June 2017

RADIO SOCIETY *of* GREAT BRITAIN
CITY *of* BRISTOL GROUP
NEWSLETTER

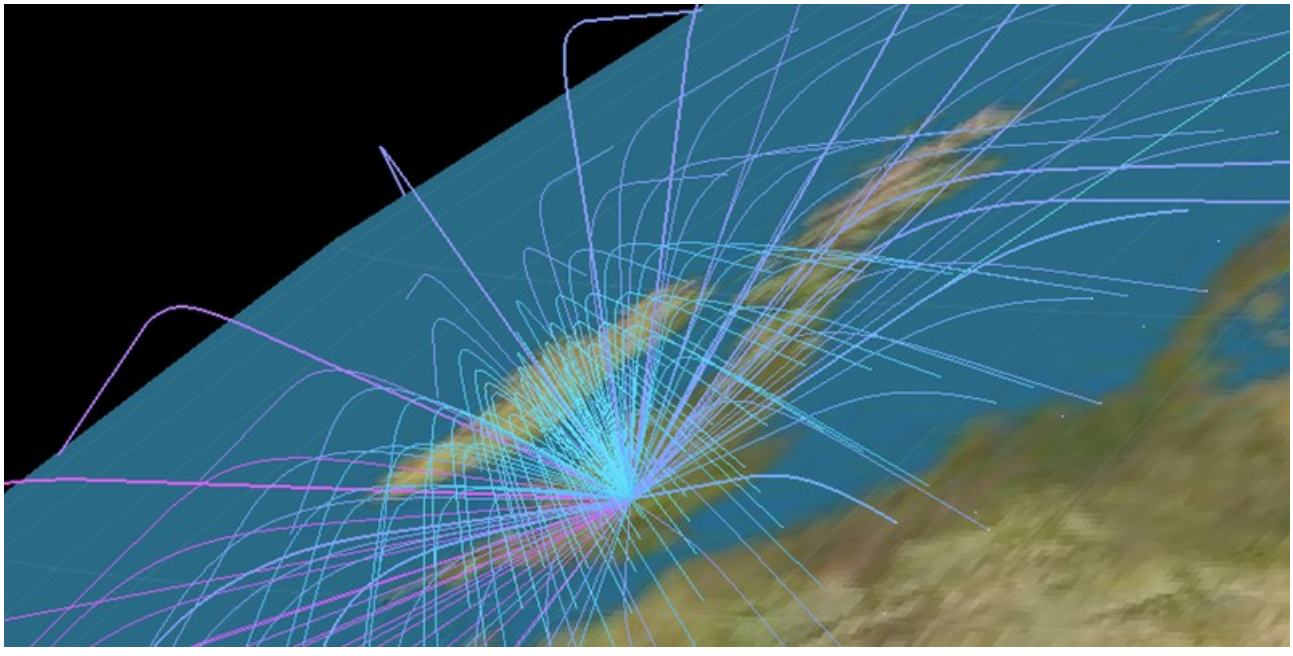
Monthly meetings at the BAWA, 589 Southmead Road, BS34 7RF

NEXT MEETING MONDAY 26 June 7.30pm

HF PROPAGATION

Professor Cathryn Mitchell M0IBG

The talk will give a brief overview of the history of HF propagation staring with the early work of Marconi, leading through to the importance of HF during the second world war and then discussing the present day research in this area. Opportunities for radio amateurs to contribute to modern HF propagation experiments will be outlined and there will be time for discussion.



The picture shows ionospheric propagation paths at 2MHz HF for a transmitter placed in Milton Keynes.

PRACTICAL RADIO ASTRONOMY FOR AMATEURS

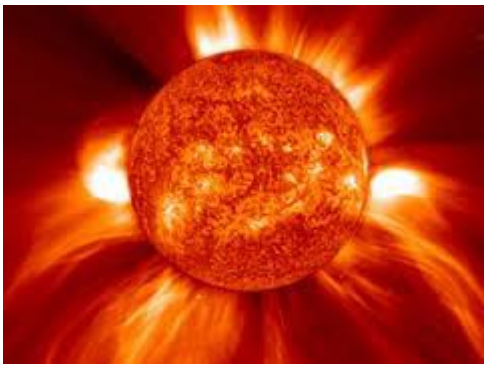
Paul Hyde G4CSD

At our May meeting, a full room of members and guests assembled to hear a really fascinating talk about how with simple and inexpensive equipment, it is possible to make useful radio astronomy observations. Paul began by pointing out that signals from the universe are weak and radio astronomers are plagued by the same sources of interference that bother us as radio amateurs; noisy lamps, switch mode power supplies, power line data transmitters etc.

One method around these problems is to monitor strong terrestrial radio signals that are affected by astronomical events, ie indirect observations. Sudden Ionospheric Disturbances (SIDs) are caused by x-ray and UV emissions from the Sun. These can be detected by monitoring the various VLF signals in the 15-25kHz range. Whilst dedicated receivers for these frequencies are available, a loop aerial connected to the microphone input of a computer sound card will work well. A free computer programme called SpectrumLab is used to monitor signal levels and when a SID occurs, a very distinctive “sharks fin” shaped variation in the trace is seen.

Another indirect observation may be used to detect meteors. When meteors burn up in the atmosphere, they leave an ionised trail of gas which reflects VHF radio signals strongly. The strongest signal to monitor is the French space radar system at Dijon, called GRAVES. This transmits a sweeping carrier wave on 143.05MHz, which can conveniently be received by many 2m SSB receivers and aerials. When a meteor enters the atmosphere, a very distinctive ping is heard. This is Doppler shifted by the velocity and direction of the meteor. Again, SpectrumLab software is used to show the strength, frequency and duration of the ping. These are very strong and if you tune to 143.049 USB with almost any aerial, particularly in the mornings, you will hear a few most days.

If you want to hear a genuine extra-terrestrial signal, the strongest are the radio emissions from the planet Jupiter. These are affected by the orbit of one of its satellites, Io, and predictions are available for when these peak. These are best observed on a quiet (if you can find one!) frequency in the 20MHz region. A standard communications receiver and wire dipole aerial will suffice.



Two signals may be found; L-bursts which sound very like waves crashing on the sea shore, and S-bursts which sound like hailstones falling on a conservatory roof. The Sun is a powerful emitter of radio signals over a wide frequency span. It is possible to use a scanning receiver that records the signal level at each step, and then uses special software to plot the results on a computer screen. It is then possible to eliminate terrestrial signals and identify radio bursts from the Sun.
A more challenging task is to detect the Hydrogen line on 1421MHz. Neutral ie non-ionised Hydrogen, emits a spectral line at 1421MHz, which can be Doppler shifted if it is moving relative to the earth. For this, a minimum sized 2m parabolic dish is required, together with low noise amplifiers, filters and a suitable microwave receiver. Some people also use an array of yagi aerials. It is possible by means of Hydrogen line observations to show the structure of the Milky Way spiral arms and other galactic objects.
Finally, Paul mentioned interferometry, where the signals from two widely spaced aerials are combined and observations are deduced from the minute differences between the two signals.
Paul said that he wanted to encourage collaboration between local amateur radio clubs, where there was expertise in radio reception, and astronomy societies with knowledge of the things to be observed. This was a really interesting talk and I know that a few people left the meeting thinking whether their next project might be to attempt one of these observations. Paul gave out some leaflets describing these observations in more detail and I have attached them to the end of this newsletter.

WEST *of* ENGLAND RADIO RALLY

Sunday 25 June 2017

10.00am – 2.00pm

at the CHEESE & GRAIN HALL

Bridge St.,FROME, SOMERSET BA11 1BE

Adults Entrance £3.00 - Accompanied Children under 14 Free
Follow signs for the Tourist Information Centre or the Town Centre

Free parking on a Sunday
300 spaces in Bridge St car park above & more parking nearby
www.westrally.org.uk

ANNUAL DINNER

The 2017 Bristol RSGB Group annual (Christmas!) dinner will take place on Monday 31st July at the Windmill Inn, 58, Nore Road, Portishead BS20 6JZ, arrive 7.00pm for 7.30pm. We will book a table so that everyone can sit together, but there is no fixed menu; you can choose what you want and then everyone pays individually for what they have. Keith G4EJH is co-ordinating this event, so please let him know by Thursday 27th July if you are coming. Of course, you are welcome to bring your partner aswell! Contact Keith on 01275 843 897 or keithg4ejh@talktalk.net

THE HAM RADIO SHOP

On Saturday 20th May, Dan Grace G3VM opened the Ham Radio Shop at Two Mile Hill, Kingswood, next to the crossroad with Kingsway. A good crowd of local radio amateurs turned out to inspect the kit on display and enjoy the free barbecue. The shop is an authorised dealer for Yaesu and Icom, aswell as for several brands of high power linear amplifiers. There is also a selection of accessories, cable, connectors etc.
The shop has been refurbished and redecorated, with comfortable sofas and smart new carpet. There is an operational demonstration shack, so that you can try out the various rigs on air, and an impressive array of aerials above the roof. Also on the same site, there is a new shop and office for Dans other business, the well known “Aerial Man” contractor, which supplies and fits TV aerials, satellite TV systems and has been known to install the occasional amateur radio system! Its been a long time since there was an amateur radio retailer in Bristol, so lets hope that this new venture is successful. You can contact the Ham Radio Shop on 0117 901 2418 or at http://thehamradioshop.co.uk

RALLIES & EVENTS

A selection of radio rallies & events within reasonable travelling distance of Bristol.

18 June	Newbury Radio Rally
25 June	West of England Radio Rally Frome
16 July	McMichael Rally Reading
30 July	Chippenham & DARC Rally Kington Langley
13 August	Flight Refuelling ARC Rally Wimborne
18-20 August	Bristol Model Engineering Exhibition Thornbury Leisure Centre
20 August	Rugby ATS Rally Princethorpe
2-3 September	Telford Hamfest & QRP Convention
10 September	Blackwood ARC Rally Newport
10 September	Wildhern Radio & Computer Boot Sale Andover
10 September	Torbay Rally Newton Abbot Racecourse
17 September	Weston-super-Mare RS Radio & Electronics Rally Worle
29-30September	National Hamfest Newark
13-15 October	RSGB Convention Milton Keynes
15 October	Holsworthy ARC Rally
5 November	West London Radio & Electronics Show Kempton Park Racecourse
19 November	Plymouth Rally Plympton

You may wonder why a model engineering exhibition is listed amongst the radio rallies? Well, it is local and is a very good place to buy the mechanical bits and pieces that are useful for radio homebrewing, such as handtools, nuts & bolts, materials etc. Be warned though; model engineering exhibitions are more expensive than radio rallies and entrance is £10. However, besides the trade show, there is a great display of models of all types, many of which are powered up and working. A really good day out and thoroughly recommended.

AROUND THE LOCAL CLUBS

Bath & DARC **http://badarc.webs.com**

Chepstow & DARC www.gw4lwz.co.uk

Chippenham & DARC www.g3vre.org.uk

Mid-Somerset ARC www.midsarc.org.uk

North Bristol ARC www.nbarc.org.uk

Shirehampton ARC www.shirehampton-arc.org.uk

South Bristol ARC www.sbarc.co.uk

Thornbury & South Glos.ARC www.tsgarc.uk

Trowbridge & DARC www.radioclubs.net/trowbridgedarc

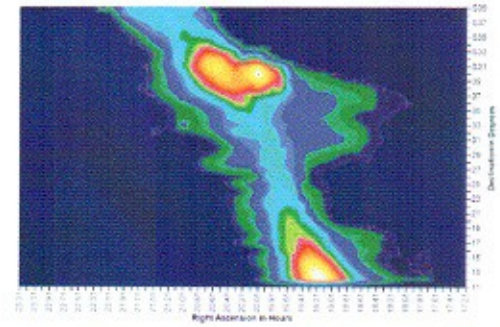
Weston-super-Mare RS www.g4wsm.club

If your club has a major event or talk by a "star" speaker, send details to the secretary – g8vpg@aol.com – and I will be pleased to include it here. Also, please send reports & photographs of your recent activities and any news.

Well, that's it, something of a bumper edition this time! I hope to see many of you at Westrally on Sunday 25th June and of course, at our June meeting the day after.

73 Shaun G8VPG, Secretary.

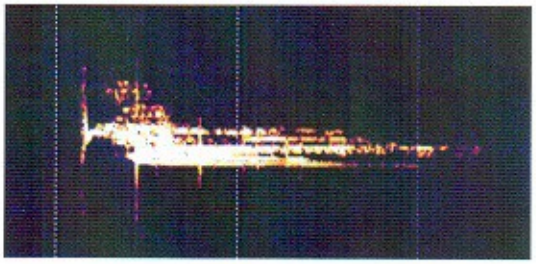
British Astronomical Association
Radio Astronomy Group



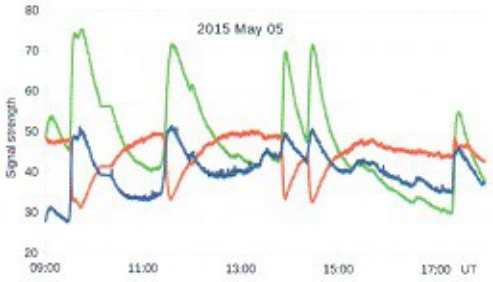
The Milky Way at 408 MHz (by John Smith) with the radio sources Cygnus A (right) and Cygnus X (left) at the top of the image

Amateur Radio Astronomy

Radio astronomy provides a very different view of the Universe compared to that obtained at optical frequencies. As with optical astronomy, professional astronomers use very large instruments located in locations chosen for low background noise, but amateurs can still undertake observing work at home. Objects such as supernova remnants and radio galaxies need dishes of 2 metres dia. or more and are susceptible to local electrical noise, but other targets are attainable through much simpler equipment and are within the reach of non-radio experts.

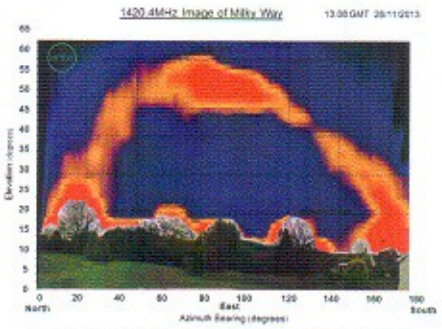


Meteor activity can be monitored throughout the day and under cloudy skies. There is still work to be done to increase our understanding of this phenomena

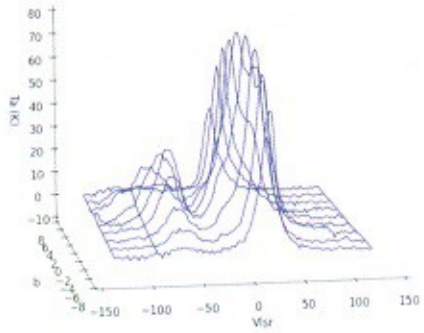


Sudden Ionospheric Disturbances are caused by solar x-ray flares and can be observed using a simple indoor loop antenna

Hydrogen Line radio emissions (at a wavelength of 21 cm) are more demanding and may be better suited as a club or society project. Measuring the Doppler shift of these signals reveals the structure of the Milky Way and can be used to map out the spiral arms.



H-Line emissions from the Milky Way, courtesy David Morgan.



Velocity map of H-Line emissions, courtesy HLOG (Brian Coleman/Gordon Dennis)

British Astronomical Association
Radio Astronomy Group

The BAA Radio Astronomy Group

The aim of the Group is to encourage and support amateur radio astronomy through the exchange of information on radio telescope design, observing techniques and data analysis. Membership is free and open to non-BAA members, though we do encourage people to join the BAA as part of supporting amateur astronomy in general.

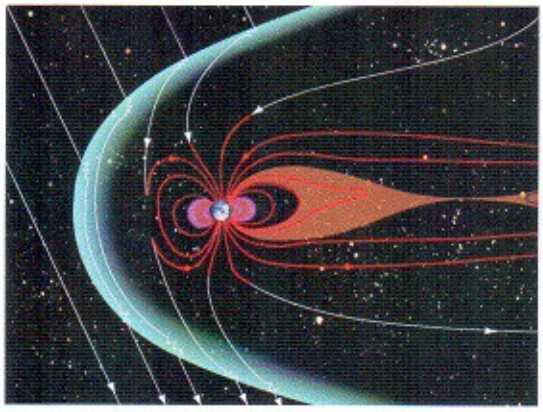
The Group maintains a website providing resources for amateur radio astronomy and where members can publish details of their work. We also publish a quarterly newsletter and run a web discussion group hosted by Yahoo. You can subscribe to this by sending an e-mail to the address listed in the Contact details below. You not need to be a Yahoo group member to participate in discussions.

The Group also organises one-day General Meetings with talks on a range of amateur and professional activities , plus Workshop events covering the more practical aspects of amateur radio astronomy and geophysics. These events are also open to non-BAA members.

Contact details

RAG Co-ordinator: radio@britastro.org
Membership: radiolist@britastro.org
Website: www.britastro.org/radio
Discussion Group: baa-rag-subscribe@yahoogroups.com

British Astronomical Association
Radio Astronomy Group



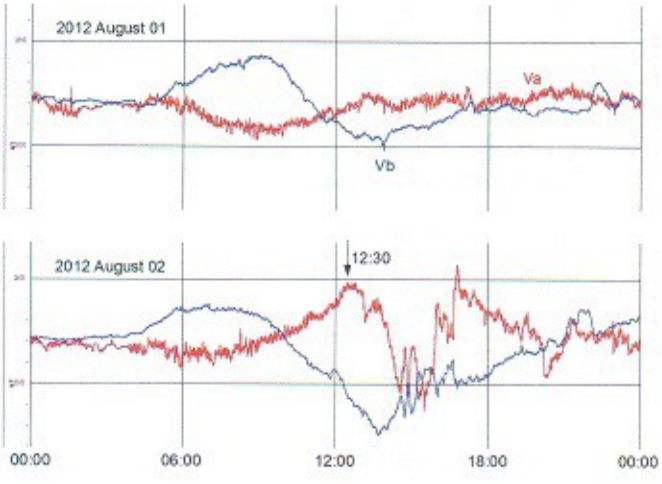
Magnetometry

Operating your own magnetometer can add an extra level of interest for the solar observer, and can provide an early warning of developing auroral conditions. There are some commercially available designs as well as the option of building a simple suspended magnet type (Jam-Jar magnetometer). A home built sensor can be quite inexpensive, while a full three axis design will be more expensive and will require careful consideration in mounting and operation.

Diagram credit: NASA/Goddard/Kasse

Theory

As the solar wind rushes past the Earth, the day side magnetic field is squashed down to about 6-10 times the Earth's radius. A supersonic bow shock (blue in the picture) is formed as the high speed wind is diverted around the Earth's magnetosphere and drawn out into a long (over 1000 time the Earth's radius) magnetotail on the night side. A magnetometer at the Earth's surface will therefore see the local magnetic field (red in the picture) gently vary through the night and day as the Earth rotates. The Earth's magnetosphere is a very dynamic structure, and changes shape in response to changes in the solar wind. Solar flares can eject large volumes of coronal plasma at high speed in the form of Coronal Mass Ejections (CMEs). If a CME is directed towards the Earth, then the magnetic field locked within that plasma can interact with the Earth's magnetosphere to produce a magnetic disturbance. Depending on the strength and orientation of the interacting fields, charged particles from the solar wind can enter the Earth's field through the polar cusps to produce aurora.



Observations

The top chart shows the diurnal curves recorded by a two axis magnetometer on 2012 August 1st, a quiet day. The blue trace shows variations in magnetic declination, while the red trace shows variations in the east/west field. There is some minor local interference present, but the typical curves can be seen.

The lower chart is from the following day, and shows a very noticeable disturbance to the diurnal curves from about 12:30. The disturbance that follows was due to the arrival of a CME associated with an M6.1 flare at 20:56 on July 28th. From these timings we can measure a CME transit time of 111 hours.

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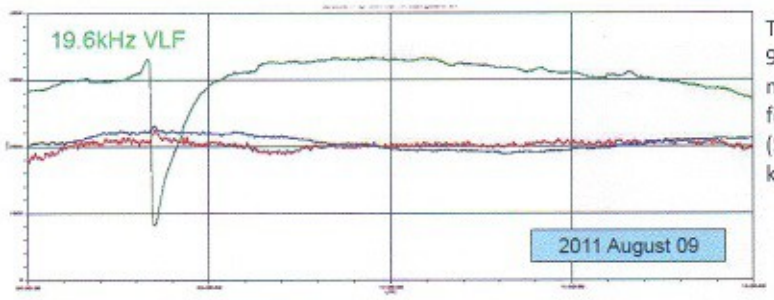
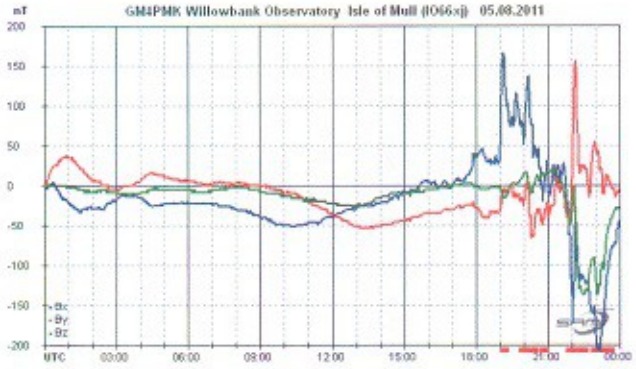
Radio Astronomy Group



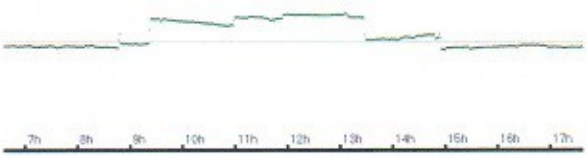
This chart from 2011 August 9th shows a more subtle magnetic disturbance in the form of a Solar Flare Effect (SFE). They are also sometimes known as magnetic crochets.

SFEs occur synchronously with the arrival of ultraviolet and X-rays from a solar flare. They cause a sudden and rapid change in the electrical currents flowing through the ionosphere, and therefore alter the Earth's magnetic field. An X6.9 flare at 08:05UT is shown in green by the Sudden Ionospheric Disturbance (SID) at 19.6kHz. A small rise in both magnetometer channels can be seen as the SID reaches its minimum level. These may be followed by a CME disturbance later, but may also occur without an Earth-directed CME. This recording and those on the previous page were made by Paul Hyde.



This recording was made using a three axis fluxgate magnetometer, aligned in 3D with the Earth's magnetic field.The third axis (Bz, in green) measures the vertical component of the field. It shows another CME disturbance starting around 18:00UT on 2011 August 5th. The sensor has been calibrated to show the strength of the field in nT (nano Tesla), having been reset to zero at midnight. The recording was made by Roger Blackwell.

The recording on the right is not of solar origin. It shows the effect of large vehicles being parked in the road about 10m west of the sensor. The vertical edges make this sort of interference easy to see, but can still hide genuine solar disturbances.



It was made using a single axis sensor mounted horizontally indoors by John Cook.

In periods with lower flare activity, coronal holes can provide long periods of magnetic disturbance. Coronal Hole High Speed Streams (CHHHS) can be quite turbulent and produce magnetic disturbances lasting for many days as solar rotation aims them towards the Earth.

Contact details: Co-ordinator: radio@britastro.org Membership: radiolist@britastro.org
VLF and magnetic observations: John Cook, jacook@jacook.plus.com
Website: www.britastro.org/radio

British Astronomical Association
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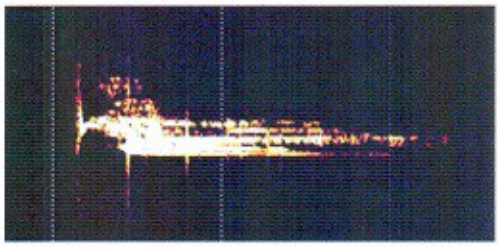


Meteor Scatter

Meteor Scatter enables you to monitor meteor activity using the radio signals reflected from the associated plasma trails. This is one of the easiest applications for the amateur radio astronomer as the reflected signals can be quite strong and the receiving equipment is relatively simple and compact. You can also monitor meteor activity throughout the day, even under cloudy skies, moonlit nights and light pollution.

Suitable observing frequencies are 143.05 MHz, using the powerful GRAVES radar system in France, or at 49.97 MHz using the low-power BRAMS meteor beacon in Belgium.

Theory

As a meteoroid burns up (ablates) in the upper atmosphere it creates a region of ionised gas, or plasma. Depending upon its density, plasma can reflect radio waves from far-off transmitters so that you can detect the signal until the plasma dissipates away. The duration of these reflected signals can last from a fraction of a second to over a minute.

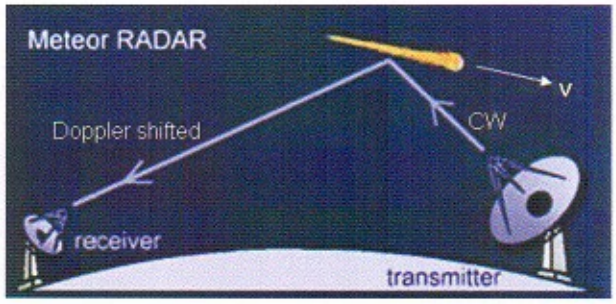
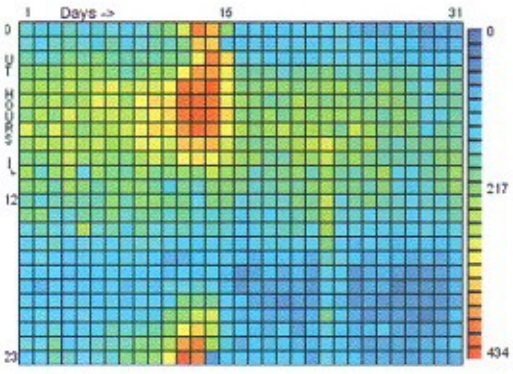


Image credit: NASA

The frequency of the reflected radio signal is also Doppler-shifted by the moving plasma, allowing you to measure the line of sight velocity of the plasma. In the images above the plasma trail has split into a number of tubes moving at slightly differing velocities, providing information on how the trail dissipates.



Observations

Meteor activity is very dynamic with both daily and seasonal variations. This chart shows activity during a typical December with each hour colour-coded to represent the number of meteors detected. 'Sporadic' meteors occur throughout the year and are strongest during the early hours of the morning. There is also increased activity at certain times of the year as the Earth passes through streams of meteors left by comets, in this case the Geminids.

Diagram credit: Radio Meteor Observing Bulletin

British Astronomical Association
Radio Astronomy Group

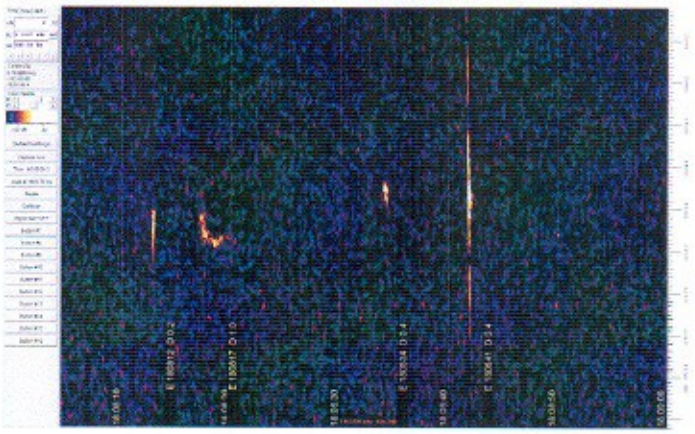
The equipment

Meteor Scatter signals can be received using any communications receiver covering the required frequency and which can demodulate Upper Sideband (USB) signals. It is an advantage if you can switch off any Automatic Gain Control (AGC) function. You can also use one of the new SDR-based receivers such as the FUNcube Dongle, shown here.

Image credit: Howard Long/AMSAT UK

The antenna can be a simple Yagi, using standard copper pipe fixed to a wooden boom. A suitable design for 143.05 MHz was featured in the June 2014 edition of Sky at Night magazine, a reprint of which can be found on the RAG website at the address below.

Whilst the antenna can be located in the loft, much better results will be obtained if it is mounted outside at about 3 metres above ground. You do need a location that does not have any major obstructions in the direction of the radio source being used, for instance to the south-east for the GRAVES source.



There are several freely downloadable software packages for displaying meteor events. The Spectrum Lab application automatically captures screen shots, audio recordings and timestamps to help you analyse meteor activity.

Further information on setting up a simple meteor scatter observatory can be found on the BAA RAG website. There are several web resources providing more information about meteor scatter and a good place to start is with the International Meteor Organisation at www.imo.net/radio

Contact details
RAG Co-ordinator: radio@britastro.org
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Membership: radiolist@britastro.org
Discussion Group: baa-rag-subscribe@yahoogroups.com

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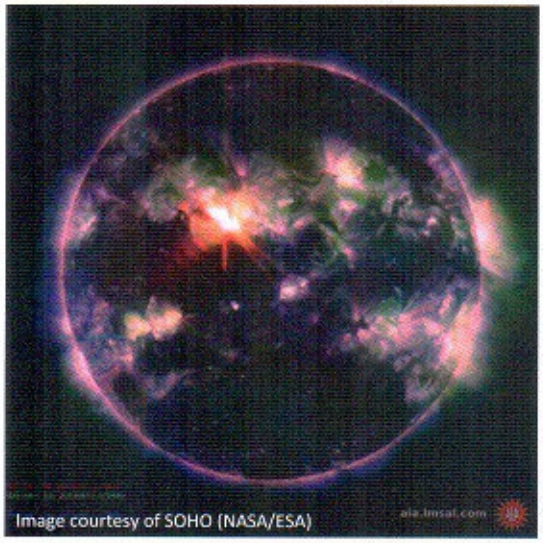
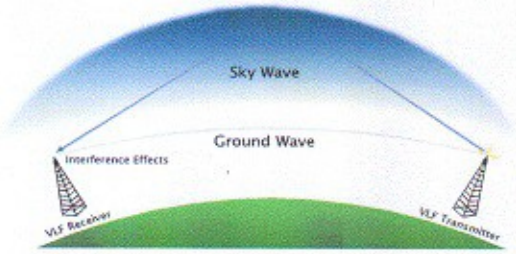


Detecting Solar X-ray Flares by Radio

Very energetic solar flares produce huge amounts of X-ray and UV radiation. Detecting these events is an easy way into radio astronomy as the equipment is simple and compact and the costs are low to negligible.

Theory

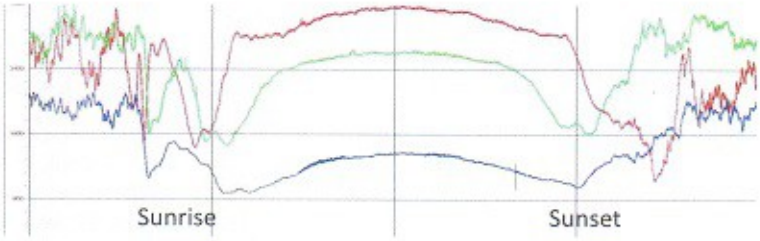
Radio waves emitted at very low frequencies (15 to 25 kHz) are reflected by the D-layer of the earth's ionosphere. This layer is only formed during the daytime. When solar flares occur, the D-layer becomes more reflective and the strength of the signal's Sky Wave increases, producing a noticeable change in the receiver output. These events are called Sudden Ionospheric Disturbances (SIDs) and provide a simple way of detecting when an X-ray flare occurs.



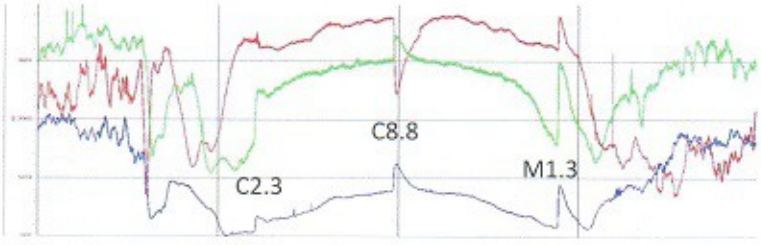
There are several VLF transmitters around the world that can be used to detect SIDs. The charts below show how the signal strengths of three of these transmitters are affected by these flares.

Observations

During the night time, signal levels vary rapidly and no useful information can be obtained. Sunrise results in the formation of the D-layer in the ionosphere and signal levels stabilise until sunset



Solar X-ray flares produce characteristic 'sharks-fin' variations in received signal levels



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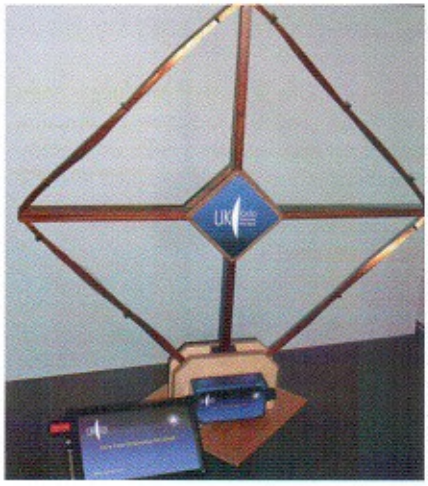


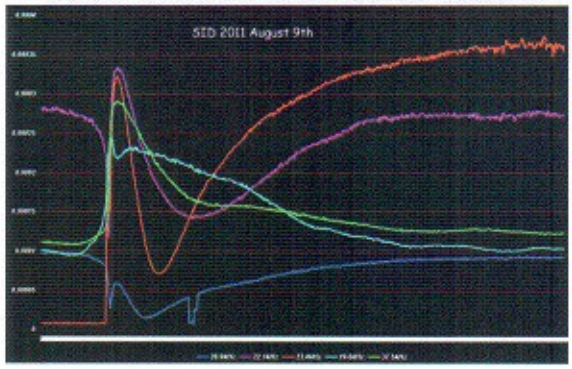
The equipment

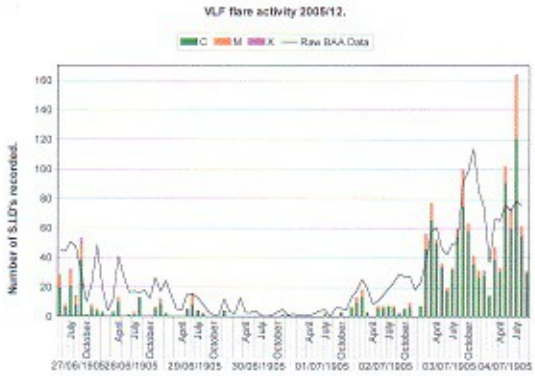
Detecting a SID requires a VLF radio receiver. This example has been tuned to the 23.4 kHz transmissions from a station in Germany. These receivers can be purchased or made from a kit; BAA RAG can advise on how to get started for either method.

The aerial is a coil of wire wound onto a 42 cm square frame. This is tuned for resonance at a particular frequency using a variable capacitor. Once set up correctly the receiver will provide a slowly varying DC voltage output where the voltage level is directly proportional to the strength of the received signal. A datalogger then records the results for later analysis.

Because VLF frequencies are so low, they can also be received using the sound card in most home computers In this case the aerial is not tuned to any one frequency so is less sensitive and needs to be a couple of metres square. This can be easily draped from hooks on the wall of an observatory.

The chart to the right shows the effect of an X-class flare on five different VLF signals over a 2-hour period (Chart courtesy Mark Edwards)





The BAA RAG VLF Observing Group

The VLF Observing Group is coordinated by John Cook and has been recording SID activity for over 10 years. New contributors are always welcome and receive a monthly summary of reported observations. If you are interested in joining the Group please contact John Cook at the address below.

Contact details: Co-ordinator: radio@britastro.org Membership: radiolist@britastro.org
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