

# STCE Newsletter

30 Sep 2013 - 6 Oct 2013



*Published by the STCE - this issue : 10 Oct 2013. Available online at <http://www.stce.be/newsletter/>.*

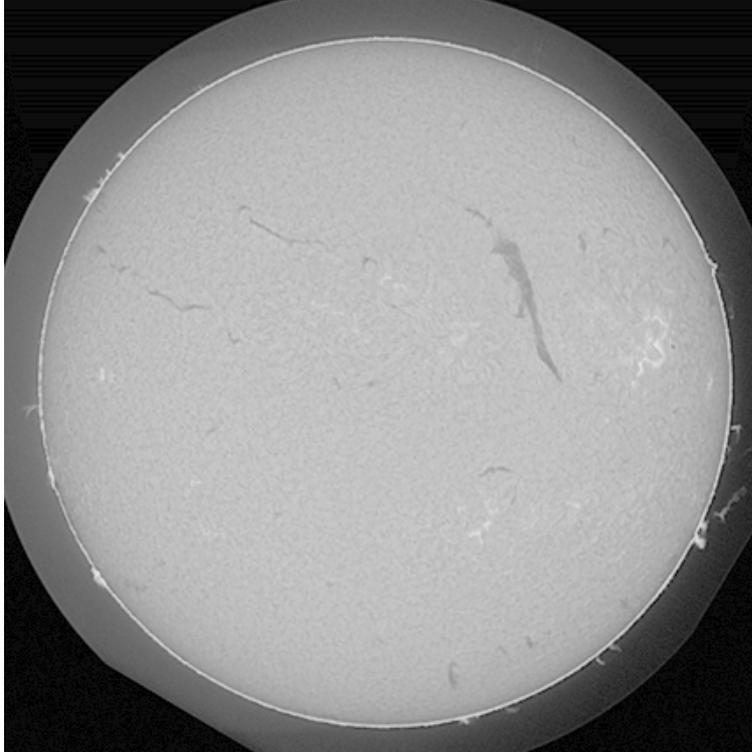
The Solar-Terrestrial Centre of Excellence (STCE) is a collaborative network of the Belgian Institute for Space Aeronomy, the Royal Observatory of Belgium and the Royal Meteorological Institute of Belgium.

<b>Content</b>	<b>Page</b>
1. Anatomy of a solar filament (30 Sep 2013 - 6 Oct 2013)	2
2. PROBA2 Observations (30 Sep 2013 - 6 Oct 2013)	5
3. Review of solar and geomagnetic activity (30 Sep 2013 - 6 Oct 2013)	11
4. Geomagnetic Observations at Dourbes (30 Sep 2013 - 6 Oct 2013)	13
5. Review of ionospheric activity (30 Sep 2013 - 6 Oct 2013)	14
6. Future Events	14

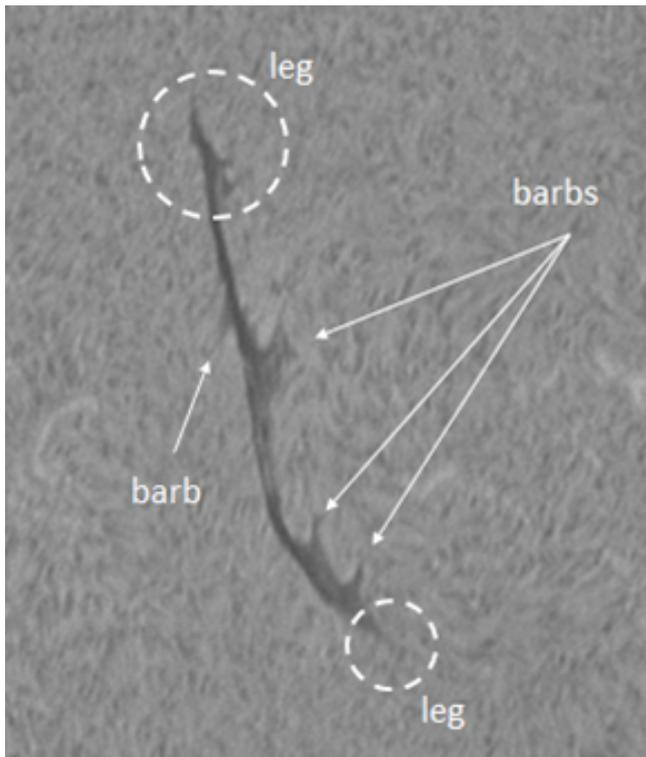
Final Editor : Petra Vanlommel  
Contact : R. Van der Linden, General Coordinator STCE,  
Ringlaan - 3 - Avenue Circulaire, 1180 Brussels,  
Belgium

## 1. Anatomy of a solar filament (30 Sep 2013 - 6 Oct 2013)

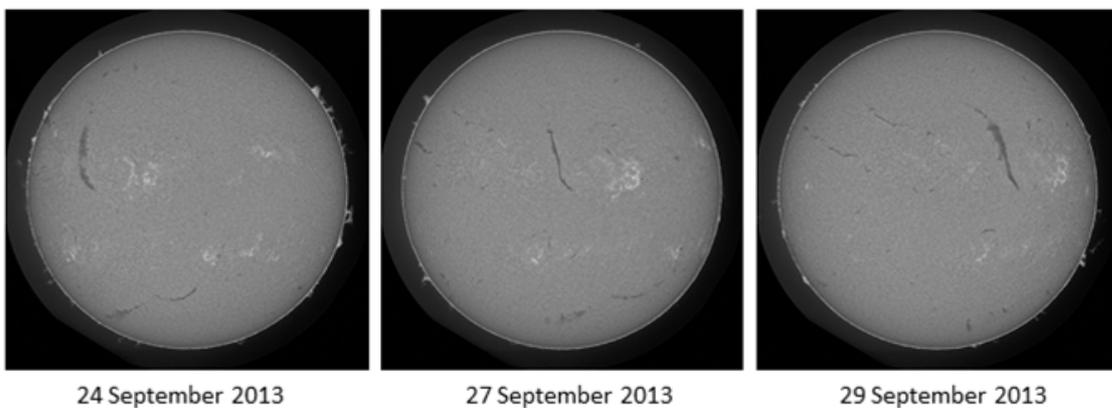
As filaments and filament eruptions continue to determine the current solar activity, it may be an idea to get a bit more acquainted.



Solar filaments are clouds of ionized gas above the solar surface squeezed between magnetic regions of opposite polarity. Being cooler and denser than the plasma underneath and their surroundings, these magnetic borderlines appear as dark lines when seen on the solar disk using special filters. One such a filter is the Hydrogen-alpha (H-alpha) line in the red part of the solar spectrum. It shows the cool inner atmosphere of the Sun. Filaments can appear in e.g. sunspot regions, where they are called active region filaments. They can also appear completely isolated on the solar disk, and then they are called quiescent filaments. These can become very long and can last for one or more solar rotation.

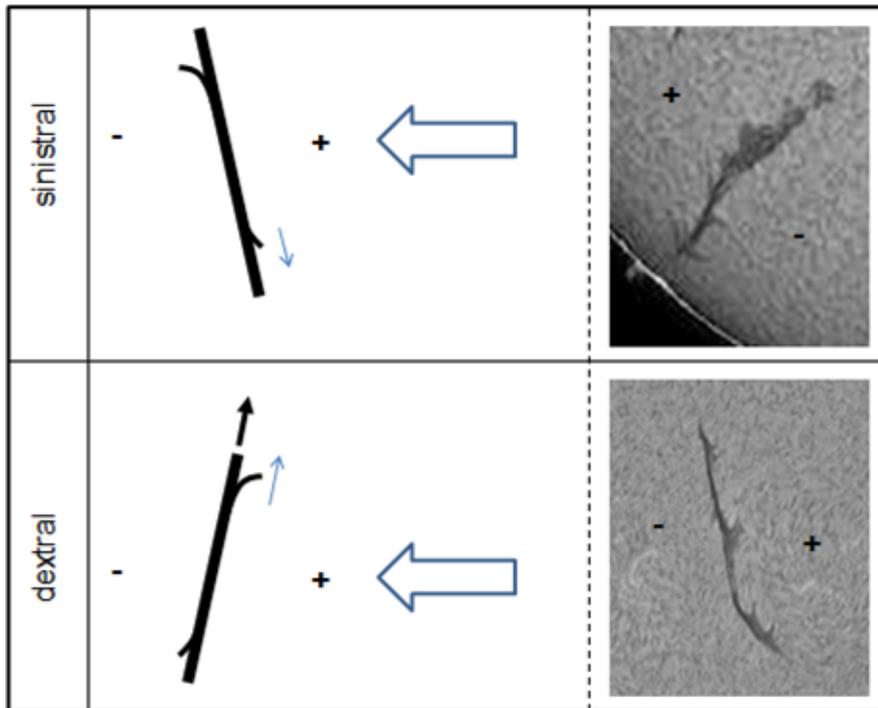


Since systematic H-alpha observations started over a century ago, the filament structure and its constituting parts have all been given names. As such, a filament consists of a spine, barbs, legs and veins. Here, "spine" is the name for the overall, long, very thin, darkish filament feature. It can be several tens of thousands kilometers high and hundreds of thousands kilometers long, yet only a few thousands of kilometers wide. Therefore in modeling, it's often called a "slab". Due to perspective effects, the filaments seem actually quite a bit wider than they actually are.

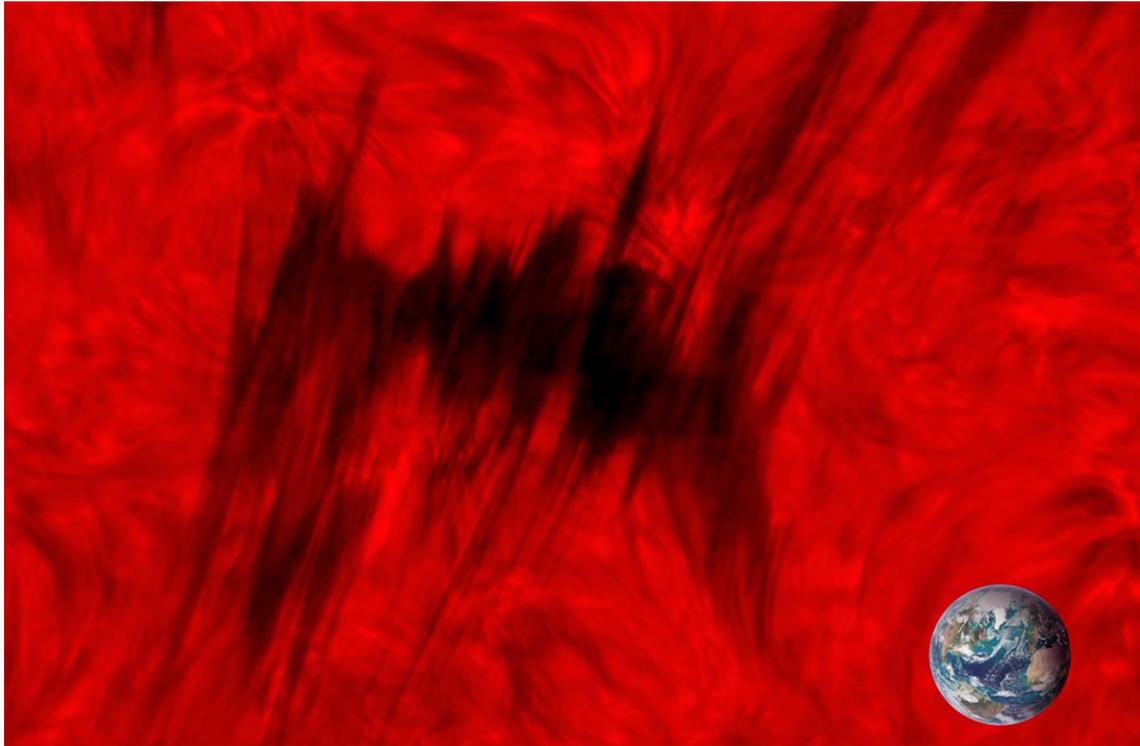


On many occasions, one can see filamentary pieces sticking out of the spine. These are the "barbs", very similar in outlook to the barbs on a harpoon. Barbs are a topic of scientific research. Indeed, the direction of the barbs as seen from the positive magnetic field that borders the filament, gives an indication of the magnetic helicity, which in turns may help in determining the magnetic orientation of the coronal mass ejection if such a filament would erupt. A large majority of the filaments on the northern solar hemisphere is directed to the right ("dextral"), whereas on the southern hemisphere, most of them are directed to the

left ("sinistral"). Amazingly, this "rule" remains valid over all the solar cycles, and thus does not depend on e.g. the polar magnetic field reversal.



The outer ends of the filament are called "legs", and they can terminate in a single or in multiple points. Often, magnetic instabilities near one of the legs may cause (part of) the filament to erupt. High resolution images of filaments have shown that the spine, barbs and legs of a filament actually all consist of many filamentary threads (also called "veins"). These thin threads are considered as the fundamental structures of solar filaments. The H-alpha picture underneath shows these threads making up a filament. It was taken by Prof. Oddbjorn Engvold (University of Oslo) with the Swedish solar telescope (SST) on La Palma. For a sense of the scale of these features, an image of the Earth has been added.



Credits - Imagery was taken from the GONG H-alpha Network (<http://halpha.nso.edu/>) and the Swedish 1m Solar Telescope (<http://www.solarphysics.kva.se/>)

## **2. PROBA2 Observations (30 Sep 2013 - 6 Oct 2013)**

### **Solar Activity**

Solar (flaring) activity fluctuated between low and very low during the week.

In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: <http://proba2.oma.be/ssa>.

This page also lists the recorded flaring events.

A weekly overview movie can be found here (SWAP184), and includes data from three planned offpoints.

[http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184\\_Sep30toOct06/weekly\\_movie\\_2013\\_9\\_30.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184_Sep30toOct06/weekly_movie_2013_9_30.mp4)

Details about some of this week's events, can be found further below.

**Monday Sep 30:**



Eruption on the east limb @ 05:58 - SWAP difference image

Find a movie of the events here (SWAP difference movie)

[http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184\\_Sep30toOct06/Events/20130930\\_Eruption\\_EastLimb\\_0558\\_swap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184_Sep30toOct06/Events/20130930_Eruption_EastLimb_0558_swap_diff.mp4)

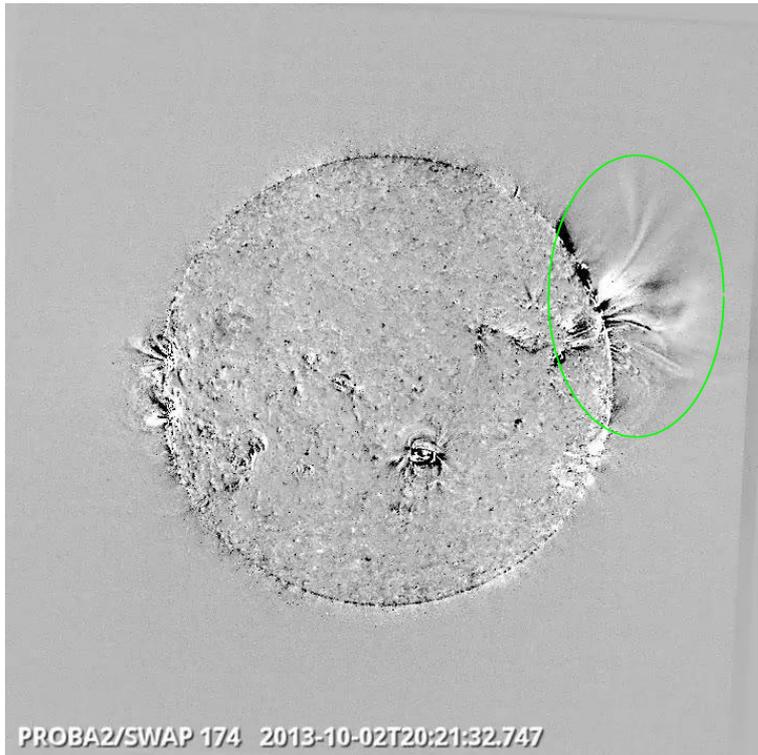


Eruption on the east limb @ 17:47 - SWAP difference image

Find a movie of the events here (SWAP difference movie)

[http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184\\_Sep30toOct06/Events/20130930\\_Eruption\\_EastLimb\\_1747\\_swap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184_Sep30toOct06/Events/20130930_Eruption_EastLimb_1747_swap_diff.mp4)

**Wednesday Oct 02:**



Eruption on the northwest limb @ 20:21 - SWAP difference image

Find a movie of the event here (SWAP difference movie)

[http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184\\_Sep30toOct06/Events/20131002\\_Eruption\\_NortWestLimb\\_2021\\_swap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184_Sep30toOct06/Events/20131002_Eruption_NortWestLimb_2021_swap_diff.mp4)

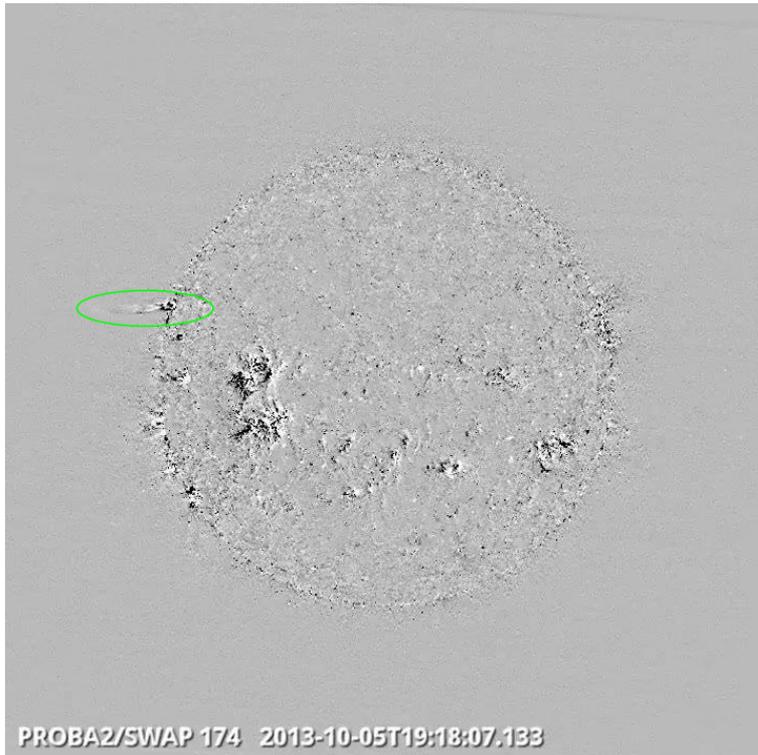


Eruption in the southeast quad @ 23:32 - SWAP difference image

Find a movie of the event here (SWAP difference movie)

[http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184\\_Sep30toOct06/Events/20131002\\_Eruption\\_SouthEastQuad\\_2332\\_swap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184_Sep30toOct06/Events/20131002_Eruption_SouthEastQuad_2332_swap_diff.mp4)

**Saturday Oct 05:**



Eruption on the northeast limb @ 19:18 - SWAP difference image

Find a movie of the event here (SWAP difference movie)

[http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184\\_Sep30toOct06/Events/20131005\\_Eruption\\_EastLimb\\_1918\\_swap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184_Sep30toOct06/Events/20131005_Eruption_EastLimb_1918_swap_diff.mp4)

**Sunday Oct 06:**



Eruption with a two ribbon flare on the south west quad @ 13:56 - SWAP difference image

Find a movie of the event here (SWAP difference movie)

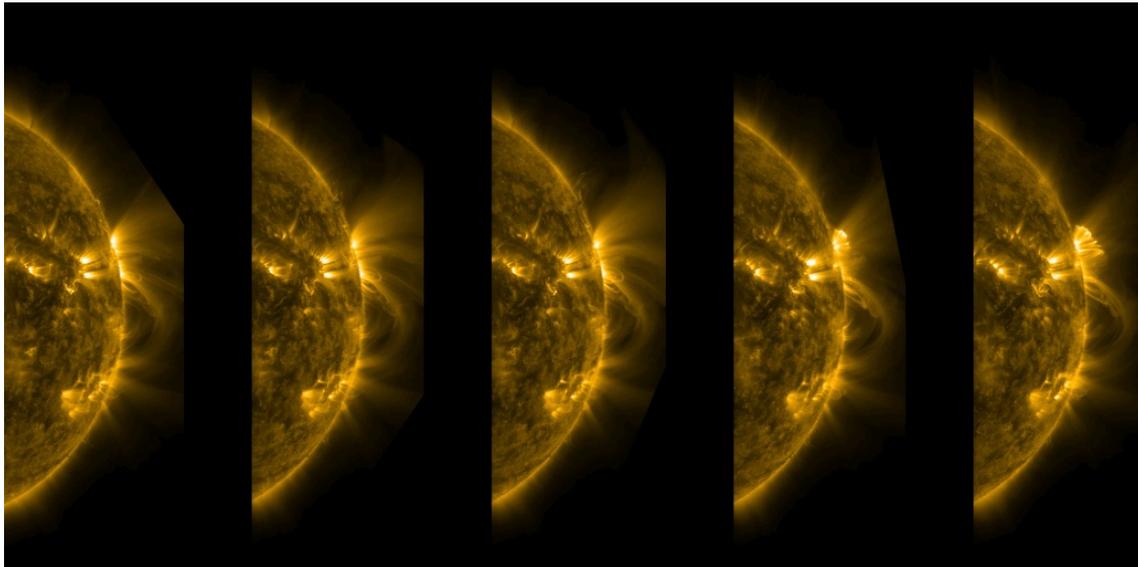
[http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184\\_Sep30toOct06/Events/20131006\\_2RibbenFlare\\_SouthWest\\_1356\\_swap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR184_Sep30toOct06/Events/20131006_2RibbenFlare_SouthWest_1356_swap_diff.mp4)

### **3. Review of solar and geomagnetic activity (30 Sep 2013 - 6 Oct 2013)**

#### **Solar Activity**

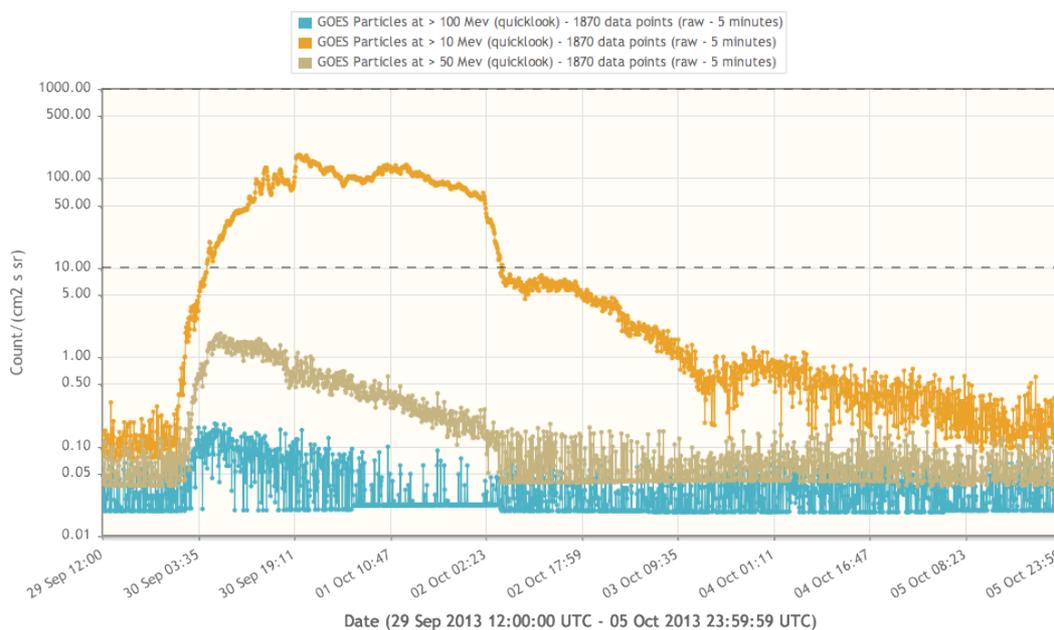
Flaring activity was limited this week to a handful lower C-class flares. The highest X-ray flux was recorded with a C2.5 flare originating from NOAA AR 1856 on Oct 4.

The most spectacular flares however were two long duration C-flares that triggered CMES. The long duration C1.2 flare of Sept 29 (peak 23:39 UT) happened just before the present period but was associated with a large filament eruption resulting in a halo CME. The plasma eruption eventually produced a geomagnetic storm on Oct 2 (see the section Geomagnetic Activity). The second long duration flare was a C1.5 flare late on Oct 2 showing a beautiful plasma eruption at the solar NW limb. In the series of pictures from SDO/AIA 171, a plasma eruption and post flare loops are visible on the solar limb.



In addition, the CACTUS software detected a partial halo CMEs observed by LASCO, leaving the Sun towards the SE quadrant on Oct 4, 19:18 UT and an homologous event on Oct 5 07:09 UT. These events were determined to be back-sided.

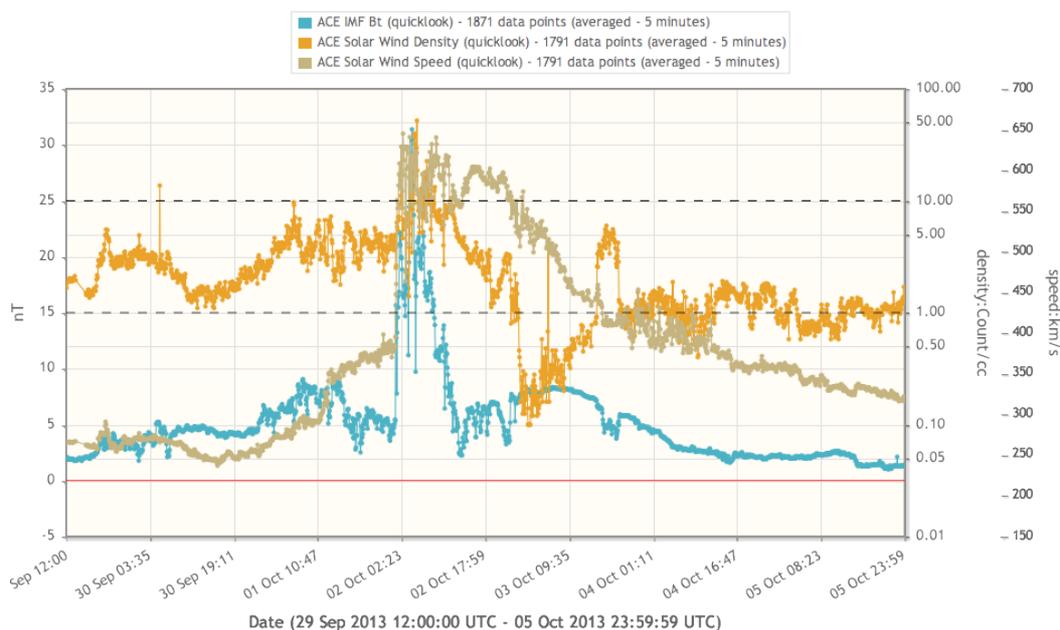
In association with the Sept 29 C1.2 flare, the GOES proton flux level (>10 MeV protons) was above the event threshold (10 pfu) from Sept 30 05:00 till Oct 2 05:00, reaching a peak value of 182 pfu at Sept 30 20:05.



## Geomagnetic Activity

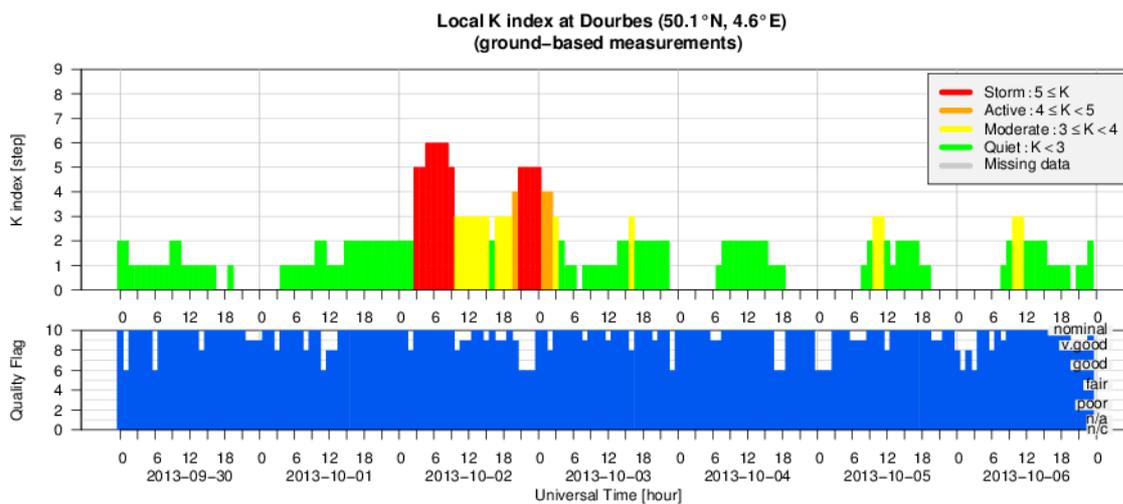
Geomagnetic activity was at the K=2 level or lower, except on Oct 2 and the early hours of Oct 3, when a geomagnetic storm took place. Local K values at Chambon-La-Forêt and Dourbes peaked respectively to K=6 and K=5 early morning Oct 2, while NOAA's estimated planetary Kp index reached Kp=7 at the same time. The driver for this storm was a shock in the solar wind on Oct 2 01:20 UT when the solar

wind speed increased suddenly from about 380 km/s up to >600 km/s. An abrupt change was also seen in the total interplanetary magnetic field (IMF) and in the density, although the density jump was less pronounced. ACE measurements of the IMF, density and speed are shown below.

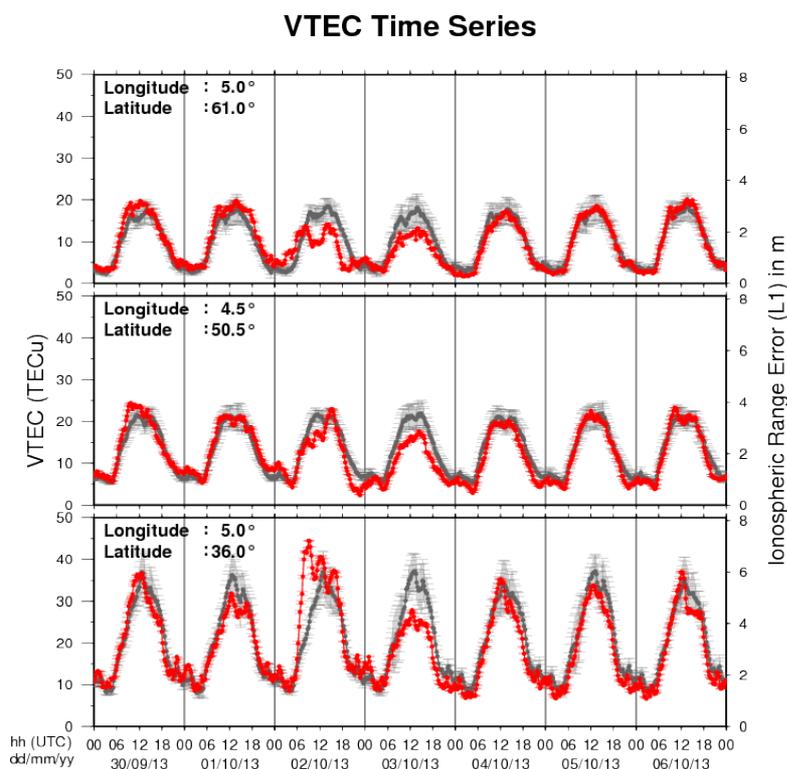


This shock was the arrival of the filament that was ejected from the Sun on midnight Sept 29/Sept 30, just before the present period.

#### 4. Geomagnetic Observations at Dourbes (30 Sep 2013 - 6 Oct 2013)



## 5. Review of ionospheric activity (30 Sep 2013 - 6 Oct 2013)



The figure shows the time evolution of the Vertical Total Electron Content (VTEC) (in red) during the last week at three locations:

- in the northern part of Europe (N61°, 5°E)
- above Brussels (N50.5°, 4.5°E)
- in the southern part of Europe (N36°, 5°E)

This figure also shows (in grey) the normal ionospheric behaviour expected based on the median VTEC from the 15 previous days.

The VTEC is expressed in TECu (with  $\text{TECu} = 10^{16}$  electrons per square meter) and is directly related to the signal propagation delay due to the ionosphere (in figure: delay on GPS L1 frequency).

The Sun's radiation ionizes the Earth's upper atmosphere, the ionosphere, located from about 60km to 1000km above the Earth's surface. The ionization process in the ionosphere produces ions and free electrons. These electrons perturb the propagation of the GNSS (Global Navigation Satellite System) signals by inducing a so-called ionospheric delay.

See [http://stce.be/newsletter/GNSS\\_final.pdf](http://stce.be/newsletter/GNSS_final.pdf) for some more explanations ; for detailed information, see [http://gnss.be/ionosphere\\_tutorial.php](http://gnss.be/ionosphere_tutorial.php)

## 6. Future Events

For more details, see <http://www.spaceweather.eu/en/event/future>

### 2nd Asian-Pacific Solar Physics Meeting, in Hangzhou, China

Start : 2013-10-24 - End : 2013-10-26

Initiated by Profs. Fang and Choudhury, the first Asian-Pacific Solar Physics Meeting (APSPM) was held in Bangalore two years ago. During the meeting, a consensus was achieved that it might be a good

idea to have the APSPM every three years. Somehow the second APSPM was proposed to be held by mainland China in 2013. APSPM is aimed to exchange the recent research results in solar physics in the emerging asian-pacific region.

Asian-pacific regions are getting more and more active in solar physics, as signified by the construction of big facilities, including the Hinode satellite (Japan), SOXS (India), Chinese Solar Radio Heliograph, and Optical & Near-Infrared Solar Eruption Tracer (ONSET). Therefore, colleagues have agreed to hold regional solar physics meetings regularly. The first Asian-Pacific Solar Physics Meeting (APSPM) was held in Bangalore during March 22-24 2011. During the meeting, a consensus was achieved that it might be a good idea to have the APSPM every three years. Somehow the second APSPM was proposed to be held by mainland China in 2013. APSPM is aimed to exchange the recent research results in solar physics in the emerging asian-pacific region.

Website:

<http://sdac.nju.edu.cn/~solar/>

### **Helicity Thinkshop on Solar Physics in Beijing, China**

Start : 2013-10-27 - End : 2013-10-31

Magnetic helicity has been intensively studied from observational, theoretical, and many other aspects of solar physics. For this meeting we would like to invite solar physicists who are interested in the observational and theoretical studies of the helicity, to encourage thorough discussions on the relevant hot issues. The 1st Helicity Thinkshop was held successfully in 2009, and now the 2nd one will be held on October 27-31, 2013 in Beijing, China.

Website:

<http://sun.bao.ac.cn/meetings/HT2013/>

### **Workshop and School on Radio Sun in Zhengxiangbaiqi, Inner Mongolia, and Beijing, China**

Start : 2013-10-28 - End : 2013-11-02

The Workshop and School on Radio Sun in Beijing and Inner Mongolia during Oct.28 - Nov. 2, 2013 is the first international academic seminar supported by the International Research Staff Exchange Scheme of the Seventh Framework Programme of the European Union (FP7-IRSES-295272-RADIOSUN).

The primary aim of this programme is to establish close research interaction and collaboration between the key research groups involved in CSRH, SSRT, and ALMA projects and in development of relevant theory and data analysis tools, through the systematic research staff and knowledge exchange, joint research efforts exploiting existing data and facilities, and preparing the future world-class partnership in exploitation of the upcoming facilities.

The Workshop and School welcome all solar physicists and students who are interested in solar radio astronomy to participate. We will discuss and exchange the scientific frontier problems, including the new-generation radio instruments (CSRH, Siberian multi-frequency radioheliograph, LOFAR, ALMA, and other new instruments), recent achievements and their scientific goals; methods and techniques of data processing (for example, software, radio image reconstructions, and method for studying various types of solar radio fine structures); and the objectives of new observational data and new mathematical methods.

Website:

<http://beijingradiosun.csp.escience.cn/>

### **25th Winter School of Astrophysics: Cosmic Magnetic Fields, in La Laguna, Tenerife, Spain.**

Start : 2013-11-11 - End : 2013-11-22

Magnetic fields play an important role in many astrophysical processes. But magnetic are difficult to detect and to model or understand, since the fundamental equations describing the behavior of magnetized plasmas are highly non-linear. Hence, magnetic fields are often an inconvenient subject which is overlooked or simply neglected. Such difficulty burdens the research on magnetic fields, which has evolved to become a very technical subject, with many small disconnected communities studying specific aspects and details.

The school tries to amend the situation by providing a unifying view of the subject. The students would have a chance to understand the behavior of magnetic fields in all astrophysical contexts, from cosmology to the Sun. From star-bursting regions to AGNs in galaxies. The school will present a balanced yet complete review of our knowledge. Extensions into the unknown are also important to indicate present and future lines of research.

The Winter School will bring together in a relaxed working atmosphere a number of the leading scientists in this field, PhD students and recent postdocs. The conditions for a successful interaction will be granted, including two special sessions for those students that want to present their own work.

Website:

<http://www.iac.es/winterschool/2013/>

## **7th Hinode science meeting in Takayama, Japan**

Start : 2013-11-12 - End : 2013-11-15

Since its launch in Sep-2006, more than 600 refereed papers have been published based on Hinode observations, presenting many new and important findings to the scientific community. However, due to the unexpectedly low levels of solar activity, until now the focus has mainly been on the more quiescent aspects of the solar cycle. With the solar maximum expected this year, through cooperative observations with SDO, IRIS, and ground based observatories, Hinode observations should lead to our understanding of active Sun phenomena, such as solar flares and CMEs, to be greatly improved. Making Hinode-7 an excellent opportunity to discuss solar activity in the current solar cycle and the related science through the use Hinode data, as well as other solar/space weather data. It will also be interesting to use this meeting to broaden our focus to include the solar-stellar connection as a means to deepen our understanding of solar activity.

Momentum is also gaining for Solar-C, which is being developed as an international collaboration between Japan, US and Europe. To further discuss this mission, the Solar-C science meeting will be held on 11-Nov.

Website:

<http://www.kwasan.kyoto-u.ac.jp/hinode-7/>

## **Space Weather: the importance of observations in London, UK**

Start : 2013-11-13 - End : 2013-11-13

Most space weather occurs due to the Sun's emissions which can affect the Earth's space environment. Modern society is ever more dependent upon ground-based & spaceborne technology which can be vulnerable to space weather. Satellites, GPS, aviation & the electric power industry are all at risk from this & hence space weather is now included on the UK's National Risk Register. It is important to have long-running, continuous observations for forecasting, nowcasting & for research in space weather. This public meeting, held during the peak of the 11 year solar cycle, addresses the deficiency in continuous, long-term observations & how this might be overcome.

Website:

<http://www.rmets.org/events/space-weather-importance-observations>

## **International CAWSES-II Symposium in Nagoya, Japan**

Start : 2013-11-18 - End : 2013-11-22

This International CAWSES-II Symposium hosted by SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) will provide an excellent opportunity to discuss the scientific accomplishments of CAWSES-II and look forward to SCOSTEP's future programs at a moment toward the end of its five-year period. The symposium will cover the six major themes of CAWSES-II tasks: 1) What are the solar influences on the Earth's climate?, 2) How will geospace respond to an altered climate?, 3) How does short-term solar variability affect the geospace environment?, 4) What is the geospace response to variable inputs from the lower atmosphere?, 5) Capacity Building, 6) Informatics and eScience. The main functions of CAWSES-II are to help coordinate international activities in observations, modeling, and applications crucial to achieving this understanding, to involve scientists in both developed and developing countries, and to provide educational opportunities for students of all levels. The symposium

offers keynotes/lectures that will be interesting for all participants every morning and more specific sessions of presentations in the afternoon. We welcome all those who are involved and/or interested in CAWSES-II to Nagoya in the autumn when we will have the pleasure of being surrounded by beautiful colorful leaves of this season.

Website:

[http://www.cawses.org/CAWSES/leaflet\\_CAWSES-II\\_120229.pdf](http://www.cawses.org/CAWSES/leaflet_CAWSES-II_120229.pdf)

## **European Space Weather Week in Belgium**

Start : 2013-11-18 - End : 2013-11-22

The 10th Edition of the European Space Weather Week will take place on 18-22nd November 2013 in Belgium. The venue will be confirmed early next year, but mark your calendars now for the 10th Anniversary of this growing European event.

The ESWW will again adopt the central aim of bringing together the diverse groups in Europe working on different aspects of Space Weather . This includes but isn't limited to the scientific community, the engineering community, applications developers, service providers and service end users. The meeting organisation will again be coordinated by the Belgian Solar-Terrestrial Centre of Excellence (STCE), ESA and the Space Weather Working Team. The local organisation will be done by the STCE.

Website:

<http://www.stce.be/esww10/>

## **1st SPRING Workshop in Freiburg, Germany**

Start : 2013-11-26 - End : 2013-11-28

The 1st SPRING (Solar Physics Research Integrated Network Group) workshop is being held from November 26 - 28, 2013 at the scenic Brugger's Hotel Park by Titisee hosted by the Kiepenheuer-Institut für Sonnenphysik in Freiburg, Germany.

The purpose of the workshop is to work on the scientific requirements for a new ground-based network of telescopes for full-disk synoptic observations of the Sun.

The desire for such a new network is motivated by new scientific research directions in solar physics, the requirement of real-time context data for high-resolution solar telescopes, and the need of continuous, long-term, consistent, and reliable solar data as foundation for space weather prediction.

Website:

<http://www3.kis.uni-freiburg.de/~mroth/spring.html>

## **Space Weather: a Dialogue between Scientists and Forecasters in London, UK**

Start : 2013-12-13 - End : 2013-12-13

The inclusion of space weather in the National Risk Assessment in 2012 means that there is now an urgent need for dialogue between those doing the science of space weather and those using the data to forecast, understand and mitigate the risks.

Since the Sun is currently at the peak of its cycle - a time when space weather events become more frequent - we have a timely opportunity to study how a range of solar activity ultimately lead to magnetospheric, ionospheric and ground level disturbances.

The goal of this meeting is to bring together those working across the broad range of space weather activities in the UK to discuss the current status of observations and recent new advances in the theories and models of the phenomena of space weather.

Website:

<http://www.mssl.ucl.ac.uk/~lmg/spaceweather/Overview.html>

## **Solar and Stellar Flares, in Prague, Czech Republic**

Start : 2014-06-23 - End : 2014-06-27

The meeting in honour of Prof. Zdenek Svestka will cover issues of the physics of solar and stellar flares.

Website:

<http://solarflares2014.cz/>

### **40th COSPAR Scientific Assembly in Moscow, Russia**

Start : 2014-08-02 - End : 2014-08-10

The 40th COSPAR Scientific Assembly will be held in Moscow, Russia from 2 - 10 August 2014. This Assembly is open to all bona fide scientists.

Website:

<http://www.cospar-assembly.org/>

### **International Chapman Conference on Low-Frequency Waves in Space Plasmas on Jeju Island, South Korea**

Start : 2014-08-31 - End : 2014-09-05

Low-frequency waves (ULF, ELF and VLF) in space plasmas have been studied for many decades. In our solar system, such waves occur in the magnetospheres of planets and in the solar wind; more recently they have also been confirmed on the Sun. In spite of the great differences in the plasma properties of these regions, the overarching schemes are wave generation, wave propagation, and wave dissipation, which are three fundamental aspects of any kind of waves. A fourth aspect of these waves is their application, either with direct benefit to humans or for scientific pursuit. Therefore, this Chapman conference will provide a forum in which various wave communities can come together and discuss recent achievements of observational, theoretical, and modeling studies.

Website:

<http://chapman.agu.org/spaceplasmas/>

### **14th European Solar Physics Meeting in Dublin, Ireland.**

Start : 2014-09-08 - End : 2014-09-12

The European Solar Physics Meetings aim to highlight all aspects of modern solar physics, including observation and theory that span from the interior of the Sun out into the wider heliosphere. These meetings provide a broad, yet stimulating, environment for European and international scientists to share their research in solar physics.

The meeting will mostly comprise of contributed talks and poster presentations, with several invited review talks (typically one per session). Posters will be on display for the whole meeting in close proximity to the lecture theatre. Refreshments will be served in the poster viewing area during two dedicated coffee/poster breaks on each full day.

Website: <http://www.espm14.ie/>

### **Solar Wind 14 in Weihai, China**

Start : 2015-06-22 - End : 2015-06-26

The Fourteenth International Solar Wind Conference will be held for the first time ever in China, from 22 to 26 June 2015, at Weihai in the Shandong province. It will be jointly organized by the School of Earth and Space Sciences of Peking University and the newly-established Institute of Space Sciences of Shandong University. The meeting will take place in the Space Science Building of Shandong University, a venue located within walking distance to the beautiful Weihai International Bathing Beach, one of the most popular scenic areas of northern China.

The conference will cover all aspects of solar wind physics, with invited reviews and contributed papers that examine the current research and outline the future research in all the relevant solar wind fields.

Website: not available yet