



Feature Story: ALPO Solar Section A Report on Carrington Rotations 2169 thru 2173

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Overview

Solar activity continued its long slide towards a minimum predicted for 2020-21. The rotational sunspot number never rose to 70 during this reporting period as evidenced in plot.1. At the time of this writing (CR 2076), we have already experienced a number of days with a count of 11, which is the lowest possible number above zero, since the formula for determining the Wolf number is $10g+s$ (or 10 times the number of sunspot groups plus the number of spots). For individual observer sunspot counts, a "personal factor" is usually applied by the tabulator, reckoned from many days of observing by that observer.

The average daily sunspot number for this reporting period (Oct. 15, 2015 - Feb. 17, 2016) was 61.2 — a drop from the 65.8 of the previous reporting period with a high of 108 (on 02/04 & 05) and a low of 12 (on 10/10)

As in the last two reports, the ALPO Solar Section will be referred to as "the Section" here. Carrington Rotations (2069-73) will be called CRs. Similarly, Active Regions will be called "ARs", using only the last four digits of the full number. "Groups" will apply to the visible light or "white light" collection of sunspots while "Region" or "Active Region" will apply to all phenomena associated with the particular sunspot group. Statistics used

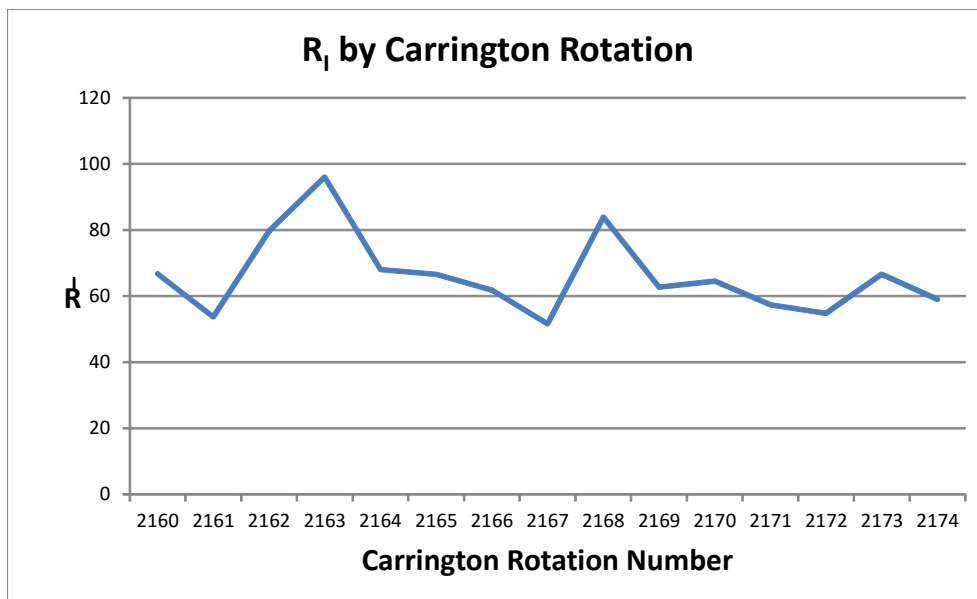


Table of Contributors to This Report

Observer	Location	Telescope (aperture, type)	Camera	Mode	Format
Michael Borman	Evansville IN, USA	102mm, RFR 90mm 102mm, RFR	Point Grey, GS3	W-L H-a CaK	digital images
Tony Broxton	Cornwall, UK	127mm, SCT	N/A	W-L	drawings
Gabriel Corban	Bucharest, Romania	120mm, RFR	Point Grey GS3-U3	H-a W-L	digital images
Rik Hill	Tucson, AZ, USA	90mm, MCT 120mm, SCT	Skyris 445m	W-L	digital images
David Jackson	Reynoldsburg, OH, USA	124mm, SCT		W-L	digital images
Howard Eskildsen	Ocala, FL, USA	80mm, RFR	DMK41AF02	CaK	digital images
Jamey Jenkins	Homer, IL, USA	102mm, RFR 125mm, RFR	DMK41AF02	W-L CaK	digital images
Monty Leventhal		250mm, SCT		W-L/H-a	drawings
Theo Ramakers	Oxford, GA, USA	40mm, RFR 80mm, RFR 40mm, RFR	DMK42AU02	H-a W-L CaK	digital images
Randy Tatum	Bon Air, VA, USA	180mm, RFR 180mm, RFR	DFK31AU	W-L-p.p. H-a	digital images
David Tyler	Buckinghamshire, UK	178mm, RFR 90mm, RFR	ZWO	W-L H-a	digital images

NOTE: Telescope types: RFR (refractor), SCT (Schmidt-Cassegrain), MCT (Maksutov-Cassegrain)
Mode types: W-L (white light), CaK (calcium chloride), H-a (hydrogen alpha), p.p. (pentaprism)

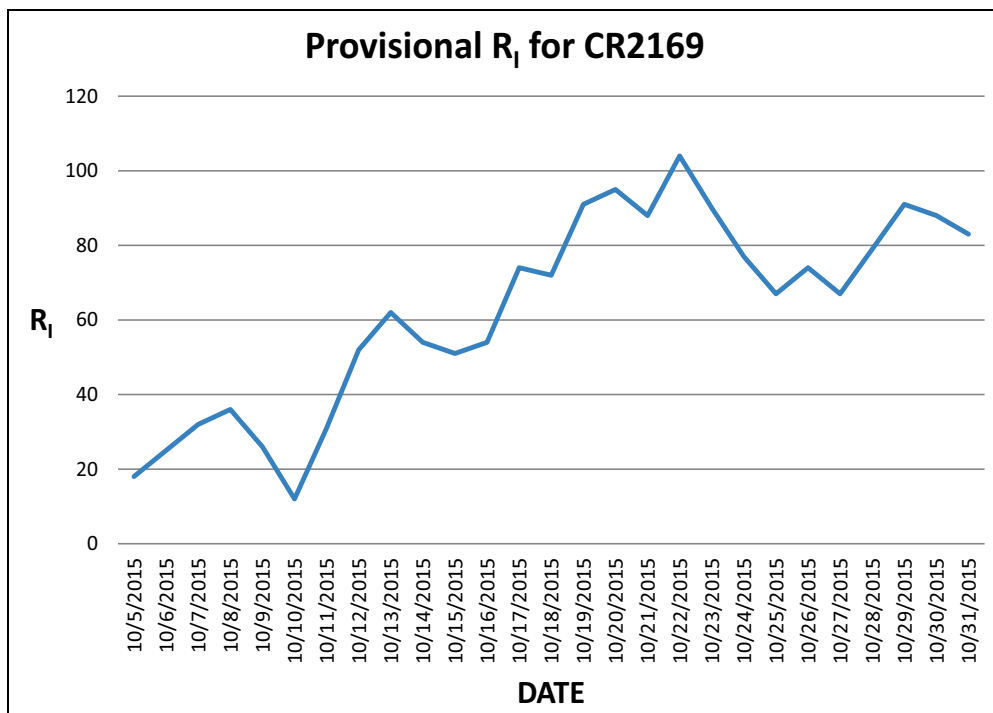
in this report are compiled by the WDC-SILSO* at the Royal Observatory of Belgium which is responsible for the International Sunspot Number used here. All times will be Coordinated Universal Time and dates are reckoned from that. Dates will be expressed numerically with month/day such as "9/6" or "10/23".

The terms "leader" and "follower" will be used here instead of east or west on the Sun. "W-L" may be used to indicate White Light observations while Hydrogen-Alpha may be "H-a" and Calcium K-line "CaK", abbreviations well-familiar to the experienced solar observer. An important point, "naked eye" here means the ability to see a feature on the Sun through a proper and safe solar filter with no other optical aid. You should never look at the Sun, however briefly, without proper filtration. All areas on the disk will be expressed in the standard measurement of millionths of the disk, with a naked-eye spot generally being about 1,000 millionths for the average person. Spot classifications are the ones defined by Patrick McIntosh of NOAA (McIntosh 1981, 1989) and detailed in an article in the JALPO 33 (Hill 1989). This classification system is also detailed by the author on the Section website in an article on white light flare observation.

Observers contributing to this report and their modes of observing are summarized in the table on page XX of this report. It will be used as a reference throughout this report rather than repeating this information on every image or mention.

References:

Hill, R.E., (1989), Journal of the Assn of Lunar & Planetary Observers, Vol. 33, p. 10.



Livingston, W., Penn, M.; (2008) "Sunspots may vanish by 2015." https://wattsupwiththat.files.wordpress.com/2008/06/livingston-penn_sunspots2.pdf

McIntosh, Patrick S., (1989) "The Classification of Sunspot Groups" Solar Physics, Vol. 125, Feb. 1990, p. 251-267. <http://link.springer.com/article/10.1007/BF00158405>

McIntosh, Patrick S., (1981) The Physics Of Sunspots, Sacramento Peak National Observatory, Sunspot, NM; L.E. Cram and J.H.Thomas (eds.), p. 7. <http://adsabs.harvard.edu/abs/1981phss.conf.....C>

Further references used in the preparation of this report:

Solar Map of Active Regions <https://www.raben.com/maps/date>

SILSO World Data Center <http://sidc.be/silso/home>

SILSO Sunspot Number <http://www.sidc.be/silso/datafiles>

The Mass Time-of-Flight spectrometer (MTOF) and the solar wind Proton Monitor (PM) Data by Carrington Rotation <http://umtof.umd.edu/pm/crn/>

NOAA Solar Indices Data <http://www.ngdc.noaa.gov/nndc/struts/results?t=102827&s=1&d=8,4,9>

Carrington Rotation 2169

Dates: 2015 10 04.5722 to 2015 10 31.8639

Avg. R₁ = 62.7

High R₁ = 104(10/22)

Low R₁ = 12(10/10)

The first rotation of this reporting period showed moderately increasing sunspot numbers. They could not get much lower than what they started with! (Again, keep in mind that the lowest possible sunspot number above zero is 11.) The lowest R₁ for this rotation was 12 representing 1 group with 2 spots. The largest region of this rotation was AR 2436, first observed in the Section by Broxton in a sketch on 10/20 at 0814UT and imaged 10 hours later by Jenkins in a w-l image at

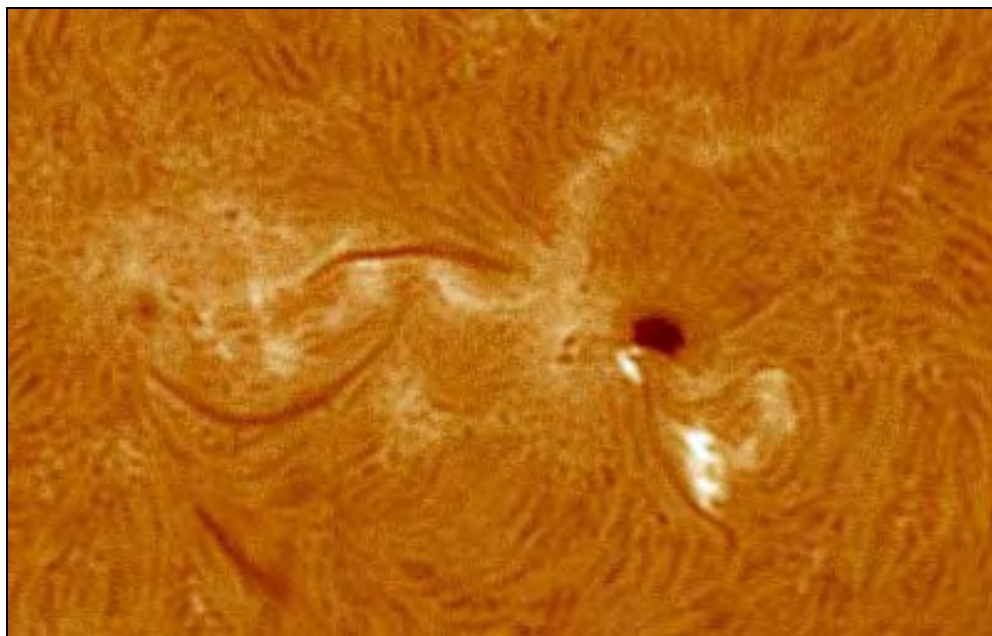


Figure 1. H-alpha image of AR2435 by Theo Ramakers on 10/23 at 1438UT using equipment specified in Table 1.

1854UT. While Broxton rated the group as Eki, it was officially listed as Ekc with an area of 260 millionths. In the previous 48 hours, it had produced over 20 flares, most of them C-class. They showed it to be an east-west elongated leader spot in a well-organized penumbra, with a detached small portion to the south, surrounded by many small umbral dots followed by at least half a dozen umbrae in rudimentary penumbra, some detached, with one prominent umbral spot between this leader-follower configuration.

There were no more observations until 10/23 when AR 2436 was on the central meridian (Fig. 1). All observations (w-l, Ha and Cak) were by Ramakers. The earliest image was the w-l at 1430UT, and it showed the leader spot already past the meridian but not the follower. The leader was more circular now with one detached piece following with some umbral spots. The follower collection had one spot with rudimentary penumbra and a scattering of 8-10 umbral spots. Though the group was still

listed as Eki, this change in morphology hinted at a waning sunspot group and the decrease to 250 millionths (from a high of 290 two days earlier) supported this. Even so, Ramakers caught a small flare at 1438UT in an H-a observation. Two days later, a drawing by Broxton

showed both the leader and follower breaking down. The class was Eko with an area of 240 millionths; but while occupying the same area, the spots themselves were smaller and had less penumbrae. Gossett showed the follower collection of spots to be breaking down rapidly on 10/26. The area was still slowly decreasing, now below 200 millionths by the end of the day with a class of Esi. Broxton got the last look at this region on the 10/28 when only the leader was left in the typical circular spot but there must have been some follower spots left, as the class was Cao with an area of 100 millionths.

Carrington Rotation 2170

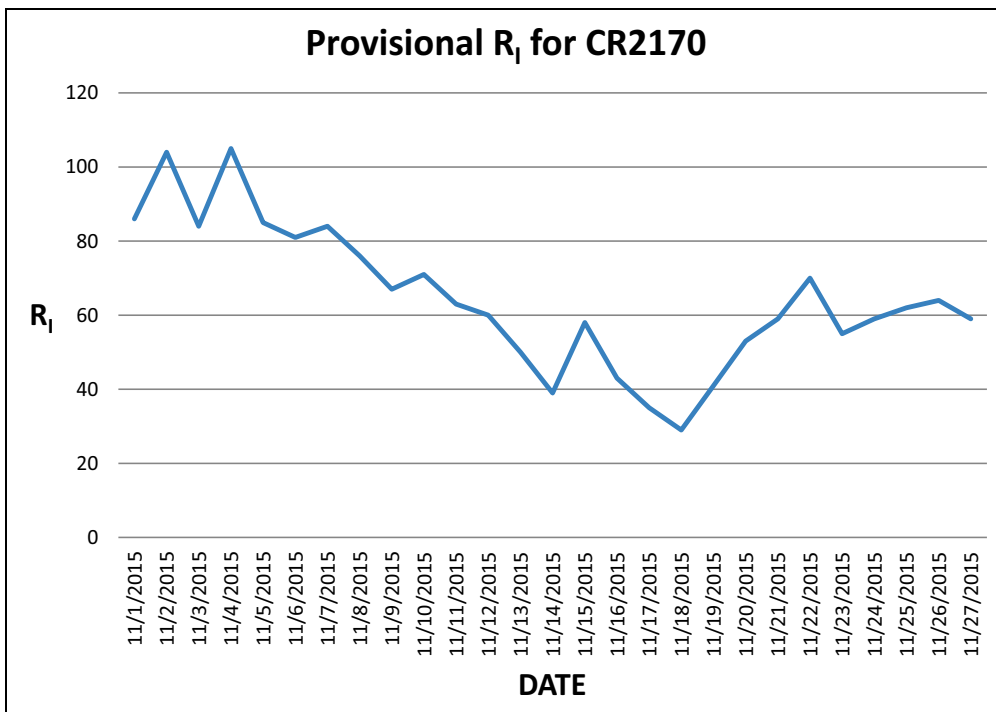
Dates: 2015 10 31.8639 to 2015 11 28.1715

Avg. $R_i = 64.5$

High $R_i = 105(11/04)$

Low $R_i = 29(11/18)$

Sunspot activity declined during this rotation but there was one good sunspot group, AR2443, that came on the disk at the end of the previous rotation. It was



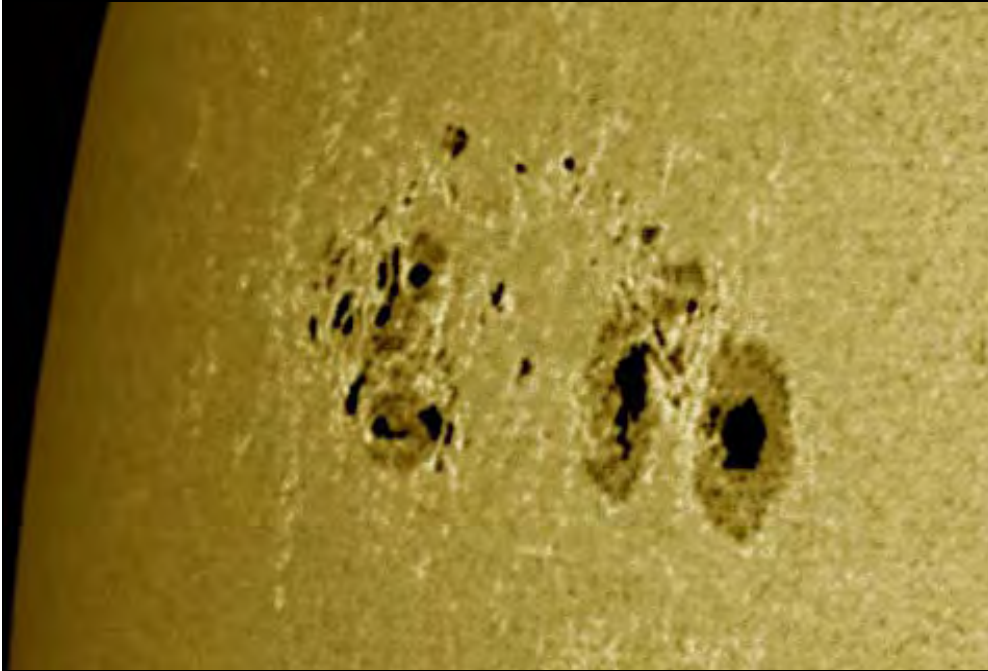


Figure 2. White-Light image of AR2443 by Theo Ramakers on 10/30 at 1420UT using his w-l equipment noted in Table 1.

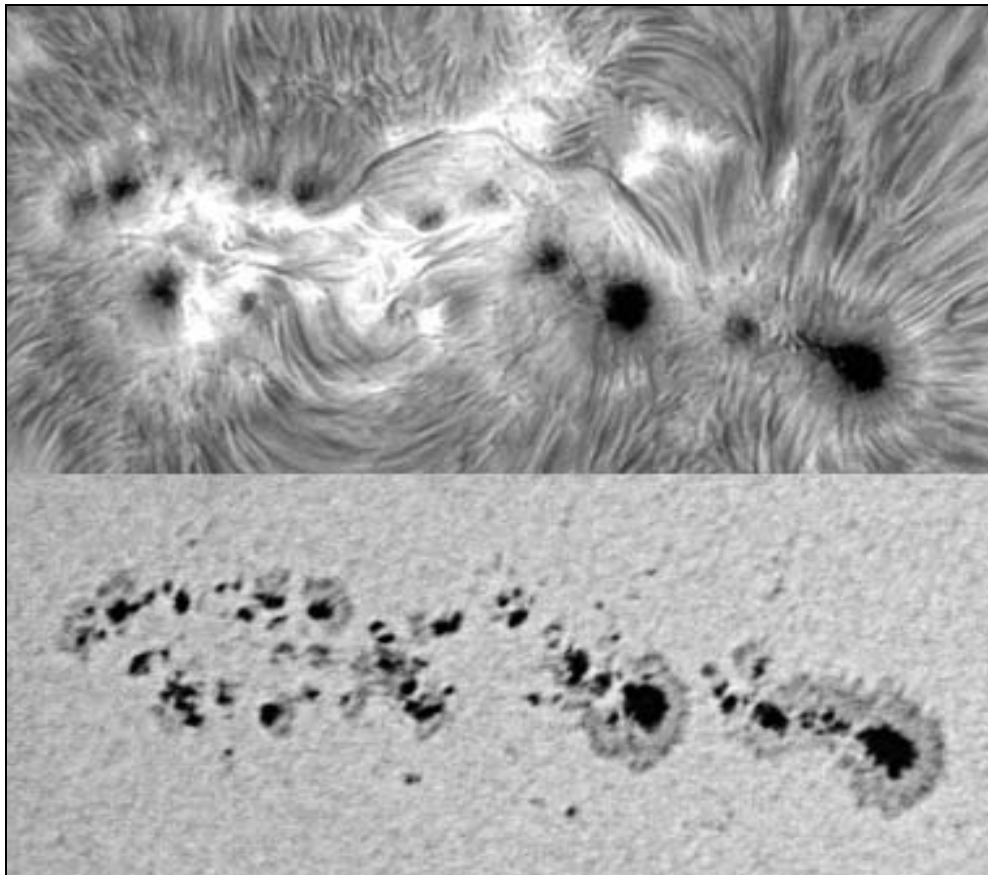


Figure 3. Two views of AR2443. The upper is an H-alpha by Gabriel Corban 11/01 at 1229UT using his H-a setup from Table 1. Below is a white-light image by Hill on 11/01 at 1950UT using the 120mm SCT telescope listed in Table 1.

first recorded by Ramakers in w-l, H-a and Cak, both whole disk and high-resolution on 10/30 between 1417-1439UT. This was followed the same day by a drawing by Leventhal at 2125UT. These showed the group to have a complex leader of two spots, each with its own penumbra containing many umbrae and bright faculae between these two spots. This leader was followed by a large collection of small umbrae, a dozen or so, in chaotic penumbra. There was a filigree of faculae around the whole group. This is all well shown in the w-l image (Fig. 2), taken by Ramakers at 1420UT. The next day, 10/31, Corban got very detailed near H-a image of the group at 1300UT, followed a few hours later by a w-l image by Hill at 2042UT. These showed a leader with four large umbrae, two with large symmetrical penumbrae and two that appeared to have separated from each of these on the following sides. The follower consisted of two east-west parallel lines of over a dozen umbrae in fairly disorganized penumbrae and penumbral bits. The group was now classed as Ekc (magnetic class beta-gamma-delta) with area of 560 millionths thought it seemed larger. As the class might suggest, it produced a goodly number of flares, about one per hour. We had no reports of it being naked-eye visible.

As November opened, this region was still listed as Ekc but had grown to 640 millionths and had a magnetic class of beta-gamma-delta, producing over 30 flares in a 48-hour period, two of M-class strength. It was observed by Broxton and Leventhal (w-l drawings at 0829UT and 2250UT respectively), Corban (H-a at 1128UT) and Hill (w-l at 1950UT).

In w-l, the leader spots were two main east-west collections of umbrae in penumbra with many smaller umbral spots trailing. The follower was a

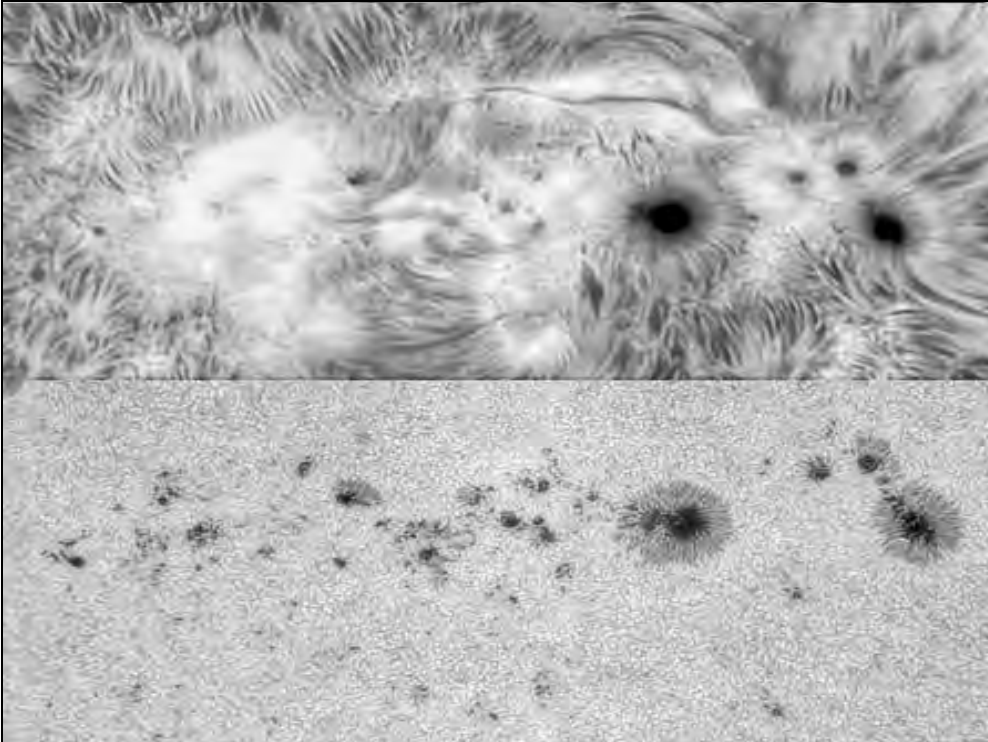


Figure 4. Two spectacular views of AR2443 on the same day by Gabriel Corban. The upper image is an H-alpha view taken on 11/04 1159UT. Note the bright region associated with the follower spots (left) that is likely a loop rising high above the region. Below is his w-l image on 11/04 at 1230UT of the same region showing the complex white light appearance among the follower spots. Instrumental details can be found in Table 1.

grouping of 30 or more umbral spots. Some of the larger umbral spots had rudimentary penumbra on the side away from the center of this grouping. In H-a, the follower grouping was immersed in a bright plage with only the larger umbrae seen through it (Fig. 3). Things peaked on 11/02 as shown in a w-l montage by Hill (2251UT) and drawings by Leventhal and Broxton (0915UT). The group now was at 650 millionths, still far from naked eye, but impressive and classed as Fkc. The leading-leader spot had begun a slow rotation in a clockwise direction forming a hook-shaped spot with penumbra only on the outer side. This hook-shape became a little more pronounced on 11/03 in w-l and H-a images by Corban. The follower spots were reduced in number and area while the following-leader seemed to be moving away from the leading-leader. The area of the group reflected the change in the follower spots

by dropping slightly to 590 millionths but the classification remained Fkc.

On 11/04, the hook had broken off the leading-leader as seen in a Corban w-l image, and both pieces were reduced in size. The following-leader was now the main spot in the group while the follower spots showed no organization with several dozen umbrae scattered over a large area with detached penumbral material mixed in. What was really interesting was seen in H-a by Corban. The area occupied by the following half of the follower spots had a huge bright loop over it (Fig. 4). It would have been fascinating to see this on or near the limb. On 11/05, a Hill w-l montage at 1858UT followed by Leventhal w-l whole disk drawing at 2110UT, showed the umbra that made up the "hook" to now be without any penumbra and the spot it broke off from (the leading-leader) was

reduced in size with another piece of umbra having calved off inside the symmetrical penumbra. The former following-leader had become a sizable middle spot. The follower collection of small spots had decreased in numbers and size again with only three having rudimentary penumbrae. This decrease in activity was reflected in the area being now 380 millionths with the class Fhc and magnetic class beta-delta, but it was still the major flare producer on the Sun at the time, being the source for a dozen flares in 48 hours the largest of which was M3.7.

Leventhal, in a whole disk drawing for 11/06 at 2115UT, showed things to be relatively unchanged with some flare activity in the follower spots, where most of it had been all along. The region was then classed Fsc (magnetic class simply beta) at 220 millionths area. Due to a paucity of observations reported, his was also the sole observation two days later, on 11/08 at 2105UT, when it appeared that the follower spots were gone and only the two larger spots remained with a few attendant umbral spots. The area was now 120 millionths and class Cso (magnetic still beta) with only half a dozen flares to its credit in 48 hours. Hill in another w-l montage and Leventhal in one of his w-l whole disk drawings, got the last look at this group on 11/09 when it appeared as just two spots on the limb wreathed in faculae.

Carrington Rotation 2171

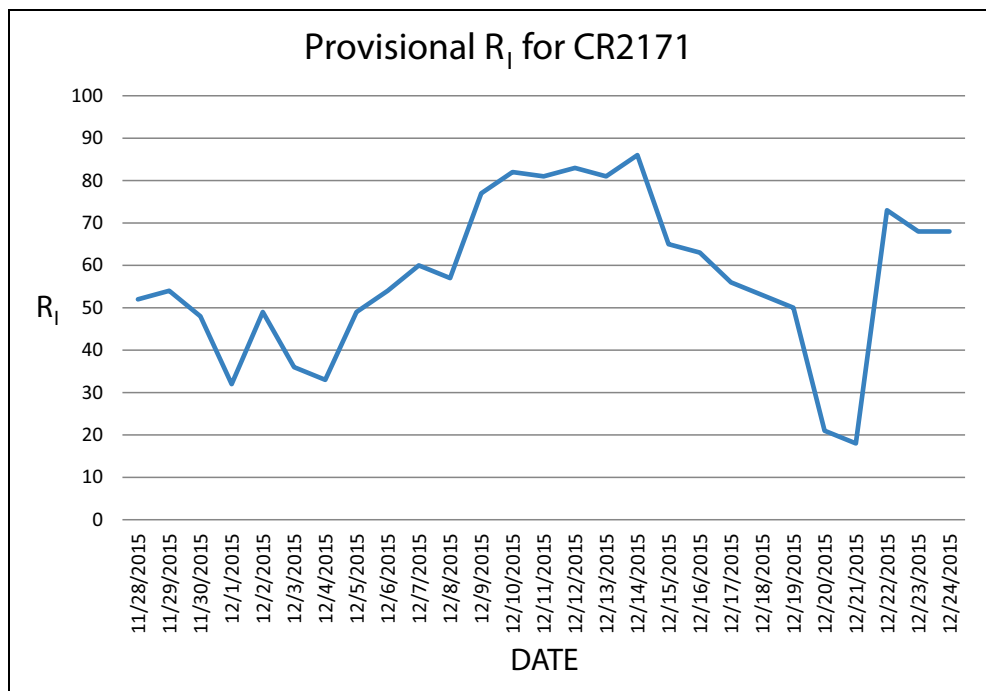
Dates: 2015 11 28.1715 to 2015 12 25.4944

Avg. R_i = 57.4

High count = 86 (12/14)

Low count = 18 (12/21)

This rotation saw a further decrease in peak sunspot activity with no days where the number rose to 90 and a low that dipped for one day below 20.



penumbra on the outer side from the center of the group. There were some umbral spots and penumbral fragments surrounding. This too would be a good site for flaring. The situation was not greatly changed on 12/16, with the leader a bit more round and the light bridge more the intensity of normal photospheric material. The surrounding umbral spots had coalesced into just a couple of spots with pores. The following arc of spots was also coalescing, becoming more round with more penumbral material on the spots. The number of surrounding umbral spots was about the same. Observations by Corban, Hill, Leventhal and Ramakers on 12/17 showed both leader and follower to be more round with less umbral spots. The light bridges in the leader were now two parallel thin bridges, but were not particularly bright and hence not very active. This region was classed as Eko with an area of 610 millionths and only a half-dozen flares, none stronger than C1.7 in the previous 48 hours, not a surprise since it never evolved above a magnetic class of beta. On the 18th, the situation was essentially unchanged with the exception that the follower (now reduced in size) was breaking up as well. Clearly, dissolution had begun. Officially it was still Eko but the area was reduced to 550 millionths. This breakup of the follower continued on 12/19 as the class dropped to Eho with an area of 450 millionths. A Ramakers CaK image at 1452UT showed a bright plage on the leading side of this follower, but the leader itself appeared utterly quiescent. Flare production was now only 3 in 48 hours though the magnetic class was still beta. Leventhal noted no flare activity around 2055UT. Ramakers and Eskildesen, CaK and H-a observations showed even less activity on the 20th. In w-l the leader was seen as a three-lobed umbra in a radially symmetrical penumbra with a follower

AR 2470 came onto the disk on 12/13 as a fully developed region. First observed by Section members Jenkins, Leventhal and Ramakers, they saw it in w-l as a two-spot leader, each with penumbra, followed by a complex but as yet unresolved follower and a small spot between and to the south. Between leader and follower was a lot of bright facular material well-shown in Ramakers' CaK image at 1510UT. On 12/14, Leventhal, in a w-l/H-a whole-disk drawing, showed that the two leader spots had merged and there was a large hedgerow prominence on the limb near this region. The region was well covered on 12/15 by Ramakers (w-l, H-a and CaK) and Jenkins (w-l). Their images show a rapidly growing Eki group of some 500-600 millionths (Fig. 5). While the leader was a single spot with radially symmetric penumbra, the umbra was divided into 3 pieces. There was a line of umbral spots following this leader. The smallest piece was very small but the two larger ones had a bright north-south light bridge bisecting the pieces, a good site for flares. The follower was an arc (probably a broken ring) of umbrae, with

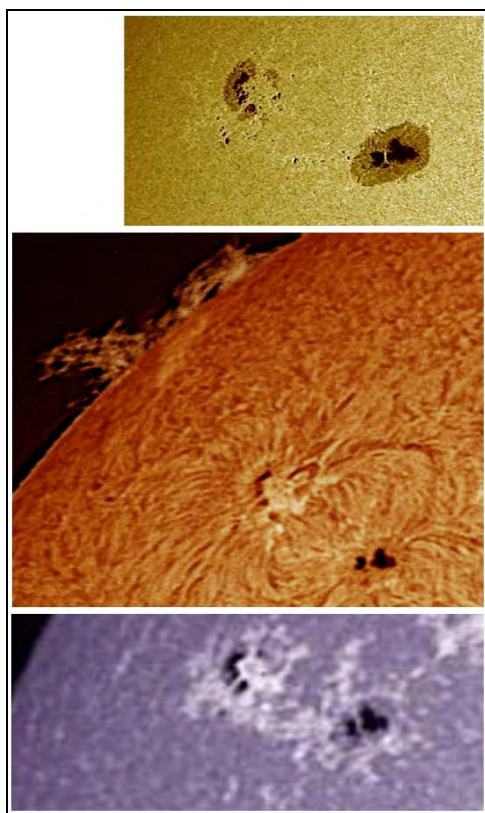


Figure 5. Three comprehensive views of AR2470 12/15 by Theo Ramakers. Top is a w-l view at 1519UT, middle is H-alpha at 1536UT and bottom is CaK at 1527UT. Instrumental information is found on Table 1

that was just 3 or 4 umbrae surrounded by some pores. We have no further observations until 12/23, when a nice high-resolution w-l image by Tyler showed it to be a single spot, the former leader, that was quite round with the penumbra surrounding. It was now classed Hhx with an area of 320 millionths and no flare production. It remained this way as it left the disk and was last observed by Leventhal, who noted extensive faculae around the spot on 12/24.

Carrington Rotation 2172

Dates: 2015 12 25.4944 to 2016 01 21.8319

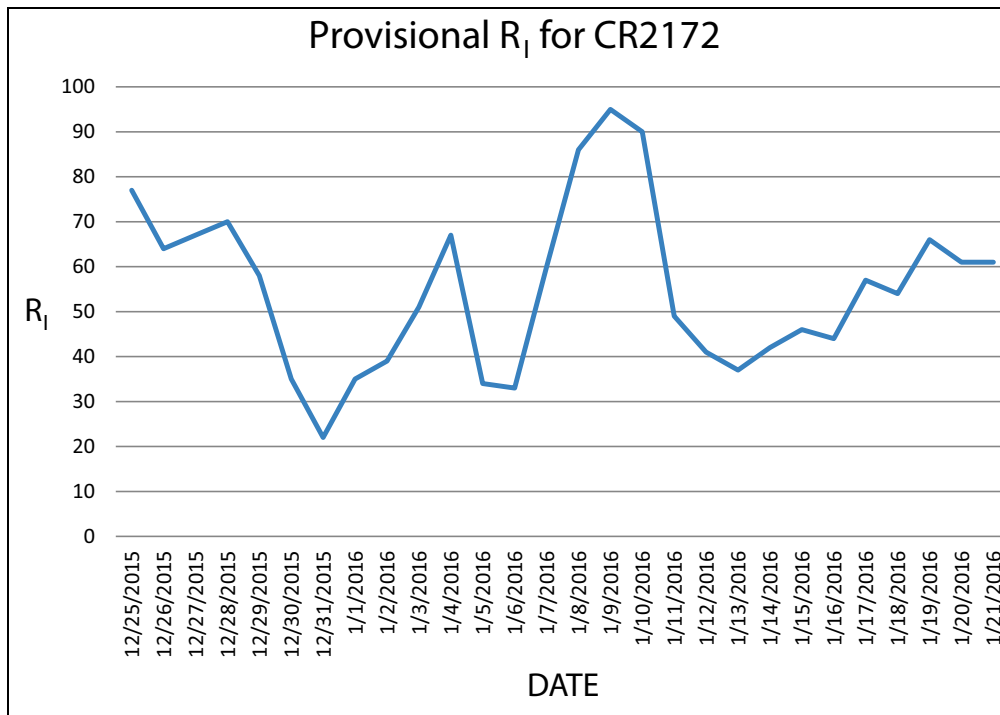
Avg. R_i = 54.8

High count = 95 (01/09)

Low count = 22 (12/31)

As with the previous rotation, no days during this rotation saw a sunspot number as high as 100. The peak daily sunspot number was 01/09, caused by many small groups of low count. But the largest and most interesting region was AR 2473 that came on the disk in the previous rotation.

Though AR 2473 came on the disk on 12/21, it was not observed until two days later, 12/23, when Tyler got fine H-a and w-l images of it (Fig. 6). The images show that the group consisted of three main spots, all about the same area. The group was classed as Dac with an area of 230 millionths and magnetic class beta-delta which guaranteed flare production producing over 40 in the previous 48 hours, including a few M-flares. In w-l, the leader had a massive umbra with small collection of small umbrae to the north, all in one fairly symmetrical penumbra. The middle spot was similar, with the large umbra possibly being composed of three smaller umbrae with the penumbra on the following side disrupted. In H-a, this spot showed a hot



light bridge passing between several of the umbrae and a bright area that went from between the middle and follower spots to north of the whole region. There were some very interesting arms of cooler material that appeared to emanate from the leader spot into this bright area. These probably rose above the whole region and would have been splendid prominences on the limb. The follower spot was much more complex with the side towards the middle spot quite disturbed, also bordering on the aforementioned bright area. Several pieces of the larger spot had broken off on this side and penumbra was missing altogether. On the following side of the follower spot the penumbra was radially symmetrical for that half of the spot and quiescent in H-a. In w-l, the whole region was in a filigree of faculae without indication of the overlying chromospheric activity. A whole disk drawing depicting w-l and H-a by Leventhal confirmed the gross appearance described above.

On 12/24, Borman did a nice series of whole disk images in w-l, H-a and CaK from which the AR 2473 portions are extracted here (Fig. 7). Things were mostly unchanged in w-l, also noted by Broxton in a whole disk drawing, with more stray umbral spots in the group. The follower may have been a bit reduced in area and was now the smallest of the three spots. In H-a, a magnetic neutral line (dark) was very evident running through the plage while there was no hint of it in the CaK. The group was classed Ekc and the area had jumped to 430 millionths with the magnetic class still beta-gamma having again produced 40 flares in 48 hours including an M4.7. This flare activity was also noted by Leventhal on 12/25 when he recorded a very bright flare in a whole-disk drawing (w-l & H-a). The next day, 12/26, was the day of maximum development. The McIntosh class was Fkc and the area 590 millionths with magnetic class beta-gamma-delta. Even so, the flare production was down a bit from previous days with less than 40 flares in a 48 hour period. W-l images by Ramakers showed

the leader to be very round with symmetrical penumbra, the follower was a cluster of 4 - 6 spots with penumbra and between was a cluster of 6 - 8 small spots in disorganized penumbra with a separate curious configuration of spots that consisted of two close parallel arcs of umbrae with no penumbra. In w-l, H-a and CaK by Ramakers (Fig. 8), the former plage was a line that wound from follower spots, up through the middle of

the parallel arcs of spots and then to the leader, being brightest between the parallel arcs. On 12/27, a w-l image by Hill that showed a remnant of the arc was still there but the middle and follower collections of spots were all breaking down. This was reflected in the area having dropped to 530 millionths with a class of Fhc. The magnetic class had been downgraded to beta-delta with about 30 flares. The classes were

unchanged on 12/28 with an area of 510 millionths as dissolution was definitely underway. A Tyler whole-disk w-l image showed penumbra reduced around all but the leader spot, which was very round now. Even with these decreases, Leventhal caught a flare and surge south of the leader at 2240UT in another of his whole-disk w-l/H-a drawings (Fig. 9). This was a remarkable catch since these events, especially together, often are short-lived. Another w-l whole-disk image by Tyler on 12/29 showed the follower spots nearly gone and the former arc was just a couple of spots, the following one with rudimentary penumbra. The class was still Fhc, though the area was now 470 millionths and the magnetic class was just beta. Even so, Leventhal was still noting flare activity in his whole disk w-l/H-a drawings and the region produced just over 20 flares in a 48 hour period so it remained the most active region on the Sun. Leventhal showed similar activity the next day when the class had dropped to Eac with a much reduced area of 240 millionths. As this group approached the limb on the last day of 2015, Tyler and Broxton showed AR2473 to be nothing more than one fairly round spot closely accompanied by three smaller spots. These were the last Section observations for this region.

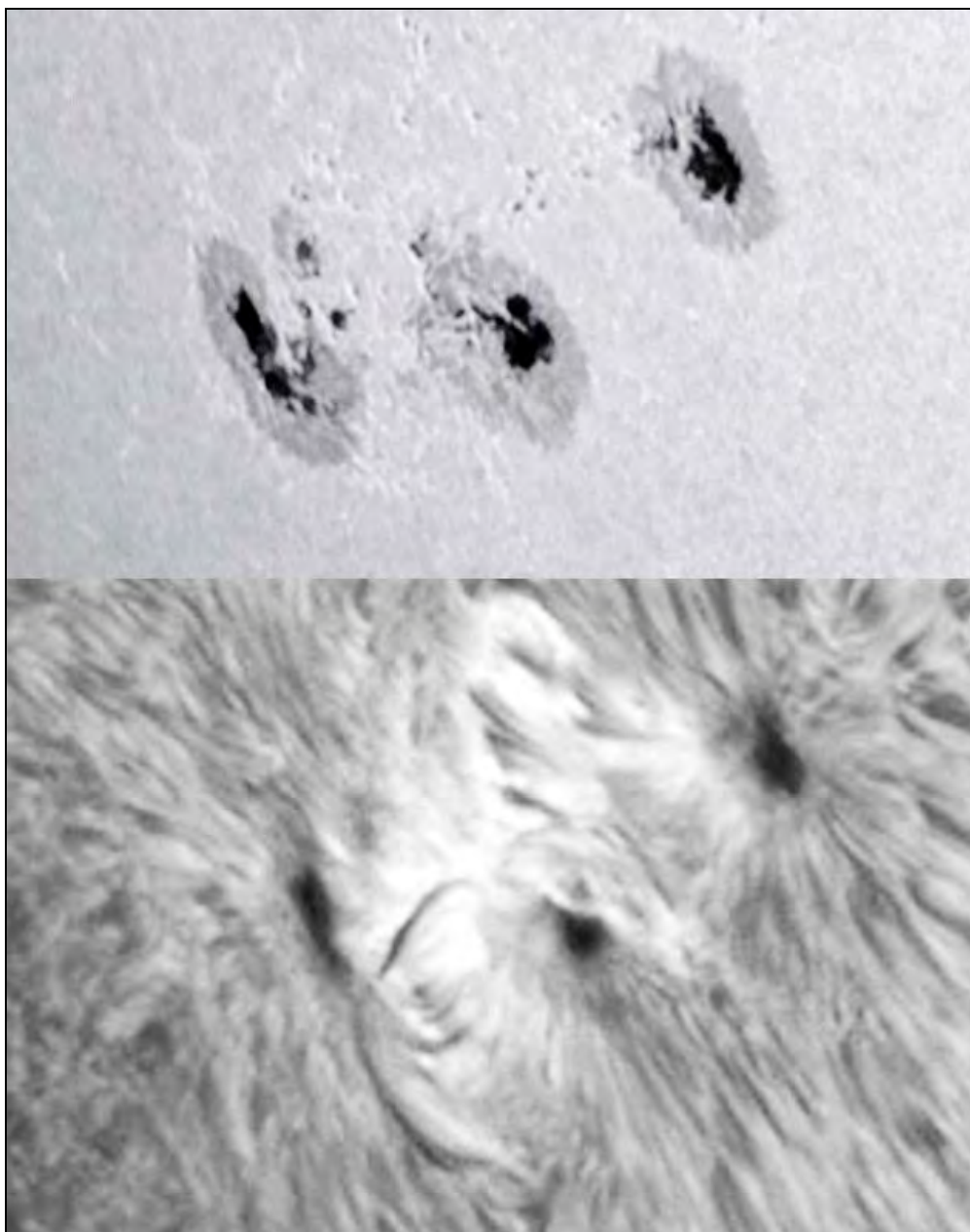


Figure 6. Two excellent views of AR2473 on 12/23 by David Tyler. The upper image is w-l at 1101UT and below is his H-a capture at 1110UT. Equipment used as in Table 1.

Carrington Rotation 2173

**Dates: 2016 01 21.8319 to
2016 02 18.1722**

Avg. R_f = 66.6

High count = 108 (02/04-05)

Low count = 32 (01/31)

The rotation opened with AR2488 being the main flare-producing region on the disk having attained a magnetic class of beta-gamma for one day. Although AR2489 that formed on the disk on 1/25 attained a greater area, it never got a magnetic class above beta and was not

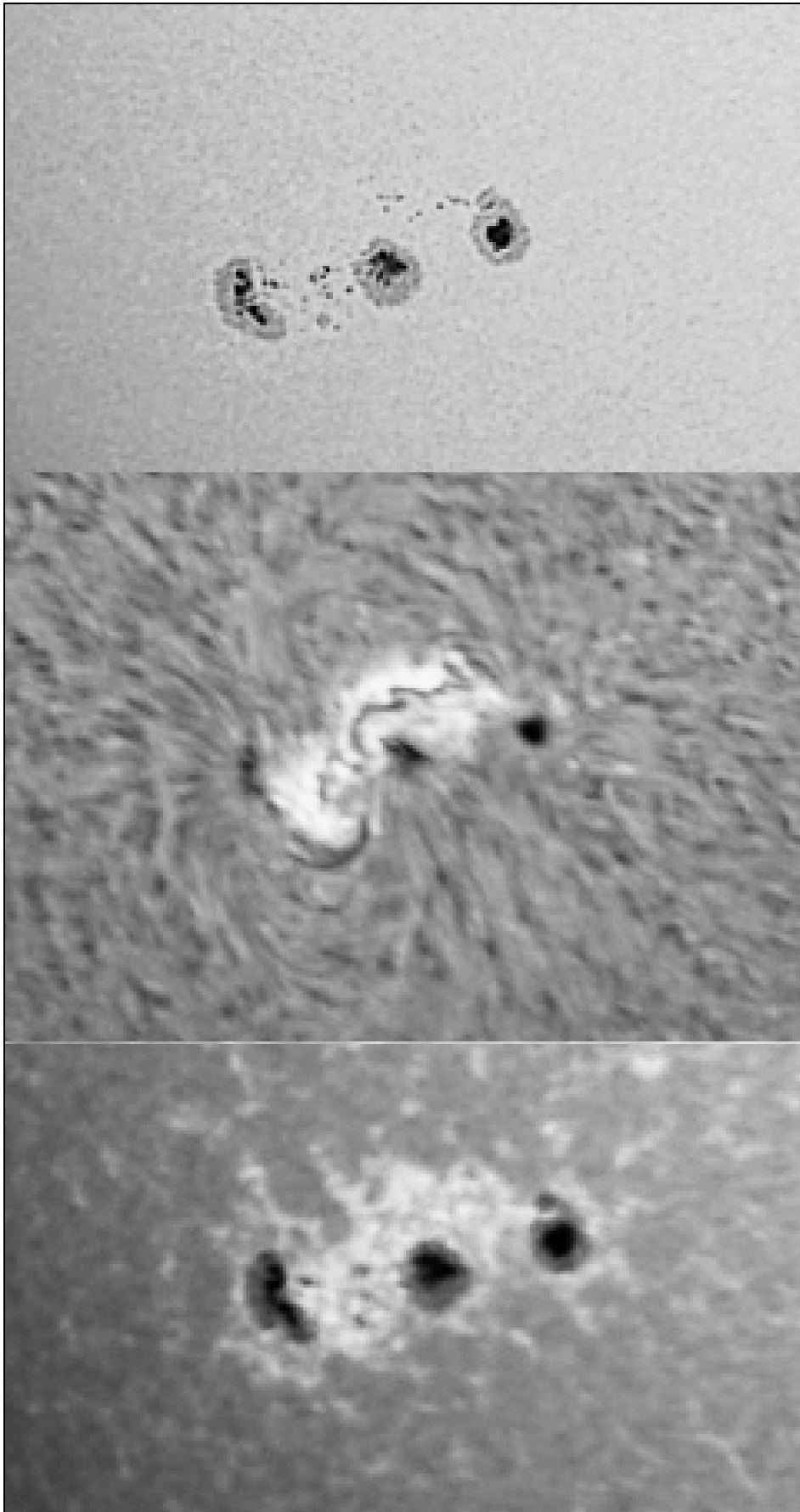


Figure 7. Three comparative views of AR2473 on 12/24 by Michael Borman. Top image is w-l at 1845UT, middle is H-a at 1830UT and at bottom is CaK at 1905UT. His telescope/camera information can be found in Table 1.

much of a flare producer. On 1/24, Ramakers caught a splendid sinuate filament that extended to the south from ARs 2486/87 for a distance comparable to the Earth-Moon distance. It was coincident with a long sinuous plage in CaK. There were no further observations of this remarkable feature.

The most interesting region was actually later in the rotation, AR2497, first observed by Ramakers as three or four umbral spots in an area of faculae near the limb on 2/6 and 1657UT. At the time, it had a McIntosh class Dai at only 50 millionths and magnetic class beta, yet it had already produced around 80 flares in a 48-hour period including several M-class flares! Leventhal noted some of this flaring at 2310UT on one of his w-l/H-a whole-disk drawings. This situation remained the same the next day, with the area increasing to 70 millionths with a Dao class. Ramakers showed about a dozen spots in a whole-disk w-l image with a tight plage about the group in H-a and CaK whole-disk images. The flare production site appeared to be in the southern most follower spots. Leventhal's observations at 2115UT agreed with this for the most part. Then on 2/9, the area tripled, while all classes and flare production remained the same. Leventhal showed more flaring in the follower spots at 2100UT. On 2/10, the magnetic class was increased to beta-gamma with an area of 180 millionths (still Dai), and with numbers of flares still at 80 in a 48 hour period. A good comparison using Ramakers' images is seen in Fig. 10. The plage can be seen right about the region in CaK and a small flare can be seen in the middle of the H-a region.

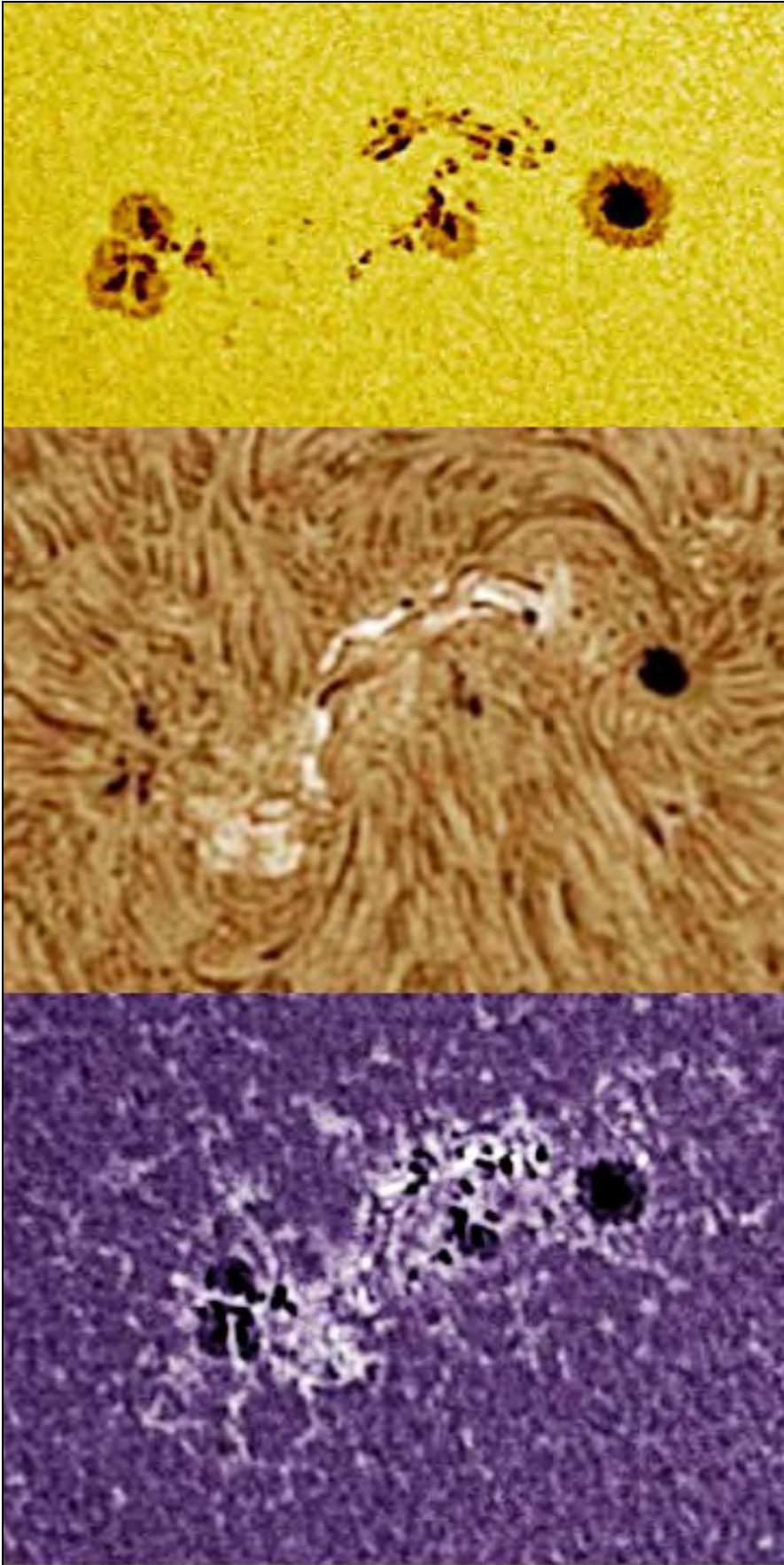


Figure 8. Three more Ramakers images this time of AR2473 on 12/26. The upper image is the w-l view at 1420UT, the middle is H-a at 1434UT and finally at bottom the CaK image at 1436UT. Further instrumental information is in Table1.

On the meridian on the 11th, the McIntosh class was elevated to Eac with an area of 240 millionths (though it seemed smaller in a Ramakers w-l image at 1548UT) with the same amount of flares but four M-class flares. An excellent image (Fig. 11) by Tyler on this date shows the w-l state of affairs. Most of the flare activity was happening between the leader spots on the right and the follower spots on the left. Leventhal also reported flaring activity through the whole region.

The evolution of this region continued on 2/12 when the magnetic class was again increased to beta-gamma-delta, Eac at 180 millionths area. Corban (Fig. 12), in a w-l image, showed this. It can be seen that even the granulation was smaller and brighter immediately about the leader spot which was crossed by many bright light bridges. Ramakers caught a very bright flare in the region south of the leader at 1722UT.

On the 13th, the area was bumped up to 250 millionths while the class remained the same. The region consisted of a grouping of a half-dozen larger umbrae in fragmentary penumbra surrounded by over a dozen smaller umbrae. Flare production was as vigorous as ever as caught in Ramakers' images and Leventhal's whole disk renderings. On the 14th, Corban caught the whole region buried in a flare at 1138UT (Fig. 13). On this same day, Hill caught a white light flare (Fig. 14) while doing a public demonstration. An Eskildsen CaK image on 2/14 at 1906UT showed the plage to have increased in size, mostly in longitude. In fact, there was a line of plages stretching clear across the Sun in his image. This activity was maintained

until the region left the disk on 2/17 as a collection of umbrae with fragmentary and rudimentary penumbrae, in a huge

wreath of faculae in w-l and in a large plage in both H-a and CaK.

Conclusion

The numbers of images, as Theo Ramakers has indicated on FaceBook and elsewhere, have increased by a factor of 3-4 this year over last. As a result we are awash in very good material making the writing of these reports and analysis of activity easier and more accurate. If you had fabulous images that didn't get published here, realize that this Journal has only so much space. If it were possible, many more would have been included. Some of these images were edited to illustrate points made in this report. This allowed the use of more of the images.

It would be helpful if observations submitted have north up and preceding to the right, and following to the left, which is also the orientation you get by just looking at the Sun with the naked eye (with proper filtration!). This conforms to what is called the "right hand rule" in planetary science for prograde rotation, where using one's right hand with the thumb pointing up represents the north pole, the fingers of that hand then indicate the sense of rotation. Images are presented that way in this report.

I want to note here that this report would not have been as comprehensive were it not for the changes to the ALPO Solar Archives effected over the last year by Theo Ramakers. Finding images and following activity has been getting easier with each report by the good organization and easy access to the images afforded by the simple-to-follow layout. I urge all those interested in solar activity and the work being done by this Section to take an evening and browse through this Gallery. You may be inspired to redouble your own efforts! Be assured, we will use your data!

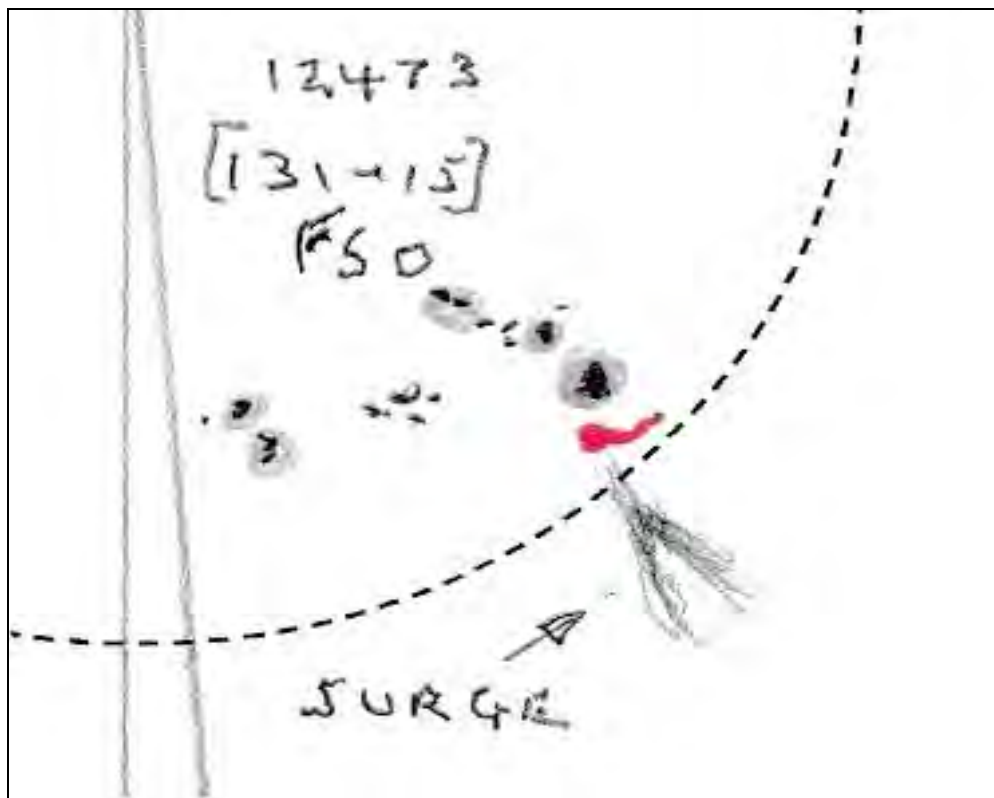
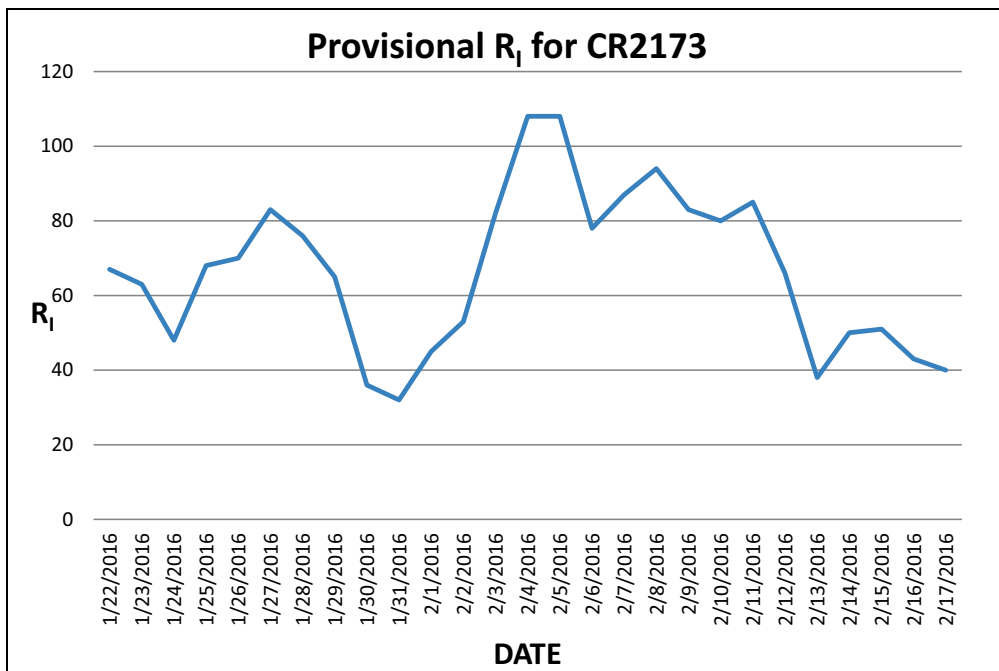


Figure 9. A subsection of a combined w-l/H-a whole disk drawing by Monty Leventhal showing his fortuitous catch of a simultaneous flare and surge (spray?) in AR2473 on 12/28 at 2240UT. See Table 1 for additional instrumental details.



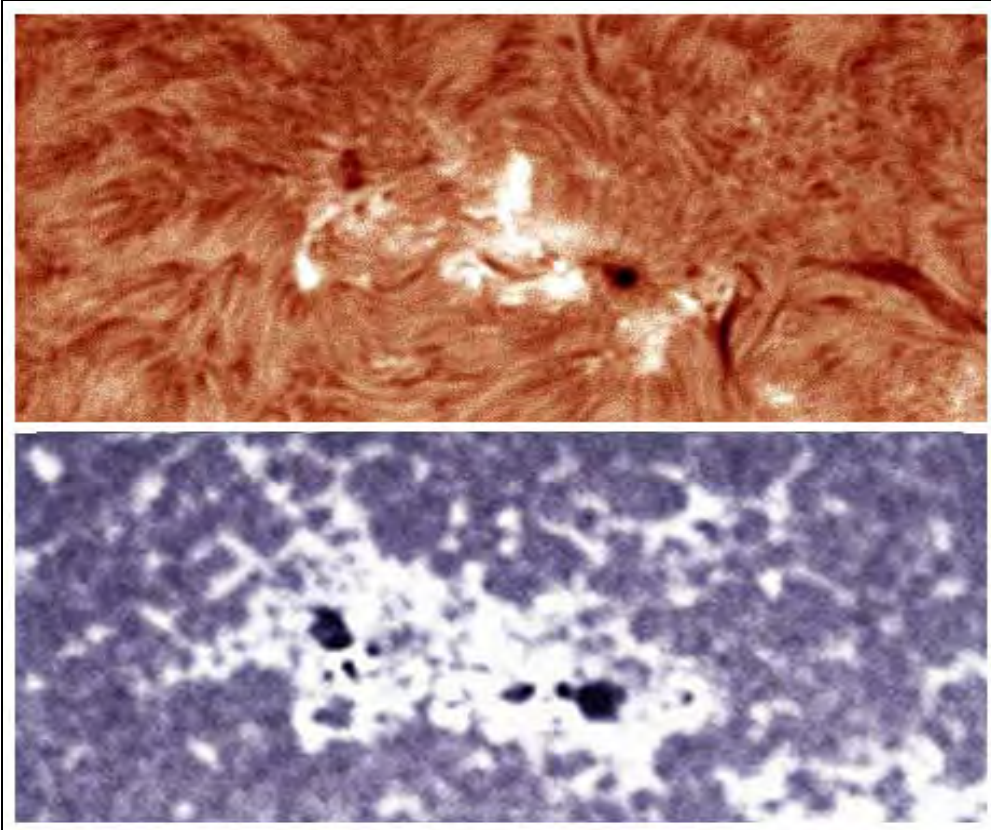


Figure 10. Two views of AR2496 by Ramakers on 02/10. The H- α image at top was taken at 1558UT and the CaK at bottom is from 1546UT. More instrument and camera details are on Table 1.

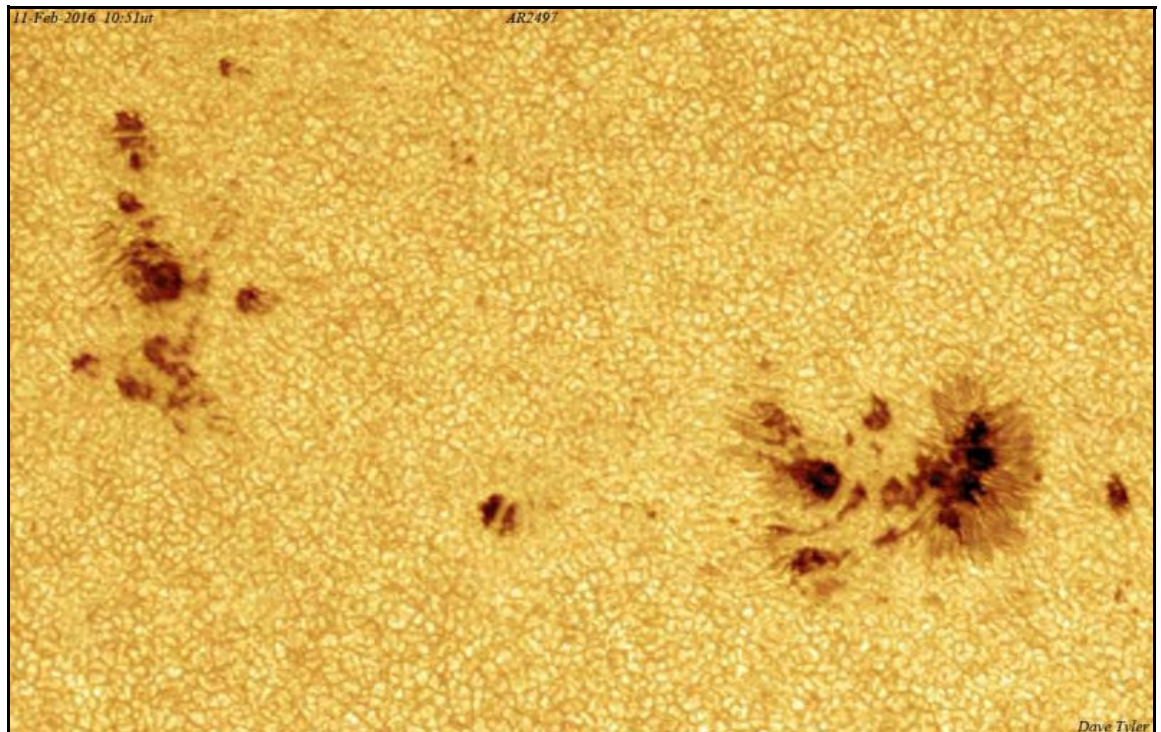


Figure 11. A fabulous white light image of AR2497 by David Tyler on 2/11 at 1049UT. Instrumental details are in Table 1.

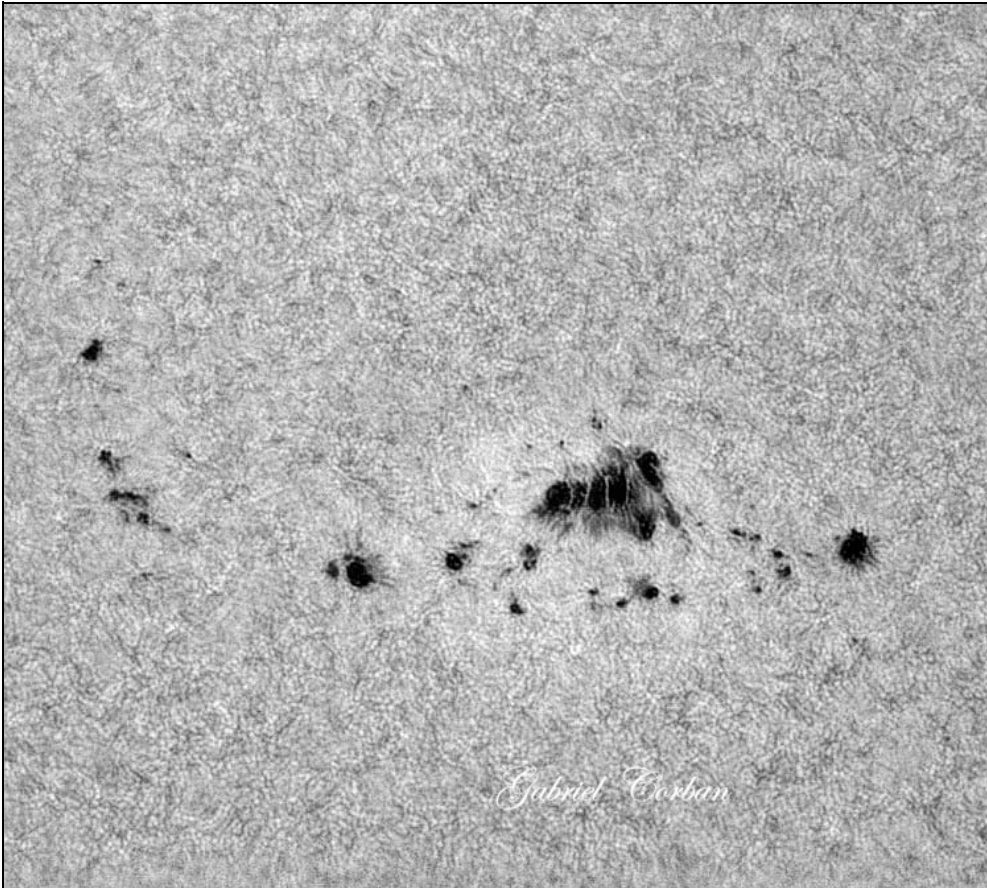


Figure 12. Another wonderful white light arc-second image of AR2497 by Corban on 2/12 at 1256UT. Equipment used is listed in Table 1.

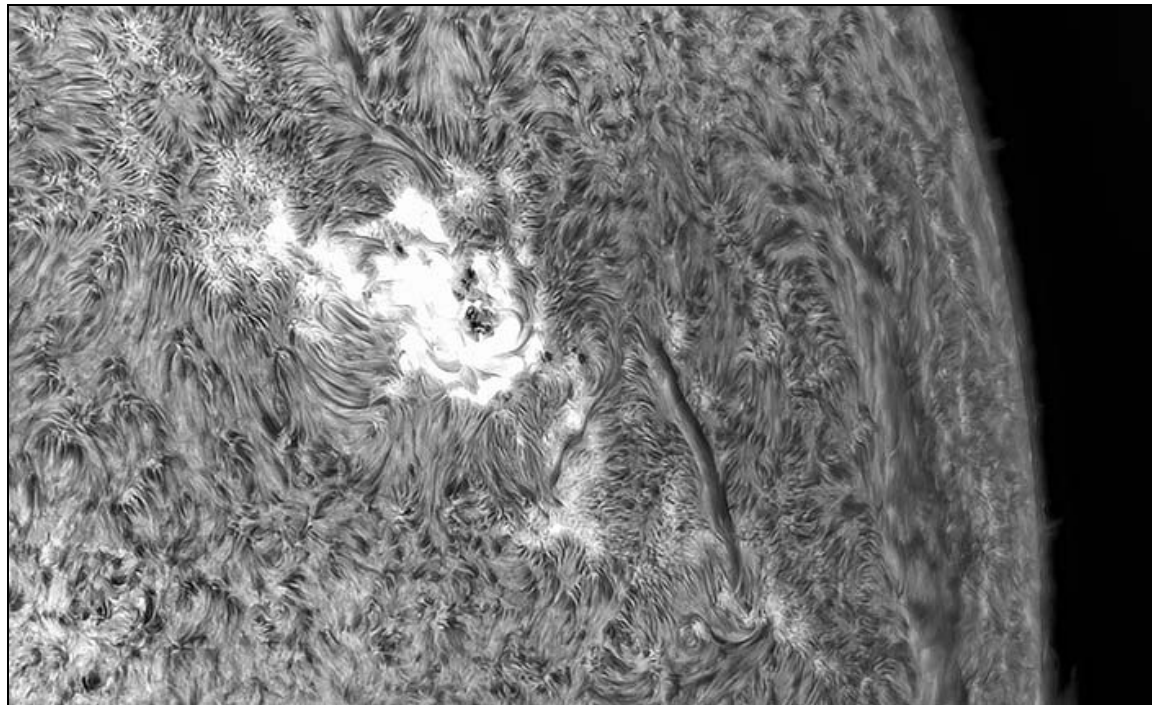
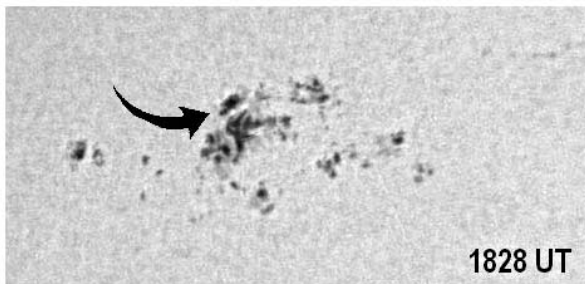


Figure 13. A breathtaking H-alpha image of AR2497 in flare by Corban on 2/14 at 1138UT. See Table 1 for his instrumentation.

**AR2497 on 2016-02-13 taken with a Questar 3.5" + full aperture
Baader filter and a Skyris 445M camera.
White light flare shown by arrow.**

White Light



Baader K-line broadband filter

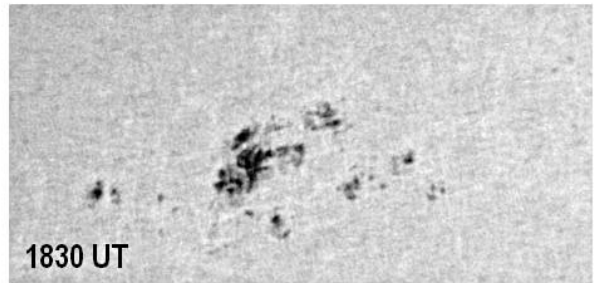
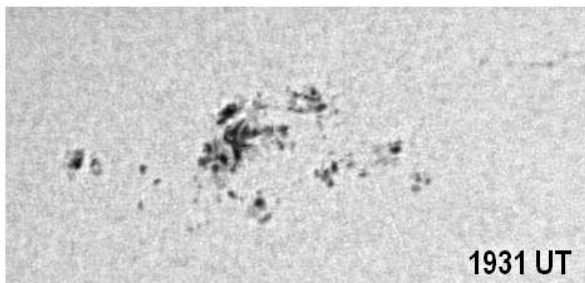
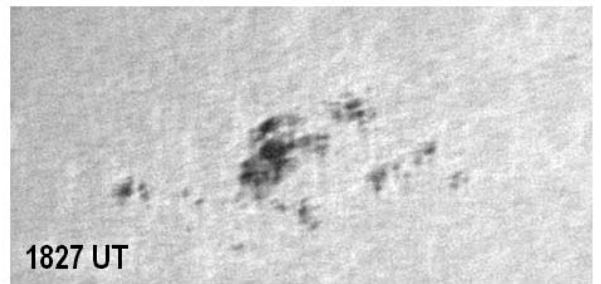


Figure 14. A white light flare caught in AR2497 with a Questar by Hill at the times shown. The instrumental details are in Table 1. A white light flare caught in AR2497 with a Questar by Hill at the times shown. The instrumental details are in Table 1.