model of the corona with land- and space-based observations of the heliosphere collected over the past solar cycle by missions such as the Solar and Heliospheric Observatory (SOHO).

Related stories

First stunning images from NASA's Sun gazer
The Sun could be heading into period of extended calm
Where are the sunspots?
'Sluggish' jet streams linked to quiet Sun
A new view of our volatile star

Related links

Sarah Gibson
Mathew Owens

Owens' team discovered that the rate at which flux is lost from the corona seems to be regulated by how "clean" the magnetic divide is between the north and south sides of the heliosphere. Where the divide becomes warped it leads to more flux being dragged out into the heliosphere. "Most novel in this paper is that they are taking into consideration how the three-dimensional global morphology of the solar wind structure affects variation of solar wind magnetic field strength," says Sarah Gibson, a researcher at the National Center for Atmospheric Research (NCAR) in Colorado.

No clear link with sunspots

The research does not, however, link conditions in the heliosphere with sunspots, which are regions on the Sun's surface where magnetic field has emerged in large bundles. Sunspots are most common during the Sun's active period when it is at its most intense and they often lead to solar flares that can be a potential hazard to communications on Earth. There is still much debate in the scientific community about why the recent quiet spell in solar activity, which ended in the past year or so, was roughly two years longer than usual.

Owens believes that we are headed for a generally quieter Sun over the next solar cycle with fewer magnetic storms, reducing the hazard to communication. On the downside, however, there will be less magnetic flux available to replenish the heliosphere, giving astronauts and space-based equipment a reduced shield from galactic cosmic rays. "So while there will probably be fewer large solar-driven events, there will likely be a higher constant 'dose' of radiation from outside," Owens tells *physicsworld.com*.

In the short term, Owens' group will look at more examples of previous solar cycles, which will require some reconstruction of historic datasets. "Ultimately, the goal is to figure out how the internal plasma circulations, the photospheric features and the upper solar atmosphere observations all fit together over the huge range of spatial and temporal time scales involved," says Owens. "That should keep us busy for some time."

This research has been submitted to the *Journal of Geophysical Research*.

About the author

James Dacey is a reporter for *physicsworld.com*

4 comments

Comments on this article are now closed.

1 **Oliver K. Manuel**
Sep 3, 2010 8:15 PM
United States

We Live in the Solar Heliosphere !

Yes, indeed!

The Sun's magnetic field creates the heliosphere, "an immense bubble-like structure surrounding the Sun" and engulfing the entire planet Earth!

That basic fact seems to have been overlooked by Al Gore, the UN's IPCC, and the self-selected gatekeepers of climate knowledge.

With kind regards,
Oliver K. Manuel
Former NASA Principal
Investigator for Apollo

Offensive? Unsuitable? Notify Editor

2 **DoImance**
Sep 6, 2010 2:16 AM

Someone needs to carry water for the Koch brothers. They're in their 70's and they need it.

Quote:

> *Originally posted by* ***Oliver K. Manuel***
> Yes, indeed!
>
> The Sun's magnetic field creates the heliosphere, "an immense bubble-like structure surrounding the Sun" and engulfing the entire planet Earth!

That basic fact seems to have been overlooked by Al Gore, the UN's IPCC, and the self-selected gatekeepers of climate knowledge.

With kind regards,
Oliver K. Manuel
Former NASA Principal
Investigator for Apollo

Offensive? Unsuitable? Notify Editor

3 **ikujyhtgrf**
Sep 6, 2010 12:59 PM

dsfsd

Quote:

Originally posted by ***Dolmance***
Someone needs to carry water for the Koch brothers. They're in their 70's and they need it.

Quote:

Originally posted by ***Oliver K. Manuel***
Yes, indeed!

The Sun's magnetic field creates the heliosphere, "an immense bubble-like structure surrounding the Sun" and engulfing the entire planet Earth!

That basic fact seems to have been overlooked by Al Gore, the UN's IPCC, and the self-selected gatekeepers of climate knowledge.

With kind regards,
Oliver K. Manuel
Former NASA Principal
Investigator for Apollo

Offensive? Unsuitable? Notify Editor

4 **Oliver K. Manuel**
Sep 24, 2010 7:46 PM
United States

Thanks for the Water!

Quote:

Originally posted by ***Dolmance***
Someone needs to carry water for the Koch brothers. They're in their 70's and they need it.

Thank you, Dolmance, for the water. It worked!

This one-page summary of other unpopular observations on the Sun shows my gratitude.

db.tt…X9uExea

Offensive? Unsuitable? Notify Editor