From the President

The 2013 Winchester Weekend

From 2013 April 5–7 the Association held its 47th annual Winchester Weekend in the glorious rural surroundings of Sparsholt College, Hampshire. Initially run by Alfred Curtis and now jointly organised by Alan Dowdell and Ann Davies, this weekend has always been a highlight of the BAA calendar with its unique combination of serious astronomical content and relaxed socialising.

This year was no exception – it was a complete sell-out, drawing the biggest number of participants in recent years. An excellent range of speakers, both from within the BAA and from outside, provided an entertaining and instructive programme of talks, with the flagship Alfred Curtis Memorial Lecture given by Dr Simon Green (Open University) on the subject of near-Earth asteroids. There was also a Historical Section meeting on Saturday afternoon which drew a large and appreciative audience. The weather gods were in our favour for once, with some (cold!) spring sunshine and clear nights, and this allowed observers to view and image comet C/2011 L4 (PanSTARRS) while it was close to M31.

The organisation of an event like this demands much commitment and sincere thanks are due to Alan and Ann for their contribution to one of the best Winchester weekends of recent times.

Comet 2011L4 (PanSTARRS) passed about 2.5° from the Andromeda galaxy M31 on 2013 April 5, 20:31–21:01UT. Imaged by Nick James from Sparsholt College, Winchester during the BAA Winchester Weekend. Canon EOS 550D on a driven mount, 135mm f/2.8, 31×30s exp.

BAA participation at external events

By the time you read this the BAA will also have set out its stall at two 'external' events: the Kelling Heath Spring Star Party and the inaugural International Astronomy Show on May 17 & 18 at the Warwickshire Exhibition Centre. We hope that our presence at and participation in these events will become a regular feature in future. Indeed, if the BAA is to continue to thrive it must seek to engage more systematically with such events and with other organisations that also serve the amateur astronomical community.

Council has set up an implementation group to investigate how we might best do this, but such engagement demands time and effort from our already hard-pressed volunteers. So far we have relied upon postholders and volunteers from within Council, but this is something to which the wider membership might also contribute. Those who already attend events such as Kelling and who would be willing to set aside some time to help out on the BAA sales and information stall in the future should contact Ann Davies in her role as Sales and Promotions organiser. All offers of help will be gratefully received!

Your subscriptions in 2013–'14

We are all aware of the tough economic times we are presently enduring, with inflation outstripping income in most cases. The same is true for the Association as its essential costs continue to rise. However, at its meeting on March 27, Council recommended that next year's subscriptions should be held at the 2012–'13 level for all categories of membership, and this recommendation was approved at the Special General Meeting held later that day.

Astronomy can be an expensive pursuit for the amateur, and I hope this helps make it slightly less so for the time being.

BAA Exhibition 2013

On Saturday 22 June the Association will hold its new-look Exhibition at Manchester Metropolitan University. As well as exhibits of the latest work from our observing Sections, there will be a rolling programme of short presentations by Section Directors throughout the day, as well as exhibits from local societies, trade stands and the opportunity to visit the Godlee Observatory. There will also be a public lecture by Sir Arnold Wolfendale, the 14th Astronomer Royal and Emeritus Professor at the University of Durham.

This will be a fine opportunity to engage with the observational work of the BAA, to forge links with astronomical societies in the Manchester area, and to enjoy meeting your astronomical friends from all over the UK. I hope that as many members and guests as possible will be able to attend and I look forward to seeing you there.

Bill Leatherbarrow, *President*

Comet Section

Comet PanSTARRS in March and April

While it was never a 'Great' comet, C/2011 L4 (PanSTARRS) put on a good show in the western twilight sky throughout March and early April. Perihelion occurred on March 10 and, in the February *Journal*, I predicted that the comet would be around magnitude –2 at this time. In fact it probably only achieved mag 0 and by the time it became visible in our skies a few days after perihelion it had faded to around mag 1. Even so, it is always impressive to see a comet against a bright blue twilight sky.

The first UK observations reported to the BAA were on March 12 when the comet was only a few degrees above the western horizon at civil twilight. The weather was patchy on that day but James Abbott in Witham, Essex saw the comet at 18:50 UTC using 15×70 binoculars and estimated the coma as magnitude +1 with a 45' tail. Up in space, on the same date but unencumbered by cloud or twilight, the STEREO-B spacecraft imaged a spectacular tail with much structure (Figure 1).

The next day, March 13, was much clearer and many observers across the UK reported good views of the comet. Jamie Cooper obtained a particularly nice image of the comet below the 2-day old crescent Moon (Figure 3). Over the following few days and weeks the comet moved further from the Sun and, although it was fading, it became easier to see against a darker sky. By March 19 Michael Jäger was obtaining images from Austria which showed similar tail structure to that seen a week earlier in the STEREO images. The tail was essentially dominated by dust emission with only a very faint gas tail visible (Figure 2).

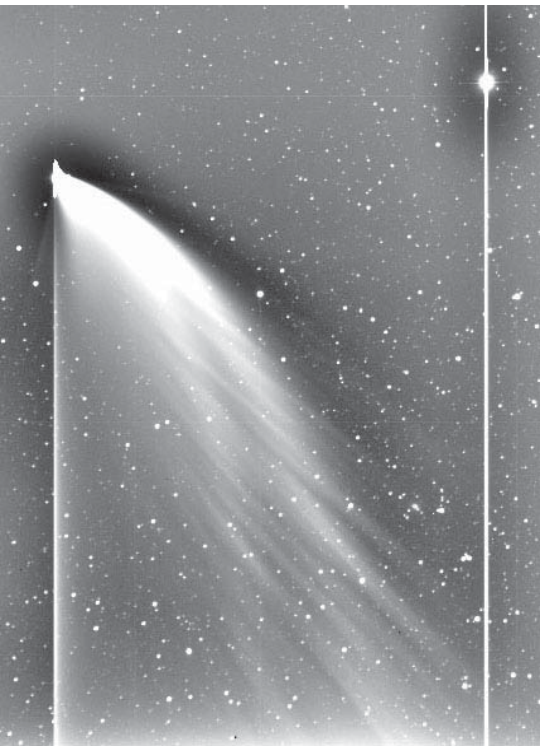
Figure 2. 2013 March 19, 18:14 UT. 11×70s + 2×90s, 100mm f/2.9 Newtonian. *Michael Jäger.*

As March turned into April the comet had moved high enough in a dark sky for observers to record a very broad dust fan. This is particularly well shown in Richard Miles' image of April 1. On that date he estimates that the tail was at least 3° long. Richard obtained a set of accurate V-band images of the comet which showed that its photometric performance was very well behaved with no sign of any outbursts.

Figure 3. 2013 March 13. *Jamie Cooper.*

By April 4 the comet was approaching M31 and many observers captured images of this conjunction (see previous page and the back cover). The comet was still an easy binocular object at that time and the inner coma was considerably brighter than the core of M31. The comet continued to be visible throughout April as a circumpolar object moving from the evening to the morning sky, and will be available through much of the rest of the year in larger telescopes as it tracks through Ursa Minor, Böotes and Corona Borealis.

Nick James



2013 March 12, from the STEREO-B spacecraft. *NASA*

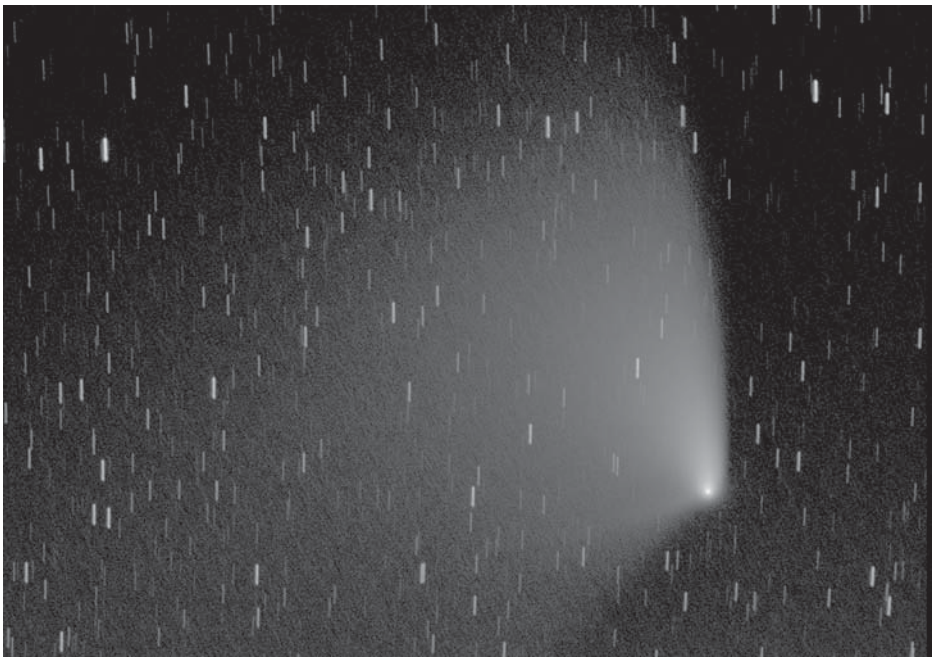


Figure 4. 2013 April 1, 20:20 UT. 66×15s + 10×30s with Astrodon V filter, 105mm f/2.8 refractor. *Richard Miles.*

Saturn Section

Interim report – Saturn at the 2012/2013 apparition

This interim report provides a preliminary assessment of Saturn observations made during the first part of the 2012/2013 apparition, *i.e.* from late 2012 December until early 2013 April.

The following observers contributed observations over this period: Paul G. Abel (UK), David Arditti (UK), Trevor Barry (Australia), Ray Johnson (Australia), Paul Maxson (USA), Darryl Milika & Pat Nicholas (Australia), Damian Peach (UK), John S. Sussenbach (Netherlands), and Anthony Wesley (Australia).

The majority of observations submitted were digital images.

Although only a relatively small number of observations have been received so far for this apparition, they have shown a number of interesting features. These include a dark spot in the planet's northern hemisphere and the resolution of a dark region around the planet's north pole into the so-called 'north polar hexagon'.

All figures in this report are oriented with south upward. Planetographic latitudes are used throughout and all latitude measurements are provisional.

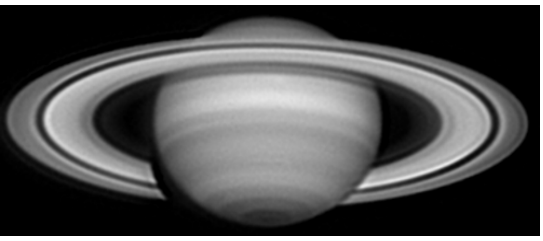


Figure 1. 2013 Mar 09d,16h37m UT. CM1= 25.5, CM2= 221.8, CM3= 107.2. 406mm Newtonian (*Barry*). Infrared image (742nm) showing a bright spot in the EZ(S), just f. the central meridian (CM).

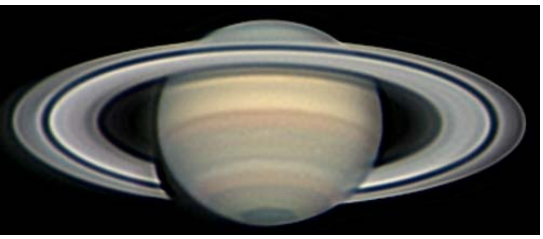


Figure 2. 2013 Mar 07d,18h33m UT. CM1= 204.8, CM2= 103.0, CM3= 350.7. 406mm Newt. (*Barry*). Light spots in the NEB/NTB complex. The dark region around the pole is the north polar hexagon.

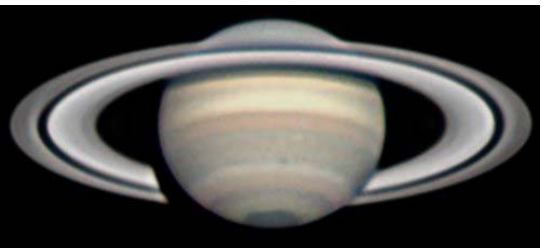


Figure 3. 2013 Mar 06d,18h34m UT. CM1= 80.9, CM2= 11.5, CM = 260.4. 370mm Newt. (*Wesley*). Light spots in the NEB/NTB complex and dark spot on the N edge of this complex (which was approaching the CM).

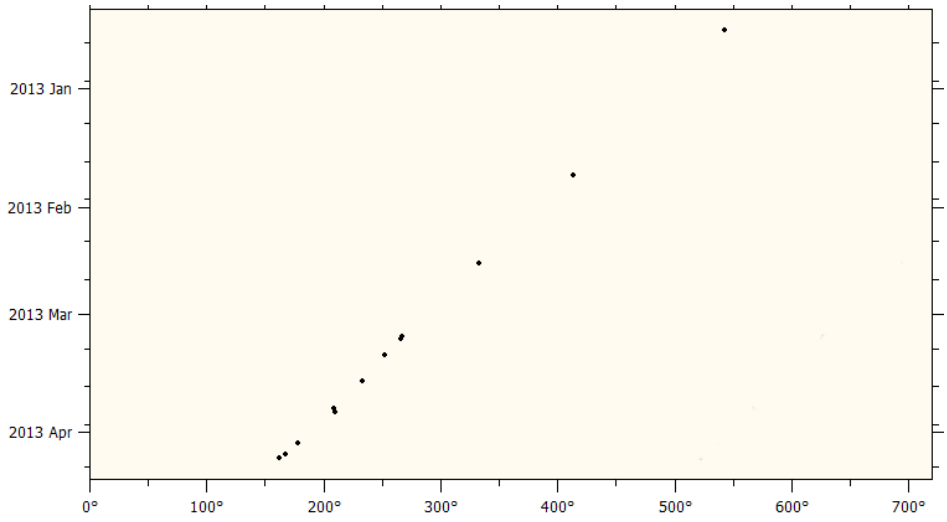


Figure 4. Preliminary drift chart of the centre of the dark spot on the northern edge of the NEB/NTB belt complex. Chart generated in System 3 using measurements from images by Barry, Milika & Nicholas and Wesley.

Observations

Over this period Saturn was in the constellation of Libra. The ring inclination with respect to Earth at the beginning of April was +18.6°. As a result only a small portion of the southern hemisphere was visible, and the latitudes of the South Equatorial Belt (SEB) were hidden by the rings.

The Equatorial Zone (EZ) was the brightest zone on the planet and had a yellow or cream colour. Within this zone was a grey Equatorial Zone Band (EB). Barry recorded a bright spot in the southern EZ (EZ(S)) on March 9 at a System 1 longitude= 31°, as shown in Figure 1. Bright spots have also been recorded in the northern EZ (EZ(N)).

The most prominent feature on the planet was a dark belt complex stretching from the approximate latitudes of 15°N to 45°N, encompassing the latitudes of the North Equatorial Belt (NEB) and North Temperate Belt (NTB), as shown in Figure 2. This has been provisionally designated as the NEB/NTB complex. A similar belt complex was visible during the previous apparition.[1]

The southern edge of the complex was marked by a distinct belt component (provisionally designated the NEB(S)) with a distinct zone immediately to the north. Overall, both of these features showed a warm or reddish colouration which contrasted with the grey colouration of the rest of the complex.

Higher resolution observations revealed up to three additional belt components within this complex. Some lighter spots were sometimes within it (Figures 2, 3, 6, 8 and 11) but analysis of the motions and lifetimes of these spots has yet to be undertaken. Similar spots have also been imaged by the *Cassini* spacecraft (Figure 5).

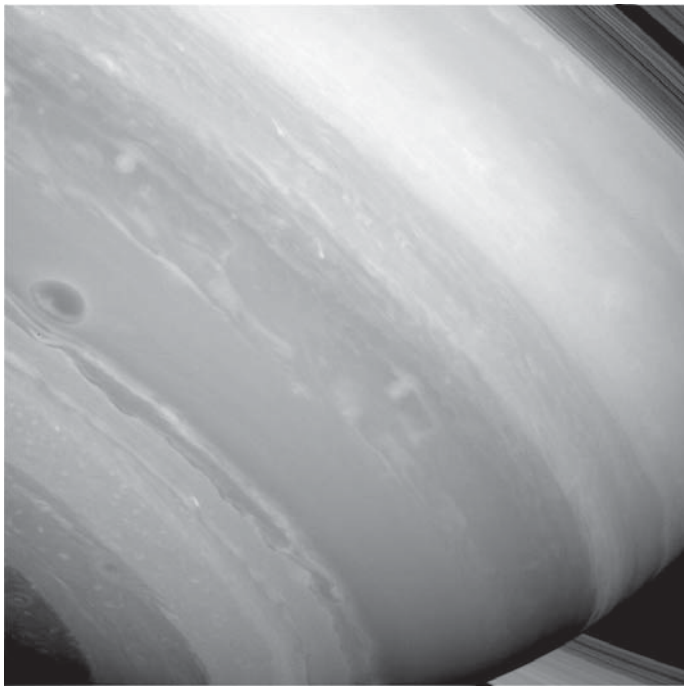


Figure 5. Saturn's northern hemisphere imaged by the *Cassini* spacecraft on 2013 Feb 28 with CB2 & CL2 filters. This shows the dark spot on the northern edge of the NEB/NTB complex, and light spots within the NEB/NTB belt complex. North is to the lower left. ©NASA, image no. W00079744.

An interesting dark spot was observed just within the northern edge of this complex (Figure 3). This spot has been followed from 2012 December 16 and measurements of its System 3 longitude vs time are shown in Figure 4. These longitude measurements show a well-defined linear track with a drift of –3.37°/day with respect to System 3. This spot may be identical to a dark spot imaged by *Cassini* on 2013 February 28 (Figure 5).

Immediately north of this complex was a bright zone (extending from approximate latitudes of 45°N to 51°N). A few light spots have been recorded on the southern edge of this zone extending into the NEB/NTB complex (Figures 2, 3, 7, 8 and 11).

The region from between the approximate latitudes 51°N to 59°N showed a noticeable warm or reddish colouration. The northern edge of this region was marked by a dark belt.

The north polar hexagon

One of the most remarkable features discovered on Saturn in recent years has been the north polar hexagon, which encircles the planet's north pole. A typical image of the hexagon taken by *Cassini* (Figure 6) is shown on the front cover of this *Journal*.

The feature is approximately 25,000km across which equates to an angular diameter of just under 4 arcseconds when the planet was at opposition on April 28.

During this apparition, a dark region of approx. 4" diameter has been observed by several amateurs around the planet's north pole. Provisional latitude measurements place this region north of 75°N latitude. The region was imaged by Milika & Nicholas on 2013 Jan 26 (Figure 8, also on the front cover). They transformed this image into a polar projection map using the *WinJUPOS* software (Figure 9), which revealed this dark region to have a hexagonal structure.

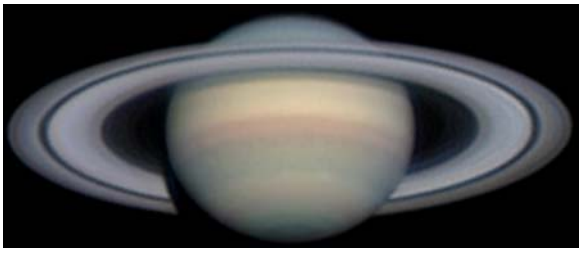


Figure 7. 2012 Dec 27d, 03h44m UT. CM1= 339.3, CM2= 358.8, CM3= 331.6. 356mm Schmidt–Cass. (*Peach*). Light spots on the northern edge of the NEB/NTB belt complex, and light spots within this complex.

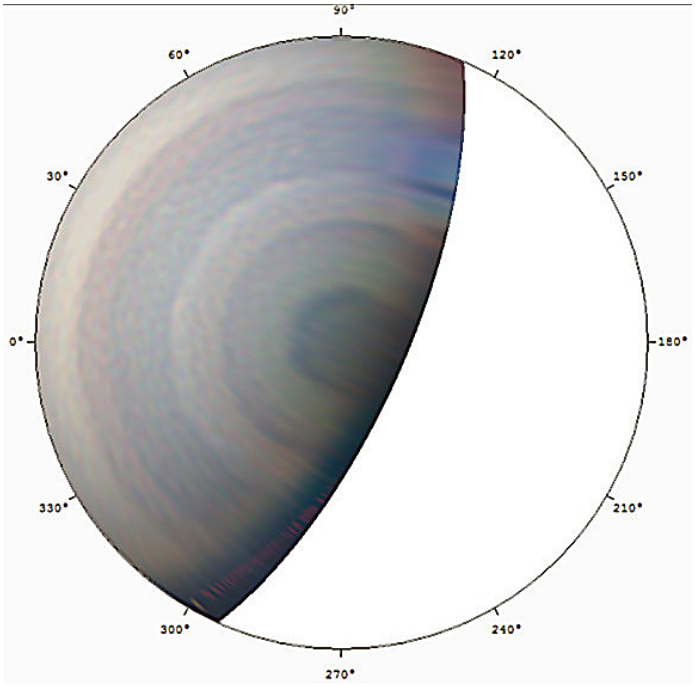


Figure 9. Polar projection map of Figure 8 (on the front cover) made by Milika & Nicholas, showing the hexagonal structure of the north polar hexagon. Longitudes are given in System 2.

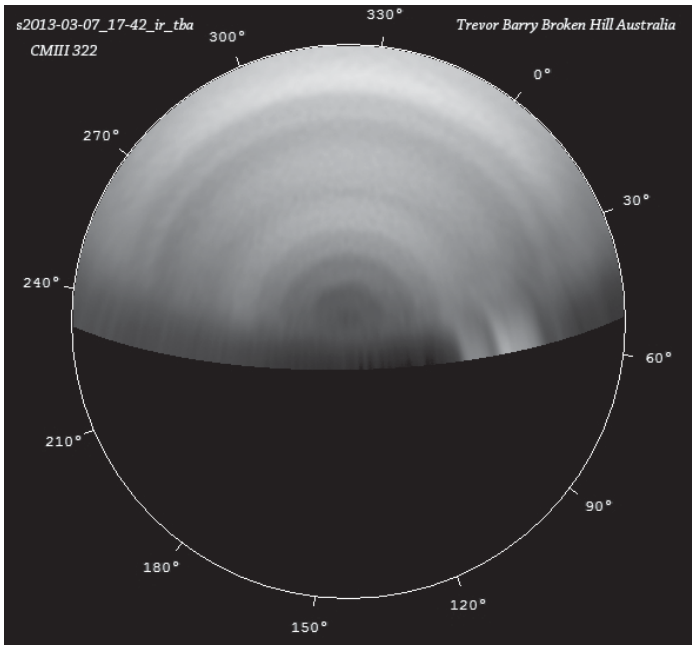


Figure 10. 2013 Mar 07d,17h42m UT. CM1= 174.2, CM2= 74.3, CM3= 322.0. 406mm Newt. (*Barry*). Polar projection map derived from an infrared image, also showing the north polar hexagon.

On learning of this observation, Barry derived north polar projections from his images taken earlier during the apparition and these also showed the polar hexagon.

From February onwards, polar projections were sometimes made by Barry, Milika & Nicholas and Sussenbach of their observations. Under good seeing these too show the hexagonal structure. The structure of the hexagon was also observed in some of the best images without recourse to polar projection transformation, such as shown in Figures 2, 3, 8, and 11.

Milika & Nicholas also recorded small light spots just north of the vertices of the hexagon at System 3 longitudes of 149° and 101°, March 5 and 25 respectively.

Some of the best images showed the hexagon to have a darker border with a slightly lighter region within the structure. A darker circular region around the North Pole itself was sometimes detected, which was more obvious in infrared images (Figure 10).

Further observations may be found in the Saturn gallery of the Section's web site at **http://www.britastro.org/saturn/**

Mike Foulkes, *Director*

1 Foulkes M., 'The 2011/2012 apparition of Saturn – interim report', *J. Brit. Astron. Assoc.*, **122**(6), 330 (2012)

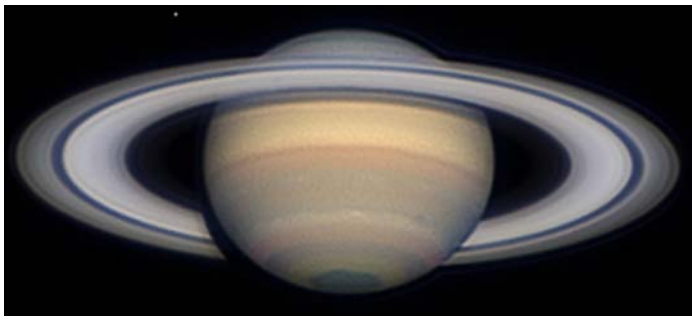


Figure 11. 2013 Mar 25d, 17h58m UT. CM1= 263.4, CM2= 301.0, CM3= 167.0. 356mm Schmidt–Cass. (*Milika & Nicholas*). Light spots on the northern edge of the NEB/NTB belt complex and light spots within this complex. Dark spot on the northern edge of this complex approaching the CM. The dark region around the North Pole is the north polar hexagon.

Solar Section

2013 February

The activity level in February fell to around half of that recorded in January and was more on a level with 2012 December. Although sunspot groups were reduced in both hemispheres the south remained active, however the north remained dominant. Sunspot groups were recorded on all days of the month.

AR1665 N11°/241° survived on the disk from the previous month in the NE quadrant type Hax on Feb 2 with an area of 120 millionths. By Feb 5 the group was of similar size but in the NW quadrant. The following day the group was type Hsx, a single penumbral spot and was last seen on Feb 9 approaching the limb.

AR1667 N23°/194° rounded the NE limb on Feb 1 and was type Dao containing 5 sunspots the following day. By Feb 6 the asymmetrical follower had reduced in size and the dominant feature was the leader which had developed a double umbra within the penumbral area. The group then started to decline and was observed as type Cso with an area of 100 millionths on Feb 8. By Feb 11 the group had reduced further to a small Hrx sunspot approaching the NW limb.

AR1670 N18°/160° formed on the disk in the NE quadrant on Feb 7, a small single sunspot. The next day the group had developed to type Dai with an area of 100 millionths. The group was of similar appearance on Feb 11 now in the NW quadrant and was near the limb on Feb 15.

AR1671 N14°/078° was first reported over the NE limb on Feb 11 as a single penumbral sunspot type Hsx. By Feb 17 the group was unchanged apart from a tiny pore trailing the penumbral sunspot to the SE (AR1678) and the group was now in the NW quadrant. On Feb 19 the group was type Cso consisting of a small penumbral sunspot and two pores to the north, both of which had disappeared by Feb 21. The group was approaching the NW limb on Feb 22.

AR1673 S10°/012° was first reported on Feb 17 in the SE quadrant type Cao consisting of a small asymmetric penumbral leader with two small pores trailing. By Feb 19 many small sunspots had developed around the penumbral sunspot but by Feb 21 the group was fading rapidly and consisted of only a faint collection of pores type Bxi. The group then faded on the disk.

AR1678 N12°/068° initially seen as a single Axx type sunspot on Feb 17 trailing AR1671, the sunspot faded the following day but re-emerged on Feb 19 as a substantial Dao group with an irregular penumbral sunspot at either end of the group giving it a total area of 140 millionths. By Feb 21 the group was type Dko with large penumbral sunspots leading and following, the follower having a double umbra. The group rounded the limb on Feb 22, no part of it being visible on the next day.

AR1682 S18°/300° developed on the disk in the SE quadrant near the CM on Feb 25. The group was type Dro consisting of four small sunspots. By the following day, three small penumbral sunspots led the group with smaller sunspots following. Both east and west elements of the group had developed by Feb 27, consisting of asymmetric penumbral areas containing many small umbrae, type Dao.

11 observers reported a Quality number of Q= 9.91

H-alpha

Prominences

15 observers reported a prominence MDF of 5.23 for February.

The majority of prominences were small and unremarkable throughout the month.

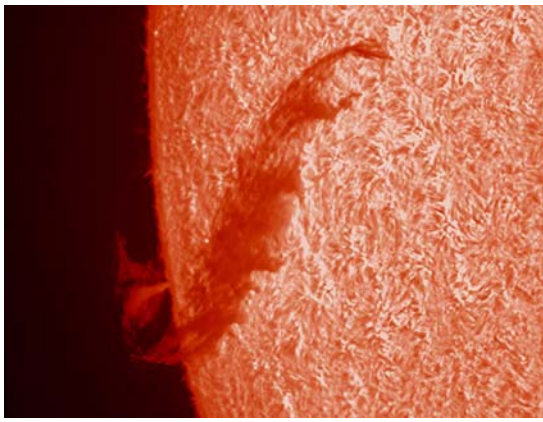
On Feb 5 a pillar rose to an approximate height of 102,000km on the SW limb. A hedgerow prominence hearth was seen extending around the SW limb on Feb 7 for about 251,000km and rising to a height of 102,000km. This hearth persisted on Feb 8 but reduced in height to 93,000km.

Another pillar was seen on Feb 9 on the NE limb rising to approximately 93,000km.

A short mound was seen on the SW limb on Feb 19 and nearby a cloud of ejecta. Two further hearths were seen on this limb both consisting of two small pillars. Also a tall pillar was reported on the SE limb.

A pillar prominence extended to a height of 93,000km on the NW limb on Feb 24.

On Feb 25 a filaprom was observed on the SW limb, consisting of a short prominence and much longer filament element. This was reversed the next day when a substantial hearth had formed (approximate height 112,000km) with a short curving filament extending onto the solar disk from the southern end of the prominence hearth.



A massive filaprom on 2013 Feb 15 imaged at 11:37 UT by Dave Tyler.

Filaments & plage

11 observers reported a filament MDF of 3.75 for February.

On Feb 1 an arcing filament was seen in association with AR1663. A long snaking filament between AR1665 and AR1667 was seen on Feb 4, 5, 6 & 7. On Feb 6 it was joined by another north-south filament located to the east of AR1667.

On Feb 15 a broad and diffuse filament was seen near the SE limb. By the following day it was thinner, more like a swan's neck close to the SE limb. On Feb 17 it was longer extending about 40° in longitude. By Feb 19 it was still strong but broken into four sections; another parallel filament had formed to the south of one of the sections. The filament was still discernable on Feb 21 but had broken up and consisted of four elements strung across the SE quadrant.

Plage was seen with ARs 1665, 1667, 1670, 1672, 1673, 1675, 1676, 1678, 1680, 1681 and 1682. A patch of plage was also seen on Feb 17 to the east of the long filament and just south of AR1676.

On Feb 19 in addition to a small flare from AR1671, bright plage was seen through AR1678

BAA sunspot data, 2013 February–March

	February		*March*	
Day	*g*	*R*	*g*	*R*
1	4	54	4	56
2	4	54	5	73
3	5	62	5	76
4	2	31	5	75
5	3	37	4	62
6	3	39	5	66
7	4	52	3	50
8	3	48	4	59
9	3	50	5	65
10	3	47	5	66
11	4	49	6	83
12	4	57	6	89
13	2	33	6	95
14	2	25	7	105
15	3	32	7	97
16	3	37	7	99
17	4	60	7	100
18	5	73	6	88
19	5	86	4	58
20	5	83	3	42
21	5	68	3	46
22	5	65	3	39
23	2	32	3	40
24	3	33	2	33
25	3	43	3	36
26	3	45	2	24
27	3	48	2	27
28	4	57	3	39
29			4	60
30			5	68
31			6	75
MDFg	3.55 (43)		4.50 (49)	
Mean R	49.92 (38)		64.19 (45)	

North & south MDF of active areas g

	MDFNg	*MDFSg*
February	2.42 (33)	1.27 (33)
March	2.47 (37)	2.33 (37)

g = active areas (AAs)
MDF = mean daily frequency
R = relative sunspot number
The no. of observers is given in brackets.

Full-disk image with active filaments by Paul Haese, 2013 March 12.

to the south of the flaring region and extending southward from AR1678 in an extensive curve some distance from the sunspot area.

2013 March

Sunspot activity increased during March largely due to an upsurge in activity in the southern hemisphere, with both hemispheres performing to a similar level. Multiple sunspot groups were reported on all days of the month.

AR1682 S18°/299° remained on the disk from the previous month, now in the SW quadrant. The group was type Dao on Mar 1 with asymmetrical sunspots leading and following, both with double umbrae. The group showed signs of decay the following day as it approached the SW limb losing much of the complexity it had earlier.

AR1683 S17°/202° was fully on the disk near the SE limb on Mar 1 type Dai. The group developed to type Dac with an area of 120 millionths by Mar 4 but had decayed the next day to type Cso with an area of just 40 millionths as it approached the CM. The group continued to decline and was type Axx by Mar 7 before it faded on the disk in the SW quadrant.

AR1686 S14°/261° formed on the disk on Mar 2 in the SW quadrant. By Mar 4 the group was type Dsc with an area of 110 millionths consisting of 3 penumbral sunspots. The following day the group had developed several pores,16 sunspots were counted, the group having an area of 140 millionths. The group rounded the limb on Mar 7.

AR1689 S17°/153° was seen just over the SE limb on Mar 5 consisting of two small pores, type Axx. By Mar 12 the group was in the SW quadrant and had developed into a substantial Eai group. The following day the group had rapidly declined and now comprised of a string of small sunspots type Cri. On both days this group was the only sunspot group seen in the southern hemisphere.

AR1692 N09°/076° rounded the NE limb on Mar 9 as a single Hsx sunspot. On Mar 12 the group was observed as type Hhx, a single strong penumbral sunspot with an area of 240 millionths. A small pore formed within its southern penumbra on Mar 13. The group was reported visible to the protected naked eye on Mar 14 & 16. By Mar 21 the group was approaching the NW limb still consisted of a strong penumbral sunspot and now with a small pore to the south, outside the penumbral area of the main sunspot.

AR1695 N10°/054° was over the NE limb on Mar 11 to the east of AR1692. The group was type Hsx on Mar 12 and 13. By Mar 21 the penumbral sunspot had become elongated with a small pore leading the group as it approached the NW limb trailing AR1692.

AR1696 N04°/092° formed on the disk to the west of AR1692 on Mar 11. The group was type Dac on Mar 12 with an area of 190 millionths with the largest sunspot being the follower. The group was still developing on the following day with many small sunspots seen between the main penumbral sunspots. The group was type Eko on Mar 15 and was nearing the NW limb on Mar 19.

AR1709 S31°/268° was seen in the SW quadrant only on Mar 29 but is notable due to its high latitude position.

AR1711 S20°/157° appeared just over the SE limb on Mar 30 consisting of a large penumbral sunspot with a penumbral follower. The group was fully on the disk on the following day and looked substantial type Dko.

12 observers reported a Quality number of Q = 12.47

H-alpha

Prominences

16 observers reported a prominence MDF of 5.85 for March. This was another month with few prominences of particular note to report.

On Mar 2 a bright detached prominence shaped like a comet tail, was on the NE limb.

A pyramid prominence was seen on Mar 4 & 5 at NE 40°. Several strong prominences were on the E limb on Mar 3 including two pyramids on the NE limb and an oddly shaped right angle arch which may have been disconnected from the limb.

A very extensive prominence hearth was seen on the SE limb on Mar 5 just south of the emerging sunspot group AR1689. The hearth consisted of 4 elements, none being particularly high. A small fila-prom was also noted on the SW limb.

A short bright prominence was on the NW limb ahead of the approaching sunspot group AR1692 on Mar 21. Two large prominence clouds were on the SE limb but both were faint and their shape was difficult to define.

A column type prominence reached an approximate height of 121,000km on the SW limb on Mar 23. Several limb prominences were seen on the E limb on Mar 25 including two eruptive jets.

On Mar 27 an elongated prominence was on the SE limb which was almost detached, the bulk of the structure pointing northward. An active prominence was also observed on the SE limb which stretched across the limb for about 233,000km.

An extensive hedgerow hearth was seen on the NE limb near the North Pole on Mar 28, but again this was not particularly high. Also on this day, a prominence was observed on the SE limb which appeared to have outstretched wings like a butterfly.

A spray type prominence was seen on Mar 31 on the NE limb at N60° and reached a height of around 75,000-80,000km.

Filaments & Plage

11 observers reported a filament MDF of 3.48 for March.

A very large inverted 'U' filament was seen on the disk on Mar 12 extending from the leading sunspot in AR1691 through AR1690 and back down to the follower in AR1691. A long forked east-west filament was also in the NE quadrant north of AR1694 and 3 quite long filaments followed AR1689 which were still present the following day. The large inverted U filament became broken into 2 north-south filaments at either end of AR1691. Also on Mar 13 a long filament escorted AR1692 to the east which developed to an open U shape to the south of the group by Mar 15. The eastern end of this filament was quite bright in plage.

On Mar 16, several regions were associated with bright plage and a few with 'hot spots' especially AR1698 approaching the SW limb.

Two north-south filaments extended northwards from AR1695 on Mar 21.

Bright plage was seen in AR1704 on the NE limb on Mar 25, NOAA reporting a B2.6 flare some 40 minutes later between 13:08 and 13:13 UT. On Mar 28 an extensive filament was observed close by the hedgerow prominence near the North Pole.

Two long north-south filaments were north of AR1704 on Mar 29, both being diffuse and a curving filament was seen extending through AR1710 which appeared quite fuzzy on the eastern end. An arc of plage closely followed AR1704.

Lyn Smith, *Director*

The Radio Astronomy Group in 2012

Solar activity in visible light as recorded in the count of active groups by Solar Section members has been fairly steady through most of 2012, after a very noticeable peak in 2011 November (Figure 1). Radio Group members have recorded a very different picture however, with a strong peak in 2012 July after a low period from 2011 November to 2012 March (Figure 2). Measurements of flare activity detected as Sudden Ionospheric Disturbances at Very Low (radio) Frequencies during the winter months will always under represent true solar activity due to the short day length and lower altitude of the Sun in our sky, and thus shorter recording periods. Unfortunately, it not easy to correct for this seasonal variation.

Figure 3 shows the last two years of SID data colour-coded to indicate the percentage of C-class flares in green, M-class flares in yellow and X-class flares in red. Not many of the energetic X-class flares have been recorded in cycle 24 so far: 2011 August 1, September 3, 2012 January 1, July 2. The proportion of the medium M-class flares does however show peaks roughly in line with the visual activity. In particular, 2012 February had no M-class flares recorded and a dip in the active area count. The weaker B-class flares have been omitted from these charts as they form a fairly continuous background, although often hidden by periods of higher level activity.

It has also been noticeable that although there have been plenty of sunspot groups on the visible disk, they have often been fairly simple

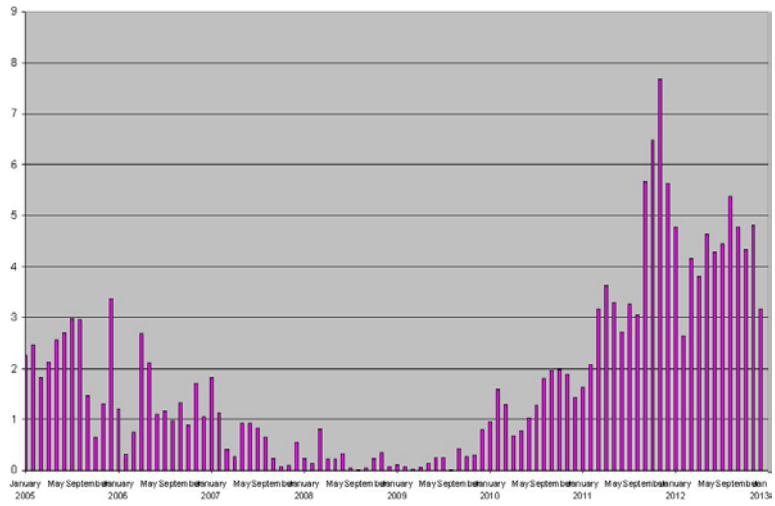


Figure 1. Solar active areas from 2005 to 2012 in visible light. Data from the BAA Solar Section.

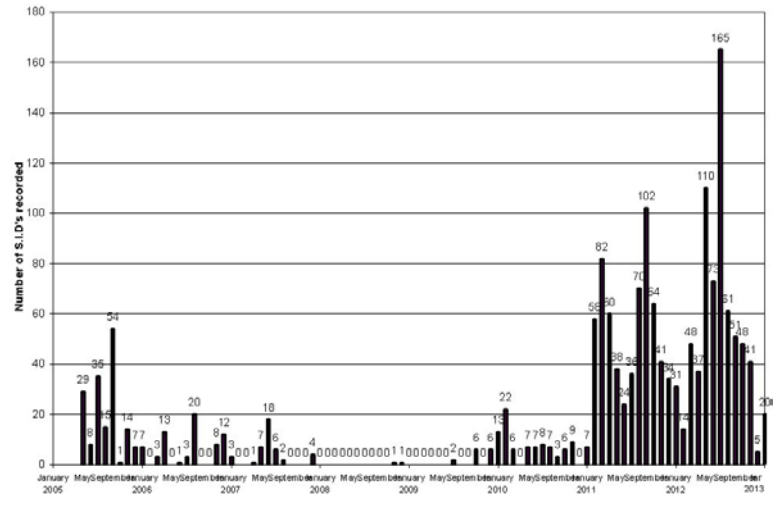


Figure 2. VLF SID activity in 2005–2012.

Figure 3. Percentages of C, M and X flares recorded as SIDs, 2011–2012.

in structure, without much development over time, and hence lower flare activity for us to record as SIDs.

The X-ray flux from a solar flare usually rises quickly to a peak, and then decays more slowly. This is recorded by the GOES series of satellites, and reported online by the Space Weather Prediction Centre. Comparing our VLF recordings with the X-ray flux has revealed some very slow flares during 2012. Often they do not create easily measured SIDs, but a very slow M1.2 flare on 2012 June 13 was well recorded by group members. Figure 4 shows the X-ray flux in black, and the 23.4kHz VLF signal in red. The C2.7 flare at about 09:20UT is fairly typical, and has produced a small SID at 23.4kHz. The M1.2 flare seems to start around 11:30UT, but does not peak until 13:00. Its decay lasts until after 16:00, and has two more flares superim-

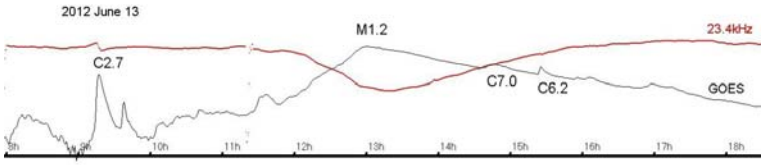


Figure 4. Activity on 2012 June 13. *John Cook (Wolverhampton, UK)*. GOES data from SWPC.

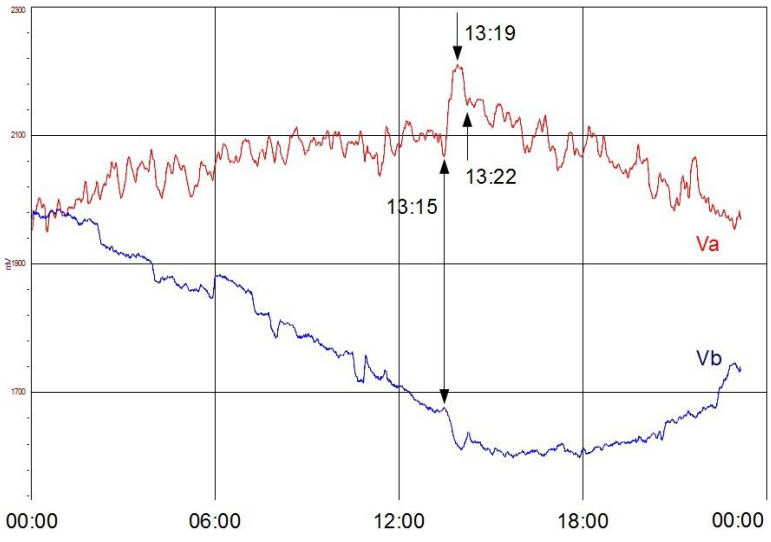


Figure 5. Possible SFE on 2012 August 16. *Paul Hyde (Basingstoke, UK)*.

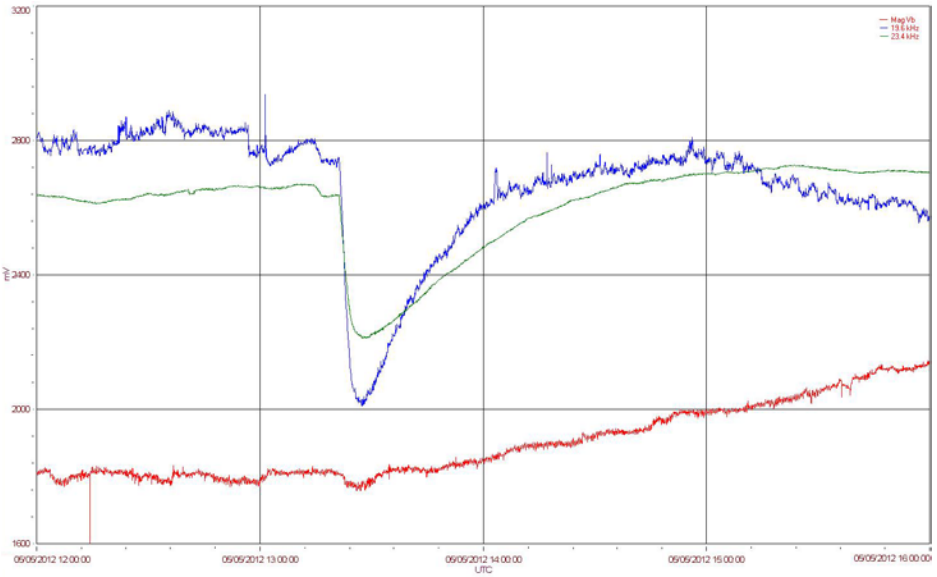


Figure 6. SFE from M1.4 flare on 2012 May 5. ***Paul Hyde (Basingstoke, UK).***

posed. The effect at 23.4kHz could easily be taken as non-solar in origin.

A similar slow flare recorded by group members as a SID on 2012 August 16 appeared to be associated with a magnetic Solar Flare Effect. See the previous RAG report[1] for details of an SFE. The two SFEs reported there were from very fast and energetic X-class flares. On this occasion the flare was of magnitude C3.6, with a rise time of 30 minutes, decaying over 3 hours. As well as recording the SID, Paul Hyde recorded a near-simultaneous magnetic event, see Figure 5.

Doubting that such a small flare could cause an SFE, we checked with the British Geological Survey who had also listed the event as an SFE. I am indebted to Orsi Baillie of the BGS for supplying more details. At the time of this event, neither SOHO or ACE measurements showed a shock arrival typical of a CME, leading to the conclusion that this was a SFE. However, magnetic recordings in the UK, USA and Australia all show a disturbance indicating that it was a global event and hence more likely to be associated with a CME rather than an SFE, which tend to be confined to regions close to local noon at the time of the flare. Clearly a very odd event!

An excellent magnetic Sudden Storm Commencement (SSC) was associated with an X1.4 flare recorded as a SID on 2012 July 12. A full report of this event by Paul Hyde was published last October.[2]

Active region AR1476 was responsible for three impulsive M-class flares within 12 hours. The first of these was recorded as a SID peaking at 13:27UT on 2012 May 5. Associated with it was a clear SFE recorded by Paul Hyde and shown in Figure 6. GOES data shows that the X-ray flare lasted just 10 minutes, but its effect on the ionosphere lasted over 90 minutes. Blue is 19.6kHz (Anthorn, Cumbria) and green is 23.4kHz (Ramsloh, Germany). Red shows the dip in the magnetometer coincident with the SID.

Several observers recorded unusual VLF activity in the afternoon of 2012 March 9. My own recording (Figure 7) shows the GOES X-ray flux in black. There is just a low background activity with a C2.7 flare at 10:23 and a C2.0 at 16:17. The red trace is 23.4kHz and shows a small SID for the C2.7 event, but also shown is a large pulse peaking at 15:43. The pulse is also shown, inverted, at 15:51 on the blue trace at 22.1kHz. This is well before the C2.0 flare, and has no clear source in the X-ray flux from the Sun.

There is plenty of magnetic disturbance evident throughout the day (green trace), linked to a huge solar proton event that started on March 7. This lasted into March 10, but does not seem to be linked to this isolated VLF pulse.

Mark Edwards has made some analysis of our recordings, but came to very different conclusions as to the ionosphere's behaviour at the two frequencies monitored; his model indicated that the base of the D-region was ascending at 22.1kHz, but the data for 23.4kHz indicated that it was descending. It would normally be ascending in the late afternoon as the level of incident solar radiation reduces towards night time. This odd event also remains unexplained.

Cycle 24 is giving observers plenty to record, although some of it is currently unexplained. Maximum is expected during 2013, so we look forward to plenty of interest over the next 12 months.

Radio Group members providing data for this report were: Roberto Battaiola, Colin Clements, Simon Dawes, Mark Edwards, John Elliot, Gordon Fiander, Paul Hyde, Peter King, Martyn Kinder, Bob Middlefell, Steve Parkinson, Tarif Rashid Santo, John Wardle and John Cook.

John Cook [*jacook@jacook.plus.com*]

1 *J. Brit. Astron. Assoc.*, **122**(3), 145 (2012)
2 *ibid.*, **122**(5), 260 (2012)

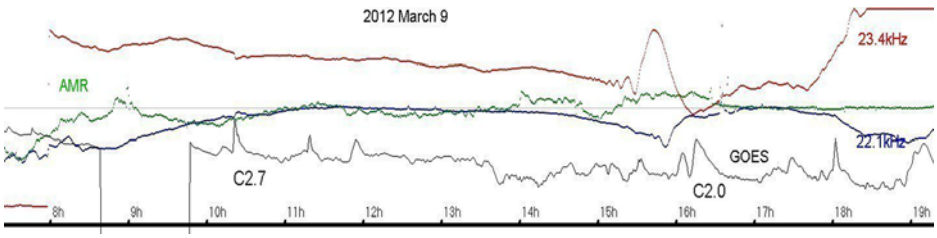


Figure 7. VLF pulse of unknown origin on 2012 March 9. ***John Cook (Wolverhampton, UK).***