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BAA Radio Astronomy Section. Director Paul Hearn.

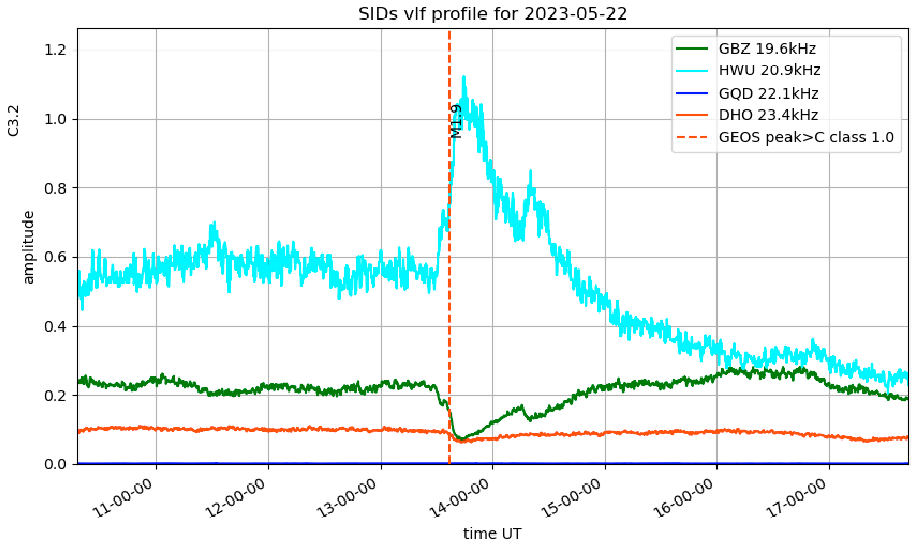
RADIO SKY NEWS 2023 MAY.

VLF SID OBSERVATIONS.

During 2023 May we recorded 227 individual SIDs, the largest number since we started recording in 2005 May. 175 of these were classified in the SWPC bulletins, again being the highest in our record. The previous peak was back in 2012 July, with 165 classified flares at the first peak of solar cycle 24. I have therefore had to alter the activity chart vertical axis in order to fit in the new peak. Cycle 25 looks to be as strong as cycle 24, if not potentially stronger; time will tell! It is also worth noting that we have gained more experience in analysing our recordings, as well as improving the equipment used. This may well bias our current observations compared to 10 years ago when comparing cycle activity.

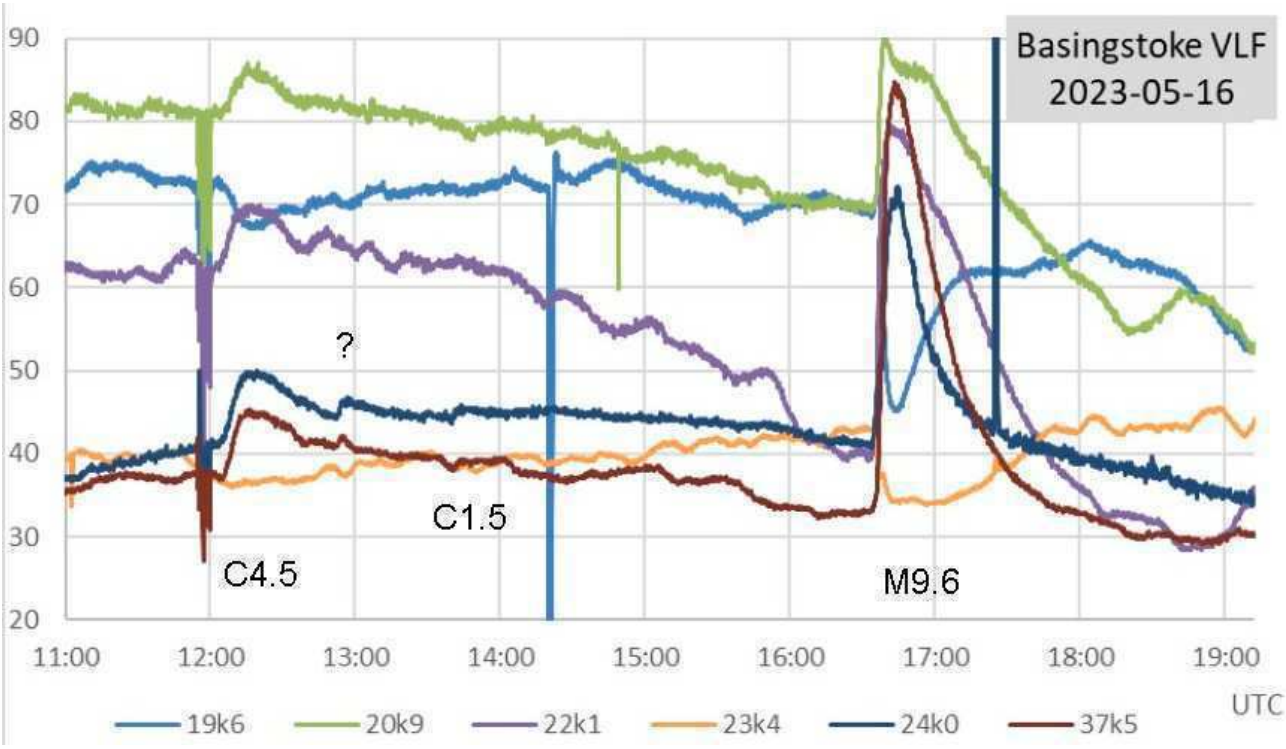
We did not see any X-flares, but a number of the M-flares did come very close to the boundary. Some of these also occurred in active regions close to the solar limb, and so may well have reached X-class if they had been seen nearer head-on.

The M1.9 flare widely recorded peaking about 13:40UT on the 22nd was not particularly strong, but is listed in the SWPC bulletin as two events. Both are listed with an X-ray peak of M1.9 at 13:37UT, but with end times of 13:43 and 06:55. The shorter flare was from AR13311, a fairly large and complex region, the second does not have a source, and seems to extend well into the following morning.

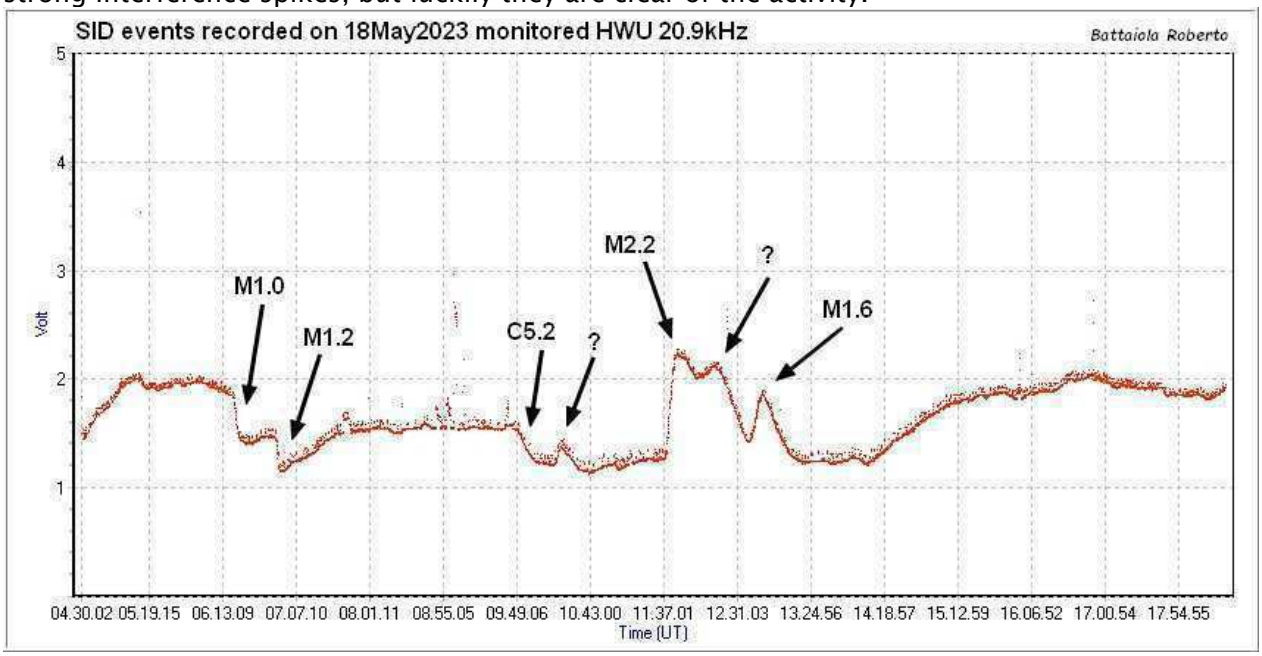


This recording from Mark Prescott shows a fairly ordinary SID at 19.6kHz and 20.9kHz, fading away as

expected for an M1.9 flare. The C7.2 flare at the start of the main SID also does not have a source in the X-ray data, the C6.3 flare afterwards is also from AR13311.

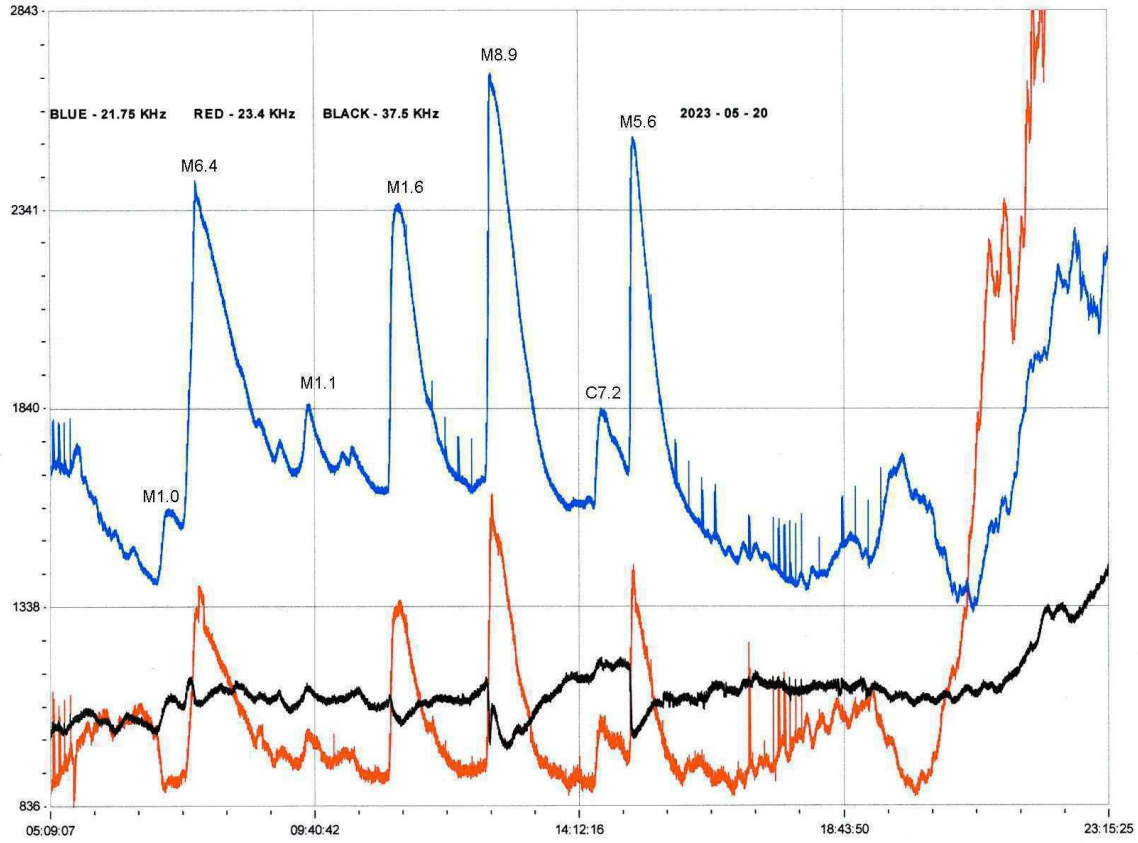


The M9.6 flare on the 16th was also widely recorded, shown here by Paul Hyde. Most of the signals show a very strong SID, although 23.4kHz looks rather subdued in comparison. Also visible is the earlier C4.5 flare with a strong and distinct SID. This is followed by the unclassified flare just before 13:00, and the small C1.5 flare. Both of these show well at 37.5kHz, while 24kHz shows the unclassified event. There are some strong interference spikes, but luckily they are clear of the activity.

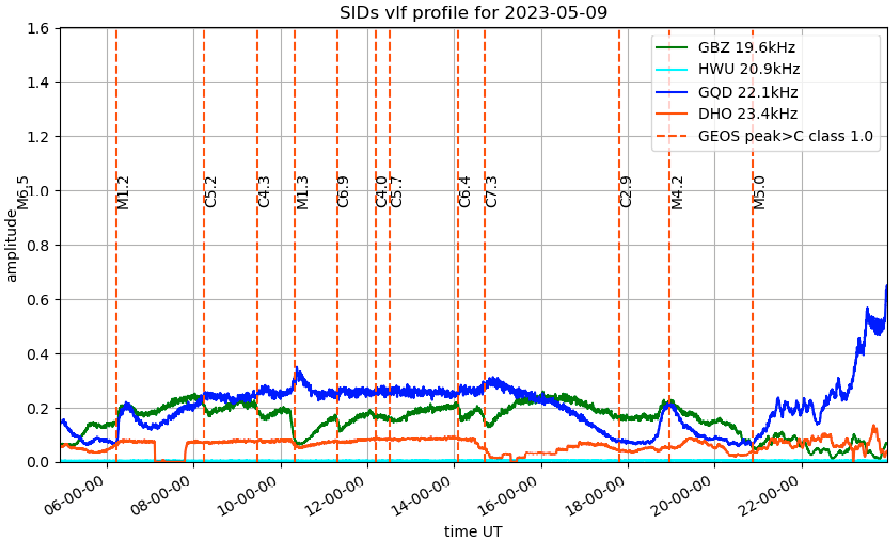


This recording by Roberto Battaiola shows activity on the 18th at 20.9kHz. The early M1.0 and M1.2 flares have produced negative going SIDs, while the later M2.2 and M1.6 are clearly positive going SIDs. The background signal also shows interference throughout the day. This was from the long lasting thunderstorms in Italy. Luckily no damage done, and the SIDs are mostly well defined. The C5.2 does have an unusual shape, and seems to be where the SID polarity changes,

May 20th was also busy with M-class flares, shown here by Colin Clements:



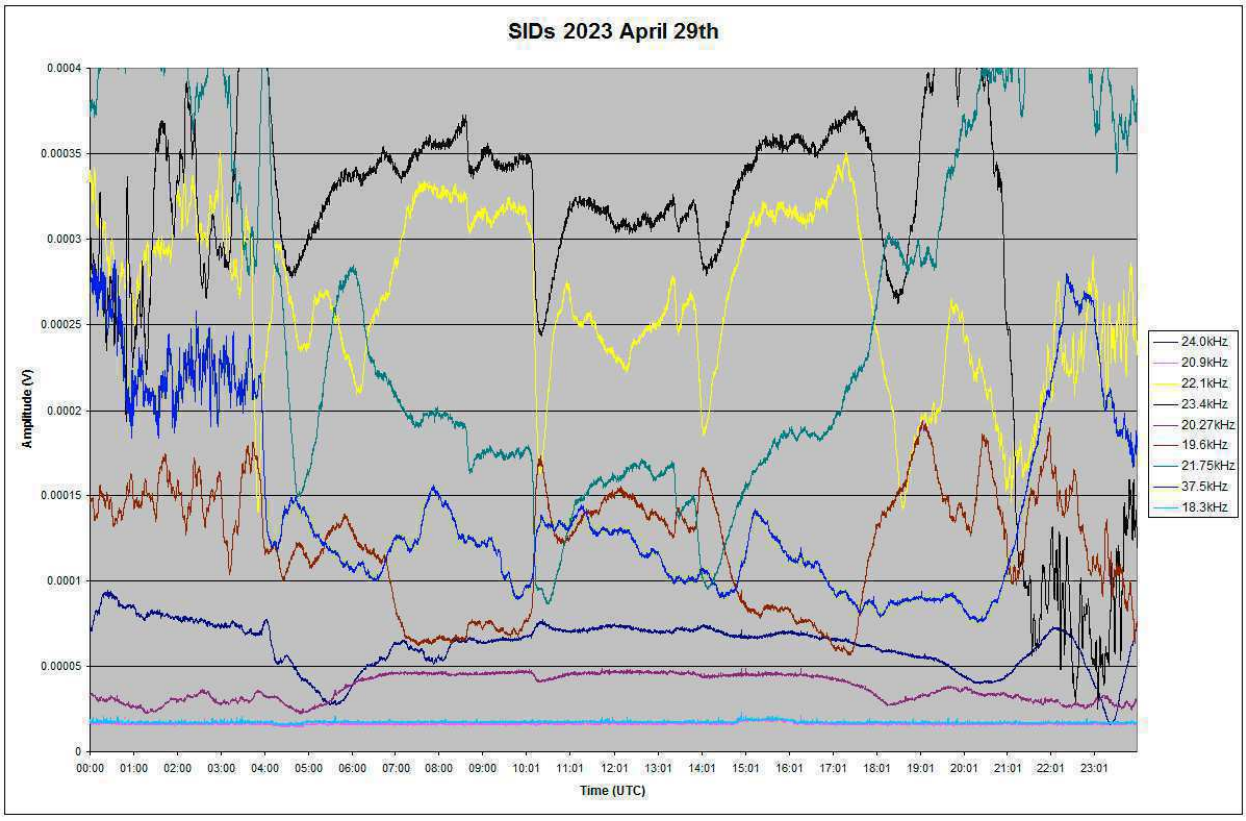
The chart shows most of the day from 05:09 to 23:15UT, with the stronger events labelled. Some of the smaller flares are also visible, superimposed on the larger ones. There is also some spiky local interference present. 37.5kHz does not seem to have responded much, while 21.75kHz shows plenty of detail.



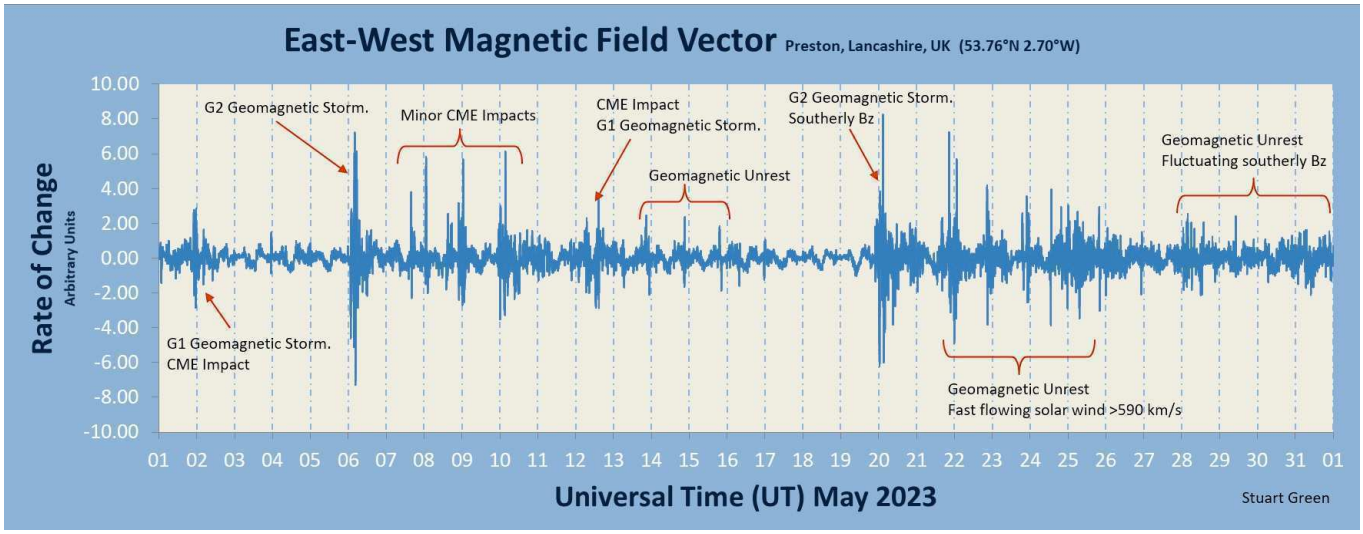
Mark Prescott's recording from the 9th shows plenty of activity, but from much weaker flares. 19.6kHz has produced the clearest SIDs, with 22.1kHz showing just the stronger events. Solar activity has been high throughout the month, with the background X-ray flux level correspondingly high. This means that many of the C-class flares represent only a small increase in flux, and so had have less effect on the ionosphere and produced smaller SIDs.

Over the past few years, some of the newer radio observations from professional observatories have been converted into sound so that we can hear what has been recorded rather than just looking at graphs and charts. This is of course ideal for the visually impaired. Mark Edwards has done this with his 19.6kHz data from the 20th, including all those M-class flares illustrated on the previous page. It covers 06:00 to 18:00UT, compressed into a much shorter time. Mark describes it as "sounding like a demented synthesiser", but the SIDS are easily heard as rises in the pitch for each flare.

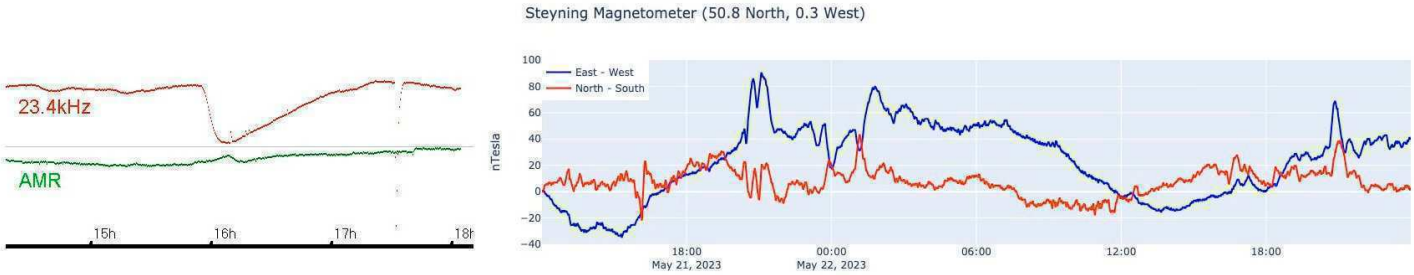
Last month's report included a rather unusual shaped series of SIDs on April 29th, recorded by Colin Clements at 21.75kHz. Mark Edwards has reported that he also saw a similar response at 19.6kHz (brown trace):



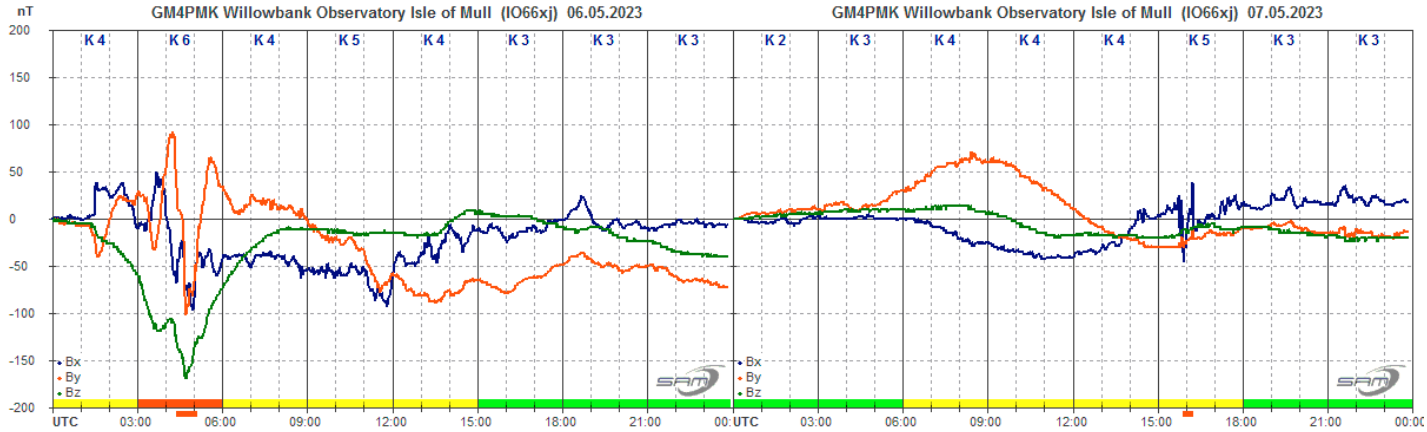
MAGNETIC OBSERVATIONS.



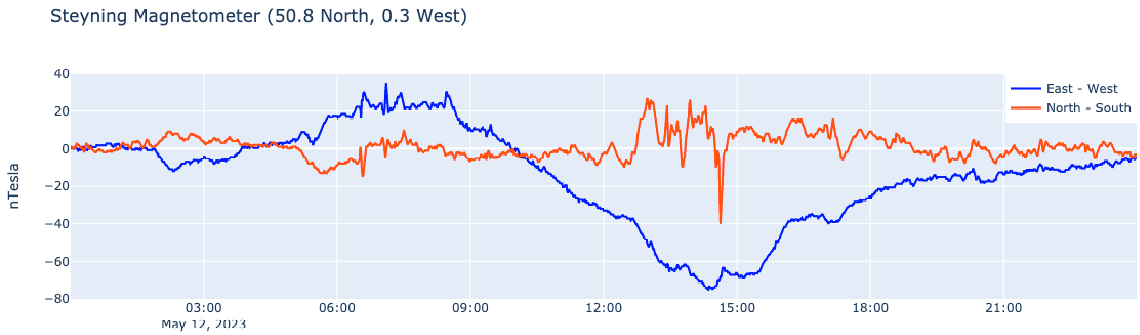
Many of the flares in May did have associated CMEs, but they were mostly not Earth-directed, and so produced only mild disturbances. There were some longer lasting high speed solar winds that resulted in periods of magnetic unrest. The M2.6 flare peaking just after 16:00 on the 20th does appear to have produced a small SFE:



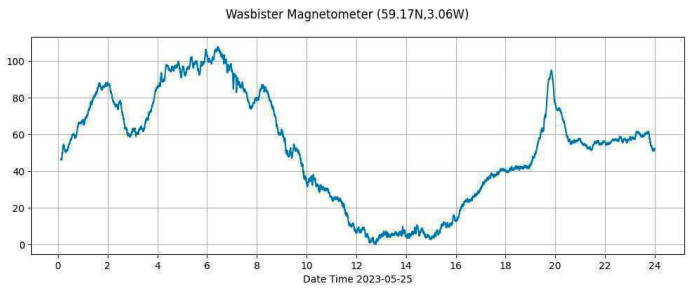
The chart on the left is my own recording showing the small (~16nT) magnetic pulse in green aligning well with the peak of the SID at 23.4kHz. Nick Quinn's chart on the right shows this pulse in the north-south component (red), followed by the disturbance over night and through the morning of the 21st. The sensor shows a stronger magnetic pulse as it is aligned to the local magnetic field, while mine is mounted horizontally.

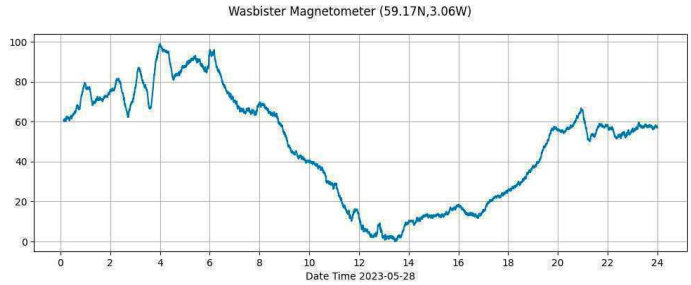


This recording by Roger Blackwell shows the short active period early on the 6th followed by more gentle activity through the rest of the day and into the 7th. The cause appears to be from a strong solar wind. There is also evidence of a CME impact around 16:00 on the 7th. There were a number of minor CMEs from the 7th to the 12th, so the precise cause is not known.

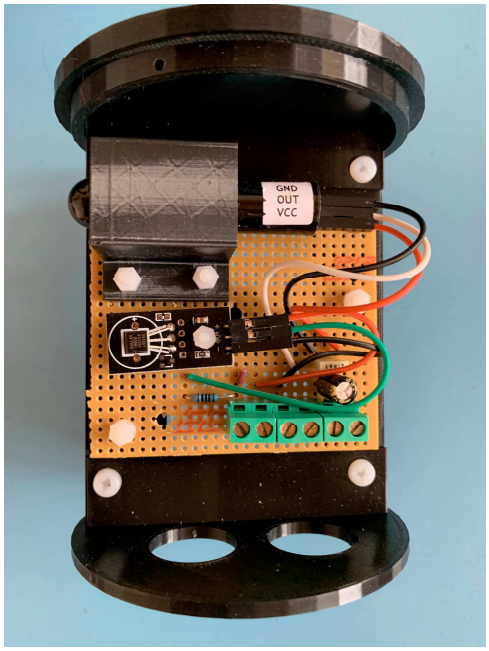


Nick Quinn's recording from the 12th shows another possible CME impact around 06:30. Satellite data suggests that this could be from a CME on the 9th, so with plenty to choose from, again the exact source is not known.



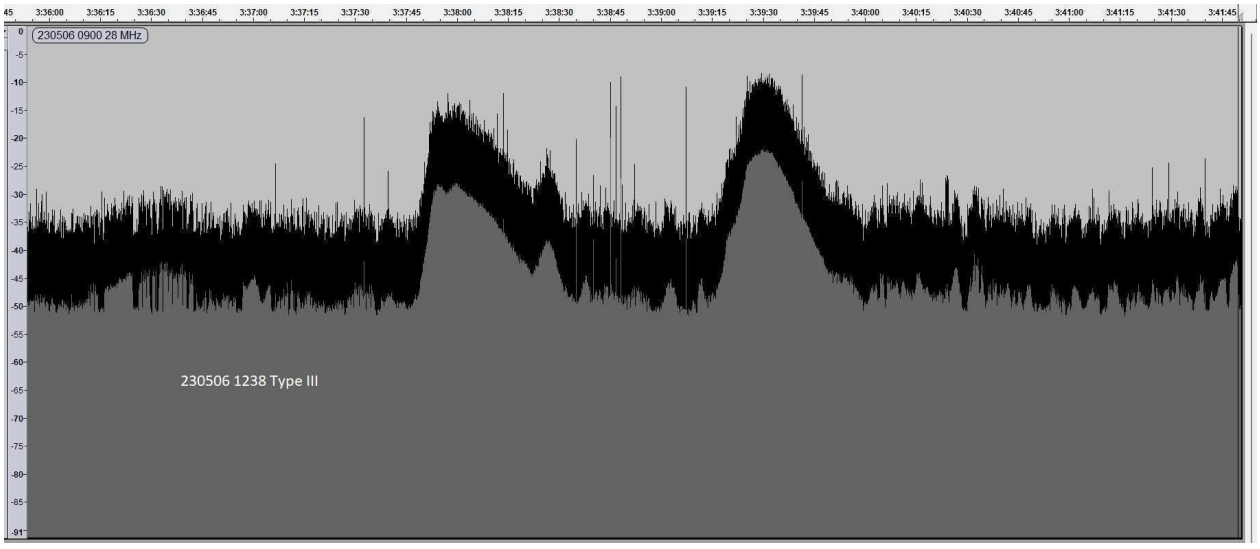


Recordings from Callum Potter on the 25th and 28th show some of the more gentle activity that ended May. Callum had noticed some strange recordings earlier in the month, and discovered that his fluxgate sensor had slipped within its mount. It has now been remounted and buried, giving some better results. He has provided a picture of the new mount, designed to fit into a plastic tube:



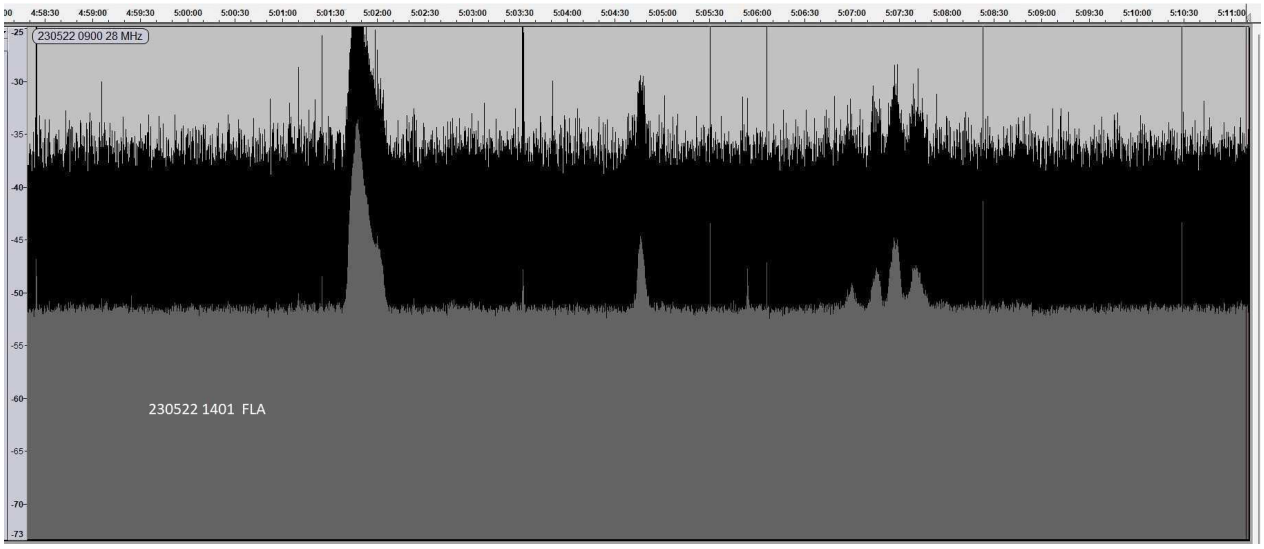
Magnetic observations received from Roger Blackwell, Stuart Green, Callum Potter, Nick Quinn and John Cook.

SOLAR EMISSIONS.

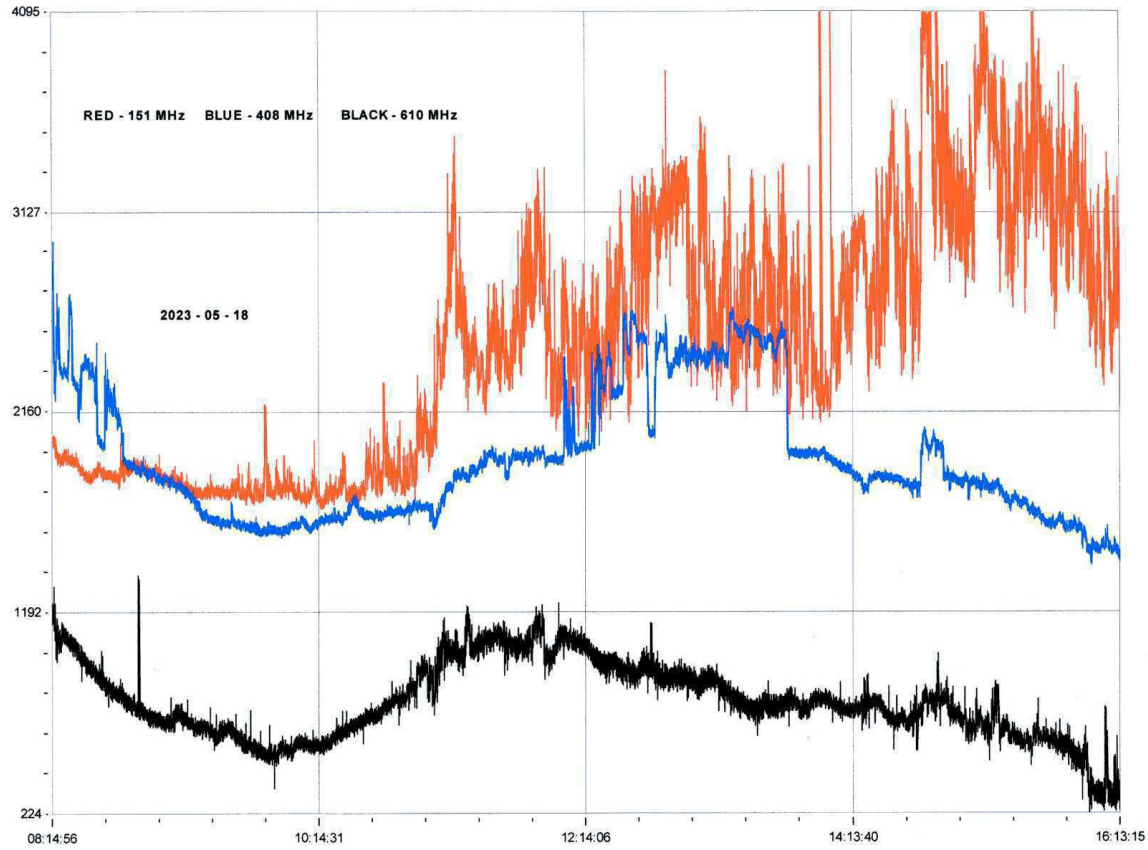


This recording by Chris Bailey shows a 28MHz type III double burst, starting at 12:38UT on the 6th.

These are both quite strong bursts, the second being a 27dB rise in noise level. The X-ray data does not show any significant flares around this time.

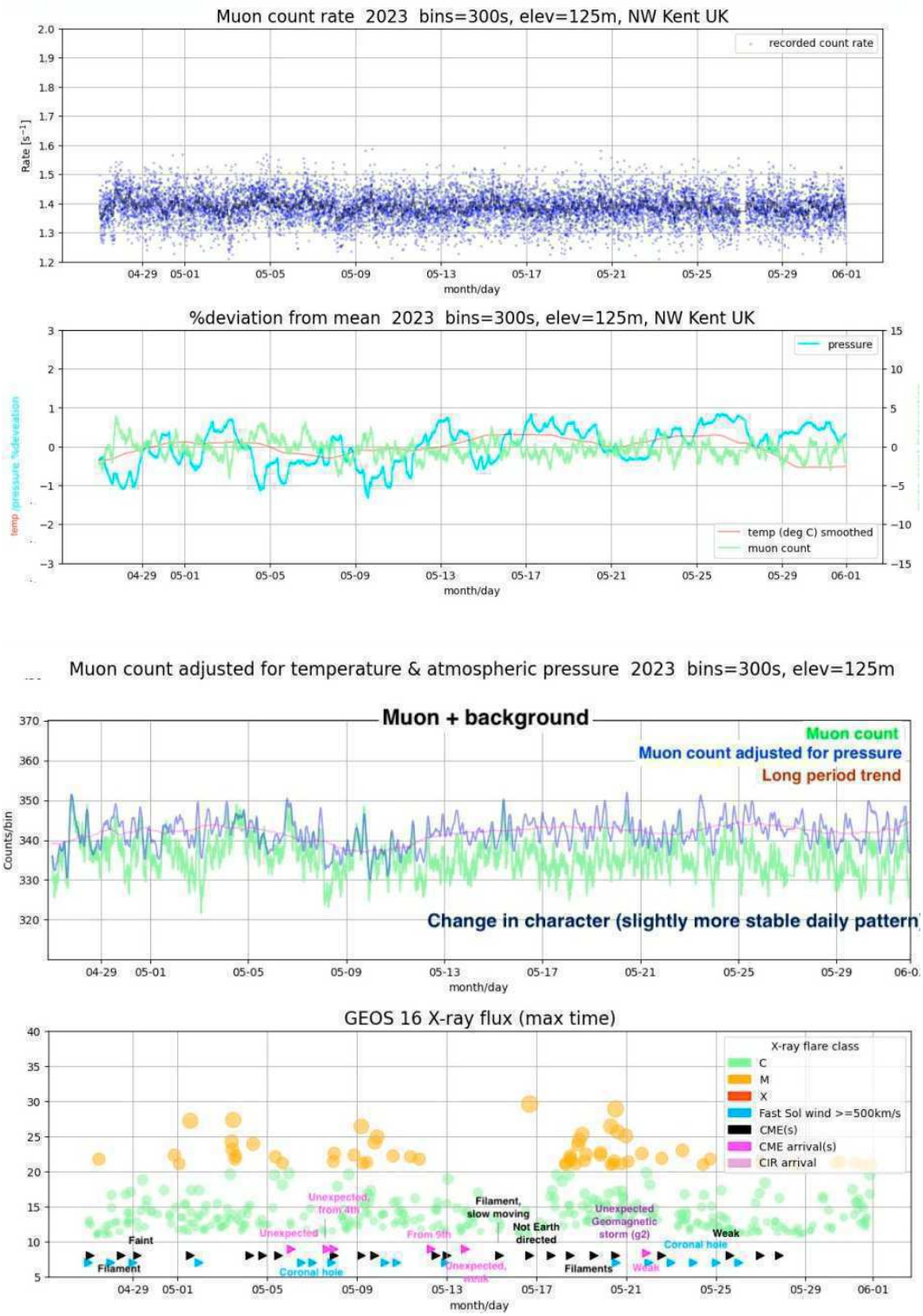


His recording from the 22nd shows a series of noise bursts, the strongest being at 14:01. The chart covers about 12 minutes. This could well be from the M1.9+M1.9 flare combination that we recorded at VLF.

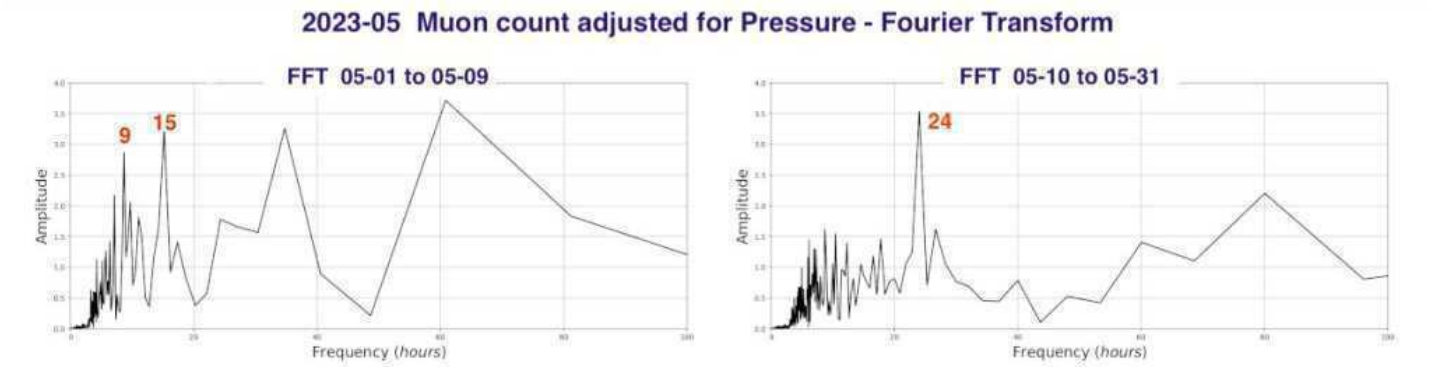


This VHF recording by Colin Clements shows activity on the 18th. 610MHz (black) has remained quiet all day, but 151MHz (red) has a very strong noise level for most of the day. There was plenty of flare activity on the 18th, including M2.2 and M1.6 flares around midday. They would match the 408MHz signal, which shows a sudden pulse of noise lasting almost two hours. Colin also recorded some strong signals on the 4th, 5th, 9th, 20th and 21st, mostly at 151MHz.

MUONS.



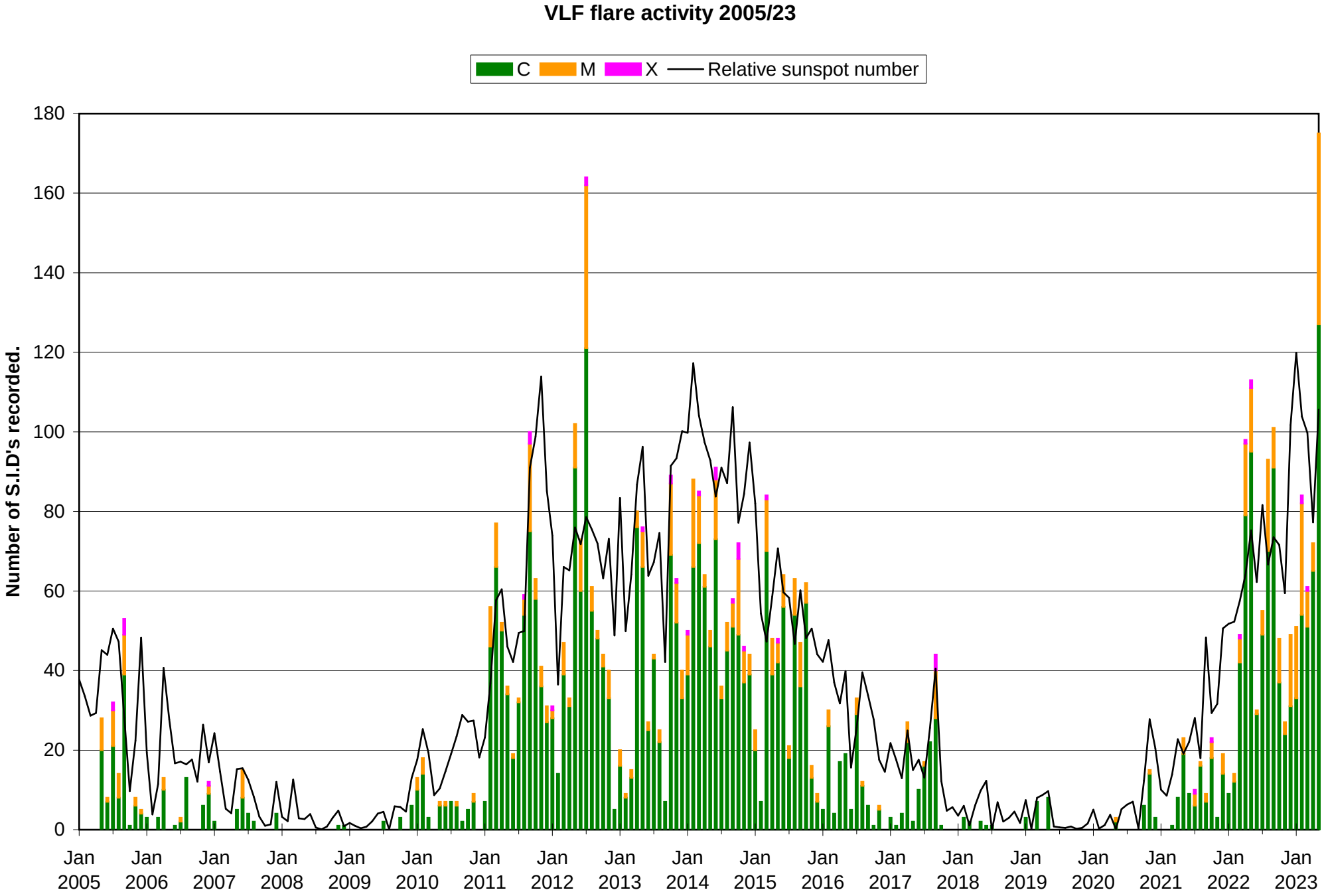
Mark Prescott has provided his charts of Muon activity, raw data at the top and pressure corrected in the lower panel. He has been comparing this data against the Neutron counts from Oulu, Finland, and notes a fairly reasonable match. The lower panel also identifies some of the solar activity for comparison. Mark also noticed a change in the general diurnal pattern of activity through the month, and has made an analysis shown below:



The left panel shows data from the 1st to 9th, showing periodicity peaks at 9 and 15 hours. The right panel covers the rest of the month, showing a strong 24 hour peak. Mark noted that this 24 hour diurnal pattern also became more prominent during the summer last year, so it may be a natural behaviour. Observations over the next few months will help to better understand this activity.

Mark Edwards has found a very interesting paper that summarises all of the various effects that we have seen in the ionosphere's D-layer, including one related to the timing of lunar tides. It would appear to result in only a small change in the reflection height, and so might perhaps be more easily detected during periods of lower solar activity.

https://hal.science/hal-02099868/file/Silber_Price2016.pdf


VLF flare activity 2005/23
C
M
X
Relative sunspot number
Number of S.I.D's recorded.
180
160
140
120
100
80
60
40
20
0
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023

BAA Radio Astronomy Section.

BARTELS DIAGRAM

ROTATION	KEY:	DISTURBED.	ACTIVE	SFE	B, C, M, X = FLARE MAGNITUDE.	Synodic rotation start (carrington's).

2552

	7	2235 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	2020 October 1	2	3
F																											

2553

	4	2236 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
F													CC											C		BCCC	

2554

	31	2237 1	2020 November 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
F		B			B	CBCC	CBC	B			C	C											CC				C

2555

	27	28	2238 29	30	2020 December 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
F		C	CM							C	C							C									

2556

	24	25	2239 26	27	28	29	30	31	2021 January 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
F																											

2557

	20	21	22	2240 23	24	25	26	27	28	29	30	31	2021 February 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
F																											

2558

	16	17	18	2241 19	20	21	22	23	24	25	26	27	28	2021 March 1	2	3	4	5	6	7	8	9	10	11	12	13	14
F																						C					

2559

	15	16	17	2242 18	19	20	21	22	23	24	25	26	27	28	29	30	31	2021 April 1	2	3	4	5	6	7	8	9	10
F	B										B																

2560

	11	12	13	2243 14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	2021 May 1	2	3	4	5	6	7
F							B			C		CCCC															M

2561

	8	9	10	2244 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2021 June 1	2	3
F	CC	CC			C									C	CCMM	CCBM				CCCC		C					

2562

	4	5	6	7	2245 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
F					CCC	CCB																C			CBC		CC

2563

2021 July 1	2	3	4	2246 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
F		MCXM	MC						CCB						C		C									

2564

	28	29	30	31	2021 August 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
F																								CCC		C	

2565

	24	25	26	27	2248 28	29	30	31	2021 September 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
F	C			CCCC	MCCC	CC	C										C	C									

2566

	20	21	22	23	24	2249 25	26	27	28	29	30	2021 October 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
F		C		MM			C		C		C									M							

2567

	17	18	19	20	21	2250 22	23	24	25	26	27	28	29	30	31	2021 November 1	2	3	4	5	6	7	8	9	10	11	12
F										CCCM	CCCC	CMMX	CC	CCC					CC								

2568

	13	14	15	16	17	2251 18	19	20	21	22	23	24	25	26	27	28	29	30	2021 December 1	2	3	4	5	6	7	8	9
F	C																						M				

2569

	10	11	12	13	14	2252 15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2022 January 1	2	3	4	5
F						CCC	CC	C			CM	M	MCC		CC	CCCM											

2570

	6	7	8	9	10	11	2253 12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1
F								C	C												C	CC		C	BCCC		C

2571

2022 February 2	3	4	5	6	7	2254 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
F	CC	CC					C			MCCC		CCM														C

2572

2022 March 1	2	3	4	5	6	2255 7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
F	CM				C	C				CCCC	C		M	CCMC					CC		CC	CCCC	C		C	C

2573

	28	29	30	31	2022 April 1	2	3	2256 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
F	CMC	MCCC	CCCC	CCCX	CCCC	CCMM	CC	C		C		CC	C			CBCC			MMCC	CCCM	CCCM	MMCM	CCCC	CMCC	CC	CMC	C

2574

	24	25	26	27	28	29	30	2022 May 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
F		MCCC	CCCC	CCC	CC	MCCM	MMXM	CCCC		MCX	BMCM	CMMC	CC	CC	CCC	C	CCX	CCMM	CCCM	CCCC	CCCC	C	CMC	CCCC	CCCC	CMMM	CMM

2575

	21	22	23	24	25	26	27	2258 28	29	30	31	2022 June 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
F	CCC	CC	CC	CC	CCM	CC	CC	CC												CC	CCMC	C		C	CCCC		C

2576

	17	18	19	20	21	22	23	2259 24	25	26	27	28	29	30	2022 July 1	2	3	4	5	6	7	8	9	10	11	12	13
F	CCCC	CCC	C	CC	C	CC	CC	C	C								BC	C	CC			M	CCCC	CCCC	CM	CCCC	CCC

2577

	14	15	16	17	18	19	20	21	2260 22	23	24	25	26	27	28	29	30	31	2022 August 1	2	3	4	5	6	7	8	9
F	CMCM	CCC	MCM	CCCC		C	CCCC			CCCC	C		C	C						CC	C		CC				

2578

	10	11	12	13	14	15	16	17	2261 18	19	20	21	22	23	24	25	26	27	28	29	30	31	2022 September 1	2	3	4	5
F		C	CC	CCCC	C	CMMM	MCC	CCMM	CMMM	MCCC		C	C			CCCM	CMMM	CMMM	CCMM	CMMM	CCCM	C	CC	CCCC	CCCC	CCCC	CCMC

2579

	6	7	8	9	10	11	12	13	2262 14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	2022 October 1	2
F	CC				C	CCCC	CCCC	CCCC	MCCC		MM	M	CC	C	MCCC	M	CCCC	CCCM	CCCC		CCC	CCCC		CC	CCMM	CC	CMMC

2580

2022 October 3	4	5	6	7	8	9	10	2263 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
F	CMMM	M	C		CM	C	CCCC	CM	MMCC	CC	C	M	C	C		C		CC		CB		CC	C	C			

2581

	30	31	2022 November 1	2	3	4	5	6	7	2264 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
F								C	C			C	MCCM	CC	C	C	CCC	CC	CC	CCC	M			CCC			

2582

	26	27	28	29	30	2022 December 1	2	3	4	2265 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
F				C			C	M				C				C			MMMM	CMCM	MMMC		CC	CCC	M	C	C

2583

	23	24	25	26	27	28	29	30	31	2023 January 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
F	CC	C		CCC	CM		CM	CCCM	C							CC	MCCM	MM	MCMM	MC	MCMC	MC	CCC	CM	C		MC

2584

	19	20	21	22	23	24	25	26	27	28	2267 29	30	31	2023 February 1	2	3	4	5	6	7	8	9	10	11	12	13	14
F	MMC	CC	CC	CMCM	C	CCC	MCM	CMCC		C		C	CC		C		C	C	C	CC	CM	MMMM	MCCM	MMXM	MMMM	CCCM	CCM

2585

	15	16	17	18	19	20	21	22	23	24	2268 25	26	27	28	2023 March 1	2	3	4	5	6	7	8	9	10	11	12	13
F	CCCC	C	CX	C	CC	CMCC	MCCM	CCCM	CMCC	CCM	CCMM	CC	CC		CC	CCCC	MCCX	CMMC	CCMC	MCCC	C	MC	CCC	CCCC	C		

2586

	14	15	16	17	18	19	20	21	22	23	2269 24	25	26	27	28	29	30	31	2023 April 1	2	3	4	5	6	7	8	9
F	C		C	CCCM	C	CCC	C	C			C		CC	CCC	CC	MC	M	CC					CCC	MC		CC	CCCC

2587

	10	11	12	13	14	15	16	17	18	19	20	2270 21	22	23	24	25	26	27	28	29	30	2023 May 1	2	3	4	5	6
F	MCCC	MC	CCC	CCCC	CCMC	CCCC	C	CC	CCC	CCC	CCCC	M	CC		CC		C	M	CC	CCCC	CCM	CCMC	CCCC	MMMM	MCCC	CMM	CC

2588

	7	8	9	10	11	12	13	14	15	16	17	2271 18	19	20	21	22	23	24	25	26	27	28	29	30	31	2023 June 1	2
F	C	CCCM	MCMM	MCCC	MCCM	CCCC	CCCC	C	C	CCCM	CCCC	MMMM	MCCM	MMMM	CCCM	CCMC	CCMC	MCCM	CCMC	CCC	CCC	MC	C	MMMC	CMCM		

BAA Radio Astronomy Section. **2023 MAY.**

	Xray class	Observers	John Cook (23.4kHz/*22.1kHz*) Tuned radio frequency receiver, 0.58m frame aerial.				Roberto Battaiola 20.9kHz Modified AAVSO receiver.				Paul Hyde (22.1kHz/*24kHz*) Spectrum Lab / PC 1.5m frame aerial.				Mark Edwards (24.0/*19.6*/**37.5kHz**) Spectrum Lab / PC 2m loop aerial.				Colin Clements (21.75kHz/*23.4kHz*) Tuned Radio Frequency receivers, 0.76m screened loop aerial.			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
1	C5.3	2	07:02	07:09	07:37	2									*06:43*	*07:15*	*07:40*	*2+*				
1	C5.2	4	07:44	07:48	08:02	1-					07:46	07:49	08:20	2	*07:42*	*07:50*	*08:07*	*1*				
1	C2.7	4	11:58	12:00	12:13	1-									*11:57*	*12:02*	*12:10*	*1-*	12:01	12:06	12:34	2
1	?	1													*12:31*	*12:47*	*13:06*	*2*				
1	**M7.1**	10	13:08	13:11	?	-	13:04	13:08	13:32	1+	13:05	13:10	14:16	2+	*13:08*	*13:11*	*14:10*	*2+*	13:12	13:14	13:32	1
1	C7.4	8	14:29	14:33	?	-	14:26	14:32	14:45	1	14:27	14:39	15:12	2	*14:28*	*14:37*	*14:58*	*1+*	13:32	14:41	15:23	3
1	C2.7	1	15:20	15:22	16:00	2																
2	C5.1	2	06:01	06:05	06:17	1-									***06:00***	***06:08***	***06:17***	***1-***				
2	C2.4	2	10:53	10:59	11:25	1+									*10:46*	*11:03*	*11:19*	*2*				
2	C3.3	1													17:33	17:36	17:45	1-				
2	C5.5	2									18:13	18:19	18:48	2	18:14	18:24	18:45	1+				
3	C3.3	5	*07:29*	*07:36*	*07:51*	*1*					07:29	07:41	08:24	2+	07:19	07:33	07:46	1+				
3	**M4.2**	10	09:17	09:30	?	-	09:19	09:26	09:52	2	09:19	09:29	?	-	09:20	09:31	10:05	2	08:43	09:34	10:11	3
3	**M3.1**	11	10:10	10:16	?	-	10:08	10:13	10:30	1	10:07	10:15	?	-	10:08	10:18	?	-	10:11	10:20	10:43	1+
3	**M7.2**	10	10:40	10:47	?	-	10:36	10:44	11:10	2	10:38	10:47	11:30	2+	10:40	10:47	11:22	2	10:43	10:51	12:14	3
3	C3.9	6	12:09	12:14	12:26	1-	12:06	12:11	12:22	1-	12:07	12:15	12:25	1-	12:09	12:13	?	-	12:14	12:18	12:30	1-
3	**M1.7**	11	12:31	12:37	?	-	12:26	12:32	12:35	1-	12:28	12:38	13:15	2+	12:28	12:33	13:11	2	12:30	12:42	13:50	2+
3	**M2.2**	11	13:47	13:51	?	-	13:45	13:48	14:11	1+	13:44	13:53	14:31	2+	13:47	13:49	14:12	1	13:50	13:57	15:04	2+
3	C3.1	3	14:58	15:00	15:22	1					14:56	15:02	15:13	1-	14:58	15:01	15:23	1				
3	C3.0	1													18:14	18:17	18:36	1				
4	**M3.9**	9	08:18	08:43	10:44	3+					08:03	08:37	09:59	3	08:20	08:42	09:57	3	07:57	08:49	12:11	3+
4	C2.8	1													14:32	14:42	14:50	1-				
4	C2.5	2									15:57	16:05	16:40	2	16:05	16:08	16:30	1				
4	C6.3	1													18:25	18:50	19:14	2+				
5	C9.5	4	07:01	07:07	?	-									07:03	07:04	07:19	1-				
5	**M2.1**	9	07:21	08:00	10:36	3+									07:46	08:17	09:45	3	07:22	08:11	10:07	3+
5	?	1													*08:52*	*08:54*	*09:52*	*2+*				
5	**M1.2**	7	15:26	15:33	16:30	2+	15:18	15:41	16:03	2	15:23	15:41	16:37	2+	15:26	15:33	?	-				
5	?	2													15:40	15:42	16:20	2	15:28	15:54	17:28	3
6	C3.6	7	14:57	14:59	15:40	2	14:55	14:58	15:01	1-	14:54	15:03	15:21	1+	14:58	15:03	15:17	1	15:02	15:06	16:05	2+
6	C1.8	1													17:43	17:46	17:53	1-				
7	C1.8	1													***10:02***	***10:14***	***10:44***	***2***				
7	?	1													11:25	11:29	11:34	1-				
8	C3.6	2													*08:23*	*08:41*	*09:33*	*2+*	08:29	08:51	09:03	2
8	C4.6	7	09:56	10:01	?	-									09:57	10:02	10:26	1+	09:57	10:10	10:57	2+
8	C2.2	1													*11:02*	*11:20*	*12:08*	*2+*				
8	C9.6	12	14:19	14:21	15:01	2	14:16	14:20	14:25	1-	14:15	14:20	15:01	2+	*14:18*	*14:22*	*15:00*	*2*	14:19	14:28	15:13	2+
8	**M2.3**	1													20:19	20:26	20:42	1				
9	**M1.2**	7	*06:08*	*06:15*	*06:41*	*2*	06:02	06:14	06:30	1+					*06:05*	*06:13*	*06:24*	*1*				
9	C5.2	7	08:08	08:13	08:44	2					08:04	08:14	08:51	2+	*08:06*	*08:19*	*08:51*	*2*				
9	?	1													**09:04**	**09:08**	**09:17**	**1-**				
9	C4.3	8	09:21	09:33	09:59	2	09:18	09:30	09:50	1+	09:14	09:30	?	-	09:24	09:34	10:02	2	09:16	09:38	10:08	2+
9	**M1.3**	11	10:07	10:18	?	-	10:02	10:21	10:52	2+	10:05	10:21	?	-	10:06	10:24	11:08	2+	10:08	10:26	11:18	2+
9	C6.9	10	11:12	11:18	?	-	11:08	11:16	11:28	1	11:11	11:20	11:57	2+	11:15	11:18	11:39	1	11:18	11:26	12:05	2+
9	?	2													*12:02*	*12:15*	*?*	-				
9	C5.7	2													*12:26*	*12:35*	*13:07*	*2*	12:05	12:38	13:26	2+
9	C6.4	8	14:01	14:07	?	-	13:58	14:04	14:21	1	13:58	14:07	?	-	13:58	14:07	14:17	1	14:05	14:13	14:32	1+
9	C7.3	7					14:26	14:45	15:05	2	14:27	14:42	15:24	2+	*14:30*	*14:44*	*15:28*	*2+*	14:32	14:49	15:38	2+
9	**M4.2**	4									18:25	18:40	19:40	2+	18:28	18:46	20:33	3				
9	**M5.0**	2									20:42	20:53	21:15	2	20:44	20:51	21:14	1+				
10	**M2.2**	11	14:15	14:20	16:00	3	14:09	14:20	15:31	2+	14:12	14:25	?	-	14:15	14:24	?	-	14:14	14:29	16:10	3
10	C5.7	2									14:58	15:02	?	-	14:57	15:03	15:29	1+				
10	C2.6	1									15:58	16:05	17:11	2+								
10	C5.3	1													19:32	19:37	19:54	1				
11	**M2.1**	12	08:54	09:01	10:09	2+	08:47	09:04	09:48	2+	08:48	09:04	09:51	2+	08:54	09:02	09:53	2+	08:59	09:09	10:49	3
11	?	1													11:02	11:11	11:30	1+				
11	?	1													12:19	12:24	?	-				
11	C3.0	1													*13:02*	*13:08*	*13:56*	*2+*				
11	C6.2	8	13:58	14:02	14:25	1+	13:56	14:05	14:22	1+	13:55	14:02	15:05	2+	13:59	14:07	15:35	3	14:01	14:09	15:35	3
11	**M1.8**	6									18:19	18:30	19:42	2+	18:22	18:31	19:26	2+				
12	C2.0	2									08:12	08:24	08:43	1+	**08:17**	**08:23**	**08:38**	**1**				
12	C4.6	10	11:35	11:41	12:15	2	11:30	11:39	12:04	2	11:33	11:43	12:33	2+	11:36	11:43	12:35	2+	11:40	11:48	12:31	2+
12	C4.4	2									12:38	12:57	?	-	12:39	13:02	?	-				
12	C5.6	8	13:27	13:36	14:06	2					13:20	13:39	?	-	13:12	13:36	?	-	12:31	13:43	15:23	3+
12	C4.9	2									14:04	14:11	14:19	1-	14:04	14:11	15:18	2+				
12	C2.5	2									15:20	15:29	15:58	2	15:27	15:31	15:43	1-				
12	?	1													***16:18***	***16:26***	***16:48***	***1+***				
13	C4.9	9	10:23	10:29	11:00	2	10:19	10:27	10:33	1-	10:20	10:30	11:01	2	10:24	10:29	10:59	2	10:25	10:34	11:28	2+
13	C2.1	1													13:48	13:53	14:19	1+				
13	C2.0	1													14:52	14:55	15:08	1-				
13	C4.3	1													18:42	18:51	19:17	2				
14	C7.0	9	09:15	09:20	09:55	2	09:11	09:20	09:41	1+	09:12	09:21	?	-	09:15	09:21	09:50	2	09:15	09:28	10:10	2+
15	C2.9	4									07:21	07:51	09:37	3+	*07:28*	*07:53*	*08:41*	*2+*				
16	C2.0	3					09:43	09:53	10:09	1+	09:48	09:54	10:23	2	09:53	10:02	10:20	1+				
16	C4.5	9	12:06	12:15	12:50	2	12:01	12:12	12:41	2	12:04	12:18	12:38	2	12:07	12:22	?	-	12:02	12:24	12:57	2+
16	?	1													12:54	12:59	13:14	1				
16	C1.5	1													*13:43*	*13:44*	*13:48*	*1-*				
16	**M9.6**	11	16:36	16:43	18:00	2+	16:34	16:39	16:49	1-	16:36	16:40	18:07	3	16:36	16:44	17:37	2+	16:41	16:51	18:19	3
17	C2.1	1													**07:56**	**08:04**	**08:10**	**1-**				
17	C2.3	2									08:24	08:30	08:48	1	08:28	08:32	08:39	1-				
17	C6.4	10	14:38	14:44	15:11	2	14:32	14:45	15:07	2	14:35	14:46	?	-	14:38	14:46	15:18	2	14:41	14:51	15:26	2
17	C4.3	4					15:17	15:27	15:40	1	15:19	15:30	15:58	2	15:25	15:30	15:53	1+				
17	C7.4	9	16:18	16:25	16:55	2	16:14	16:28	16:47	2	16:13	16:30	17:33	2+	16:16	16:29	17:15	2+	16:19	16:36	17:47	3
17	C6.2	3									18:39	18:48	19:15	2	18:42	18:47	19:19	2				
17	C5.0	2									19:30	19:36	20:00	1+	19:32	19:38	20:00	1+				
18	**M1.0**	7	06:22	06:26	06:44	1	06:19	06:27	06:41	1	06:19	06:30	?	-	*06:17*	*06:31*	*06:50*	*2*				
18	**M1.2**	8	06:53	06:55	?	-	06:50	06:55	07:04	1-	06:51	06:59	07:51	2+	*06:52*	*07:01*	*07:43*	*2+*	06:57	07:03	07:48	2+
18	?	1													*08:13*	*08:34*	*?*	-				
18	C5.2	7	10:17	10:20	?	-	09:42	10:14	10:17	2	10:15	10:22	10:43	1+	09:53	10:10	?	-				
18	?	4													10:15	10:23	10:56	2	09:47	10:28	11:06	2+
18	C4.2	5	11:02	11:05	11:12	1-					10:59	11:07	11:21	1	11:03	11:10	11:16	1-	11:06	11:12	11:26	1
18	?	3	11:23	11:25	11:32	1-									11:24	11:25	11:32	1-	11:26	11:32	11:37	1-
18	**M2.2**	11	11:39	11:45	?	-	11:35	11:46	11:59	1	11:33	11:46	12:27	2+	11:38	11:43	?	-	*11:25*	*11:57*	*12:09*	*2*
18	?	5					11:59	12:13	12:36	2					12:09	12:12	?	-	*12:09*	*12:19*	*12:45*	*2*
18	**M1.6**	8	12:42	12:48	13:31	2+	12:38	12:48	13:11	2	12:36	12:52	13:11	2	12:40	12:47	13:09	1+	12:44	12:55	13:34	2+
18	?	4	13:48	13:56	14:27	2					13:44	13:55	14:23	2	13:33	13:40	?	-	*13:33*	*13:41*	*13:48*	*1-*
18	?	2													13:46	13:59	14:16	1+	13:51	14:01	15:40	3
18	C4.0	2									15:50	15:55	16:05	1-	15:51	16:00	16:16	1				
18	?	1													17:27	17:33	?	-				
18	**M1.1**	7	17:46	17:48	18:00	1-					17:43	17:51	18:25	2	17:41	17:52	18:48	2+				
18	**M3.8**	2									20:20	10:27	?	-	20:21	20:33	?	-				
18	**M4.5**	2									20:55	21:03	?	-	20:56	20:59	21:32	2				
19	**M2.5**	2													*04:56*	*05:04*	*05:33*	*2*				
19	C5.7	3	06:47	06:51	?	-	06:43	06:49	06:57	1-	06:46	06:54	07:32	2+								
19	C4.7	3					07:31	07:48	07:59	1+					***07:37***	***07:50***	***08:12***	***2***				
19	?	1													***09:02***	***09:21***	***?***	***-***				
19	C2.8	1													09:29	09:37	09:44	1-				
19	C4.0	5	10:13	10:18	10:39	1+									10:06	10:22	?	-	09:58	10:25	11:17	2+
19	?	1													10:38	10:57	11:26	2+				
19	C6.1	6	12:23	12:33	13:06	2					12:15	12:31	13:30	2+	12:21	12:37	13:19	2+	12:16	12:46	13:32	2+
19	C2.9	1													15:34	15:50	16:15	2				

19	C5.9	5	16:17	16:30	17:00	2					16:17	16:35	17:08	2+	16:18	16:31	17:11	2+	16:23	16:40	17:21	2+
19	C4.1	1													17:19	17:25	?	-				
19	C5.3	2									17:16	17:34	17:47	1+	17:27	17:31	17:54	1+				
19	C5.1	2									19:09	19:14	19:40	1+	19:11	19:17	19:42	1+				
19	**M2.3**	2									19:48	20:06	?	-	19:51	20:09	?	-				
19	**M2.7**	2									20:21	10:28	?	-	20:24	20:30	21:08	2				
20	C6.9	1													*04:23*	*04:45*	*04:58*	*2*				
20	**M1.0**	5	06:53	07:01	07:14	1					06:49	07:05	?	-	06:54	07:02	07:09	1-	06:58	07:09	07:24	1+
20	**M6.4**	11	07:21	07:31	?	-	07:18	07:32	08:27	2+	07:16	07:32	08:53	3	*07:18*	*07:34*	*?*	-	07:24	07:38	09:21	3
20	?	1													*08:34*	*08:39*	*?*	-				
20	?	2	08:52	08:56	09:11	1									*08:56*	*09:01*	*?*	-				
20	**M1.1**	7	09:20	09:27	09:55	2	09:13	09:25	09:35	1	09:15	09:28	09:54	2	*09:15*	*09:30*	*?*	-	09:21	09:34	10:00	2
20	?	1													*09:55*	*10:05*	*?*	-				
20	?	1													*10:11*	*10:13*	*10:39*	*1+*				
20	**M1.6**	10	10:50	10:56	12:17	3	10:47	10:56	11:34	2+	10:58	10:56	11:57	2+	10:51	10:57	12:06	2+	10:54	11:05	12:19	2+
20	?	1													**11:32**	**11:38**	**12:07**	**2**				
20	**M8.9**	11	12:30	12:38	14:08	3	12:28	12:34	13:20	2+	12:27	12:39	13:53	3	12:30	12:38	13:16	2+	12:19	12:40	13:59	3
20	C7.2	6	14:21	14:27	14:41	1					14:21	14:26	?	-	14:22	14:29	?	-	14:26	14:34	15:01	2
20	**M5.6**	11	14:57	15:02	?	-	14:54	15:00	15:32	2	14:53	15:02	16:23	3	14:56	15:03	15:50	2+	15:01	15:07	16:54	3
20	C3.3	2	16:31	16:33	16:46	1-									16:19	16:28	16:37	1-				
20	?	1													16:40	16:42	16:47	1-				
20	C4.1	1													16:52	16:58	?	-				
20	C4.9	1													17:02	17:07	17:29	1+				
20	C3.7	1													17:42	17:47	18:05	1				
20	C7.2	1													18:47	18:56	?	-				
20	**M1.1**	1													19:01	19:04	19:40	2				
20	C5.1	1													20:04	20:15	20:22	1-				
21	C4.1	3	06:46	06:51	?	-					06:43	06:46	07:00	1-	*06:47*	*06:50*	*?*	-				
21	?	1													*06:56*	*07:11*	*07:32*	*2*				
21	C4.5	1													**07:49**	**08:03**	**08:20**	**1+**				
21	C4.9	3	08:29	08:37	09:04	2									08:34	08:40	09:09	2	08:33	08:46	09:31	2+
21	?	2													09:41	10:07	10:30	2+	*09:50*	*10:03*	*10:41*	*2+*
21	?	1													*10:55*	*11:06*	*?*	-				
21	C5.4	5	11:24	11:29	12:23	2+					11:22	11:29	12:04	2	11:25	11:33	11:59	2	*11:27*	*11:38*	*12:42*	*2+*
21	?	1													12:08	12:15	12:18	1-				
21	?	1													14:35	14:42	14:54	1				
21	C4.6	2									15:06	15:20	15:32	1+	15:11	15:17	15:38	1+				
21	**M2.6**	11	15:56	16:06	17:22	3	15:55	16:06	16:18	1	15:34	16:06	16:45	2+	15:56	16:08	16:42	2+	16:01	16:12	17:55	3
22	C4.9	2													*06:10*	*06:18*	*06:28*	*1-*				
22	C3.2	1													09:35	09:43	?	-				
22	C3.2	1													09:52	09:57	10:07	1-				
22	?	1													*10:17*	*10:23*	*?*	-				
22	?	1													*10:37*	*10:56*	*?*	-				
22	?	1													11:24	11:27	11:45	1				
22	?	1													*11:41*	*11:51*	*12:24*	*2*				
22	?	1													*13:10*	*13:15*	*?*	-				
22	C7.2	3	13:27	13:28	?	-					13:25	13:28	?	-	**13:26**	**13:29**	**?**	**-**				
22	**M1.9**	11	13:32	13:38	?	-	13:24	13:37	14:03	2	13:31	13:33	?	-	*13:22*	*13:40*	*?*	-	13:30	13:45	14:18	2+
22	C6.3	5	14:12	14:15	14:46	2					14:10	14:17	14:39	1+	*14:11*	*14:15*	*14:44*	*2*	14:18	14:22	16:52	3+
23	C2.3	1													*07:11*	*07:18*	*07:42*	*1+*				
23	C2.1	1													*07:46*	*07:54*	*08:09*	*1*				
23	C3.2	1													*10:07*	*10:12*	*10:36*	*1+*				
23	C4.1	5	10:42	10:44	11:07	1					10:39	10:48	11:01	1	10:42	10:45	11:35	2+				
23	?	1													**11:42**	**11:43**	**11:54**	**1-**				
23	**M3.0**	11	12:09	12:15	13:33	2+	12:05	12:13	12:49	2	12:07	12:13	13:40	3	12:01	12:14	13:33	3	12:06	12:19	13:26	2+
23	C2.9	1													14:09	14:17	14:34	1				
23	C6.8	6	14:36	14:37	15:02	1+					14:32	14:48	14:59	1+	14:35	14:38	15:00	1				
23	C4.4	3									15:32	15:36	15:47	1-	15:33	15:35	15:51	1-				
23	C3.2	2									16:04	16:06	16:15	1-	16:06	16:07	?	-				
23	C4.0	1													16:27	16:39	17:18	2+				
24	?	2													*08:19*	*08:40*	*09:22*	*2+*				
24	?	1													*09:36*	*09:31*	*19:45*	*3+*				
24	**M1.0**	9	09:57	10:00	?	-	09:54	09:58	10:00	1-	09:53	10:00	?	-	09:57	10:03	?	-	10:01	10:08	10:31	1+
24	C6.7	5	10:25	10:27	11:17	2+	10:23	10:27	10:33	1-	10:23	10:29	11:28	2+	10:23	10:29	11:00	2	10:31	10:35	11:38	2+
24	C2.0	1													13:47	13:50	14:10	1				
24	C2.4	1													15:01	15:10	15:14	1-				
24	?	1													15:28	15:32	15:47	1				
24	**M1.8**	9	17:13	17:19	17:48	2					17:04	17:15	18:36	3	17:09	17:20	?	-	17:12	17:28	19:00	3
24	**M1.0**	1													15:55	18:03	18:41	3+				
24	C5.1	1													18:56	19:00	?	-				
24	C5.1	2									19:04	19:08	19:29	1	19:06	19:09	19:25	1				
24	C3.5	1													19:52	19:54	20:04	1-				
25	C7.4	2													***05:34***	***05:43***	***05:59***	***1***				
25	C3.5	2									08:16	08:22	08:34	1-	08:18	08:24	09:20	2+				
25	C3.2	4									11:00	11:10	11:31	1+	11:04	11:16	12:27	2+				
25	C1.3	1													*12:52*	*12:57*	*13:07*	*1-*				
25	C2.0	3													13:10	13:16	13:45	2				
25	**M1.1**	8	14:42	14:47	15:14	1+					14:39	14:46	15:27	2+	14:41	14:48	15:31	2+	14:45	14:54	18:49	3+
25	C1.8	1													17:31	17:35	17:39	1-				
26	C2.1	3									14:00	14:08	14:35	2	14:04	14:07	14:37	2				
26	C3.0	2									16:58	17:03	17:26	1+	17:00	17:04	17:20	1				
26	C5.5	2									17:43	17:57	18:21	2	17:49	17:58	18:26	2				
27	C2.1	1													14:37	14:45	14:59	1				
27	C2.9	1													15:22	15:30	15:33	1-				
27	C6.2	2									19:17	19:27	19:52	2	19:20	19:27	19:49	1+				
28	**M1.0**	9	10:29	10:38	11:26	2+	10:27	10:41	11:07	2	10:27	10:35	11:33	2+	10:29	10:41	11:29	2+	10:33	10:47	12:01	3
28	C2.0	1													14:53	14:57	15:05	1-				
29	?	1													14:27	14:40	15:07	2				
29	C6.5	2									18:17	18:20	?	-	*18:20*	*18:22*	*?*	-				
29	?	2									18:24	18:29	18:55	1+	18:19	18:31	19:05	2+				
30	**M1.2**	10	?	08:10	09:34	-	07:57	08:12	08:39	2	07:59	08:12	09:02	2+	08:01	08:15	09:13	2+	08:02	08:19	09:07	2+
30	**M1.3**	10	10:18	10:22	11:53	3	10:17	10:24	10:53	2	10:14	10:18	11:34	2+	10:18	10:24	11:05	2+	10:24	10:30	11:18	2+
30	**M1.4**	10	13:37	13:40	14:16	2	13:33	13:40	13:54	1	13:35	13:42	14:28	2+	13:37	13:40	14:28	2+	13:43	13:47	16:31	3+
30	?	1													***14:46***	***14:51***	***15:02***	***1-***				
30	?	2									16:28	16:40	?	-	16:31	16:35	?	-				
30	C6.0	2									16:42	16:51	17:19	2	16:45	16:50	17:17	1+				
31	?	1													**06:25**	**06:30**	**06:35**	**1-**				
31	?	1													**06:47**	**06:53**	**07:02**	**1-**				
31	C4.6	1													*07:39*	*07:46*	*08:18*	*2*				
31	C6.1	6	08:28	08:32	08:41	1-					08:25	08:33	08:53	1+	08:24	08:34	09:15	2+	08:19	08:39	09:56	3
31	?	1													*09:13*	*09:17*	*09:36*	*1*				
31	C2.7	1													*10:13*	*10:24*	*?*	-				
31	?	1													***10:32***	***10:37***	***10:46***	***1-***				
31	C5.3	8	10:57	11:03	11:38	2	10:52	11:02	11:19	1+	10:56	11:07	11:40	2	10:57	11:10	?	-	10:59	11:16	12:29	3
31	?	1													*11:44*	*11:45*	*?*	-				
31	**M1.0**	9	12:25	12:28	13:30	2+	12:23	12:27	12:37	1-	12:23	12:27	12:56	2	*12:25*	*12:28*	*13:00*	*2*	12:29	12:34	13:49	2+
31	C2.9	1													***13:34***	***13:36***	***?***	**-**				
31	?	5									13:41	13:53	14:16	2	*13:45*	*13:51*	*14:13*	*1+*	13:49	13:58	15:06	2+
31	?	1													***14:19***	***14:20***	***14:32***	***1-***				
31	C2.5	1													**16:24**	**16:33**	**?**	**-**				
31	?	1													**16:38**	**16:43**	**?**	**-**				
31	C3.5	1													**16:48**	**16:49**	**?**	**-**				
31	C9.6	2									19:59	20:12	?	-	20:03	20:10	?	-				
31	C6.8	2									20:41	20:50	?	-	20:45	20:49	20:59	1-				
31	**M4.2**	1													22:48	22:50	23:05	1-				

BAA Radio Astronomy Section. **2023 MAY.**

	Xray class		Steve Parkinson (Various) Tuned radio frequency receiver, frame aerials.				Andrew Thomas (19.6kHz/*22.1kHz*) Tuned radio frequency receiver, 0.6m frame aerial.				Phil Rourke (23.4kHz) Spectrum Lab, 0.6m frame aerial.				Mark Prescott (19.6/*20.9*/**23.4kHz**) SpetrumLab/Starbase, mini-whip aerial. Active				John Elliott (19.6kHz) Tuned radio frequency receiver, 0.5m frame aerial.			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
1	C5.3																					
1	C5.2		07:43	07:49	08:20	2																
1	C2.7		11:57	12:01	12:11	1-																
1	?																					
1	**M7.1**		13:07	13:12	?	-	13:09	13:!2	14:28	2+					13:11	13:13	?	-	13:08	13:10	14:00	2+
1	C7.4		14:28	14:38	15:00	1+	14:28	14:37	14:55	1+					14:33	14:37	15:04	1+				
1	C2.7																					
2	C5.1																					
2	C2.4																					
2	C3.3																					
2	C5.5																					
3	C3.3		07:27	07:40	08:27	2+	07:29	07:39	08:35	2+												
3	**M4.2**		09:21	09:30	?	-					09:18	09:30	10:05	2+	09:23	09:33	10:07	2	09:20	09:30	10:00	2
3	**M3.1**		10:11	10:18	?	-	10:09	10:15	10:39	1+	10:05	10:15	?	-	10:14	10:19	?	-	10:10	10:15	10:40	1+
3	**M7.2**		10:40	10:48	11:55	2+	10:39	10:48	12:10	3	?	10:48	12:08	-	10:44	10:51	11:52	2+				
3	C3.9						12:10	12:14	12:31	1												
3	**M1.7**		12:31	12:38	13:25	2+	12:31	12:37	13:47	2+	12:31	12:37	13:35	2+	12:34	12:41	13:10		12:34	12:38	13:10	2
3	**M2.2**		13:47	13:52	14:50	2+	13:47	13:52	16:07	3+	13:47	13:52	15:16	3	13:50	13:56	14:48	2+	13:28	13:40	14:45	2+
3	C3.1																					
3	C3.0																					
4	**M3.9**		08:09	08:45	10:30	3+	08:11	08:46	10:56	3+	08:20	08:43	09:47	3	08:14	08:48	?	-				
4	C2.8																					
4	C2.5																					
4	C6.3																					
5	C9.5		07:02	07:11	?	-																
5	**M2.1**		07:20	08:00	09:00	3	07:30	08:08	09:35	3	07:43	08:08	09:07	2+	07:30	08:10	09:40	3+				
5	?																					
5	**M1.2**						15:24	15:47	16:28	2+					15:29	15:52	16:32	2+				
5	?																					
6	C3.6		14:57	15:00	15:20	1	14:57	15:01	15:18	1												
6	C1.8																					
7	C1.8																					
7	?																					
8	C3.6																					
8	C4.6		09:55	10:03	10:25	1+	09:57	10:01	10:24	1+					10:00	10:07	10:42	2				
8	C2.2																					
8	C9.6		14:18	14:22	14:55	2	14:17	14:21	14:59	2	14:19	14:23	14:57	2	14:22	14:26	15:24	2+	14:18	14:20	14:45	1+
8	**M2.3**																					
9	**M1.2**		06:10	06:23	07:09	2+	06:09	06:21	06:54	2					06:15	06:22	06:52	2				
9	C5.2		08:07	08:17	08:43	2	08:05	08:19	08:50	2					08:11	08:22	08:59	2+				
9	?																					
9	C4.3						09:20	09:40	10:00	2					09:24	09:37	10:03	2				
9	**M1.3**		10:09	10:23	?	-	10:08	10:22	11:12	2+	10:05	10:21	11:06	2+	10:13	10:26	11:12	2+	10:10	10:20	11:00	2+
9	C6.9		11:13	11:19	11:50	2	11:12	11:20	11:46	2	11:31	11:19	11:43	1-	11:16	11:23	12:01	2				
9	?						12:09	12:16	12:55	2+												
9	C5.7																					
9	C6.4						14:01	14:06	14:30	1+					14:04	14:11	14:32	1+				
9	C7.3						14:30	14:44	15:10	2					14:35	14:49	15:27	2+				
9	**M4.2**														18:40	18:51	19:49	2+				
9	**M5.0**																					
10	**M2.2**		14:15	14:26	15:20	2+	14:14	14:20	15:47	3	14:09	14:25	16:00	3	14:20	14:30	15:54	3				
10	C5.7																					
10	C2.6																					
10	C5.3																					
11	**M2.1**		08:54	09:02	09:40	2+	08:54	09:03	10:16	2+	08:53	09:03	10:46	3	08:58	09:09	10:08	2+	08:55	09:05	10:00	2+
11	?																					
11	?																					
11	C3.0																					
11	C6.2		13:59	14:03	14:20	1									14:02	14:08	?	-				
11	**M1.8**		18:21	18:33	18:50	1+	18:22	18:31	18:58	2					**18:28**	**18:36**	**18:54**	**1+**				
12	C2.0																					
12	C4.6		11:35	11:40	12:30	2+	11:33	11:41	12:16	2					11:39	11:46	12:34	2+	11:35	11:40	12:00	1
12	C4.4																					
12	C5.6						13:20	13:37	14:29	2+	13:26	13:38	14:50	2+	?	13:40	?	-				
12	C4.9																					
12	C2.5																					
12	?																					
13	C4.9		10:23	10:29	10:53	1+	10:23	10:30	11:09	2+					10:27	10:32	11:21	2+				
13	C2.1																					
13	C2.0																					
13	C4.3																					
14	C7.0		09:15	09:21	09:53	2	09:12	09:20	09:56	2					09:19	09:23	10:09	2+				
15	C2.9		07:32	08:04	09:00	3	07:33	07:59	08:48	2+												
16	C2.0																					
16	C4.5		12:07	12:19	12:54	2+	12:05	12:20	13:12	2+					12:11	12:23	13:16	2+	12:10	12:18	12:40	1+
16	?																					
16	C1.5																					
16	**M9.6**		16:35	16:45	18:00	2+	16:36	16:45	17:46	2+	16:36	16:46	18:19	3	16:40	16:49	17:39	2+	16:36	16:45	17:45	2+
17	C2.1																					
17	C2.3																					
17	C6.4		14:38	14:46	15:20	2	14:36	14:46	15:21	2					14:43	14:49	15:24	2	14:40	14:45	15:10	1+
17	C4.3																					
17	C7.4		16:18	16:30	17:18	2+	16:16	16:30	17:00	2					*16:19*	*16:32*	*17:03*	*2*				
17	C6.2																					
17	C5.0																					
18	**M1.0**						*06:21*	*06:31*	*06:46*	*1*					*06:21*	*06:32*	*?*	-				
18	**M1.2**						06:52	06:58	07:57	2+					*06:57*	*07:03*	*08:22*	*2+*				
18	?																					
18	C5.2						09:52	10:10	10:18	1+					09:52	10:14	?	-				
18	?						10:18	10:23	11:01	2					10:21	10:26	?	-				
18	C4.2						11:01	11:04	11:38	2												
18	?																					
18	**M2.2**		11:40	11:50	13:30	3	11:38	11:50	12:42	2+	11:42	11:50	?	-	11:43	11:51	?	-	11:38	11:50	12:30	2+
18	?										?	12:15	12:39	-	?	12:21	?	-				
18	**M1.6**						12:42	12:49	14:51	3+	12:39	12:50	13:45	2+	12:46	12:54	14:48	3				
18	?																					
18	?																					
18	C4.0																					
18	?																					
18	**M1.1**		17:44	17:50	18:20	2	17:42	17:52	18:15	2					*17:45*	*17:56*	*?*	-				
18	**M3.8**																					
18	**M4.5**																					
19	**M2.5**						*04:55*	*04:59*	*05:58*	*2+*												
19	C5.7																					
19	C4.7														*07:34*	*07:54*	*08:18*	*2*				
19	?																					
19	C2.8																					
19	C4.0						10:09	10:19	11:24	2+					10:13	10:24	11:44	3				
19	?																					
19	C6.1						12:22	12:36	13:30	2+					12:27	12:43	14:14	3				
19	C2.9																					
19	C5.9														*16:19*	*16:38*	*17:11*	*2+*				

19	C4.1																						
19	C5.3																						
19	C5.1																						
19	**M2.3**																						
19	**M2.7**																						
20	C6.9																						
20	**M1.0**						06:53	07:03	07:20	1+													
20	**M6.4**		06:54	07:38	09:20	3+	07:20	07:33	09:22	3	07:21	07:36	08:35	2+	07:22	07:37	08:59	3	07:15	07:40	08:15	2+	
20	?																						
20	?																						
20	**M1.1**						09:22	09:28	09:56	2					09:24	09:32	?	-					
20	?																						
20	?																						
20	**M1.6**		10:50	11:05	?	-	10:42	10:59	12:30	3	10:49	10:59	12:11	2+	10:55	11:04	12:14	2+	10:50	10:55	11:50	2+	
20	?																						
20	**M8.9**		12:31	12:40	13:50	2+	12:30	12:37	14:22	3	12:30	12:38	14:16	3	12:35	12:43	14:02	3	12:30	12:35	13:45	2+	
20	C7.2						14:22	14:28	14:57	2					14:26	14:32	?	-					
20	**M5.6**		14:58	15:05	16:30	3	14:57	15:04	16:25	3	14:57	15:04	16:26	3	15:01	15:07	16:02	2+	14:55	15:05	16:00	2+	
20	C3.3																						
20	?																						
20	C4.1																						
20	C4.9																						
20	C3.7																						
20	C7.2																						
20	**M1.1**																						
20	C5.1																						
21	C4.1																						
21	?																						
21	C4.5																						
21	C4.9																						
21	?																						
21	?																						
21	C5.4		11:24	11:30	11:55	1+																	
21	?																						
21	?																						
21	C4.6																						
21	**M2.6**		15:56	16:08	17:00	2+	15:54	16:06	17:17	2+	15:53	16:09	17:22	3	16:00	16:10	17:12	2+	15:55	16:05	17:15	2+	
22	C4.9														*08:34*	*08:47*	*09:26*	*2+*					
22	C3.2																						
22	C3.2																						
22	?																						
22	?																						
22	?																						
22	?																						
22	?																						
22	C7.2																						
22	**M1.9**		13:26	13:40	15:00	3	13:26	13:38	14:53	3	13:32	13:39	14:12	2	13:29	13:43	15:07	3	13:30	13:40	14:00	1+	
22	C6.3																						
23	C2.3																						
23	C2.1																						
23	C3.2																						
23	C4.1						10:41	10:46	11:16	2					*10:44*	*10:50*	*?*	-					
23	?																						
23	**M3.0**		12:09	12:15	13:40	3	12:00	12:14	13:58	3	11:56	12:15	13:49	3	12:13	12:18	13:51	3	12:10	12:18	13:15	2+	
23	C2.9																						
23	C6.8		14:36	14:38	15:00	1	14:35	14:38	14:59	1					*14:39*	*14:40*	*15:19*	*2*					
23	C4.4		15:33	15:35	15:55	1																	
23	C3.2																						
23	C4.0																						
24	?														*?*	*08:45*	*09:41*	-					
24	?																						
24	**M1.0**		09:57	10:04	11:03	2+	09:57	10:01	11:54	3					10:01	10:07	11:33	3	09:55	10:00	11:00	2+	
24	C6.7																						
24	C2.0																						
24	C2.4																						
24	?																						
24	**M1.8**		17:13	17:25	18:55	3	17:12	17:25	18:09	2+					17:19	17:28	18:35	2+	17:15	17:25	18:00	2	
24	**M1.0**																						
24	C5.1																						
24	C5.1																						
24	C3.5																						
25	C7.4						05:34	05:42	05:59	1													
25	C3.5																						
25	C3.2						11:00	11:12	11:37	2					*11:10*	*11:15*	*12:08*	*2+*					
25	C1.3																						
25	C2.0						13:09	13:14	13:28	1					*?*	*13:21*	*?*	-					
25	**M1.1**		14:42	14:50	15:45	2+	14:41	14:50	15:54	2+	14:42	14:51	15:21	2	14:47	14:53	16:27	3					
25	C1.8																						
26	C2.1						14:02	14:07	14:30	1+													
26	C3.0																						
26	C5.5																						
27	C2.1																						
27	C2.9																						
27	C6.2																						
28	**M1.0**		10:29	10:42	11:45	2+	10:30	10:42	12:21	3					10:34	10:44	11:53	2+	10:35	10:40	11:30	2+	
28	C2.0																						
29	?																						
29	C6.5																						
29	?																						
30	**M1.2**		08:02	08:13	09:00	2+	08:01	08:12	09:14	2+	08:05	08:14	08:55	2+	08:06	08:17	09:50	3	08:05	08:15	08:45	2	
30	**M1.3**		10:19	10:24	11:08	2+	10:17	10:25	11:45	3	10:17	10:25	11:24	2+	10:22	10:30	12:13	3	10:20	10:22	11:00	2	
30	**M1.4**		13:38	13:41	14:26	2+	13:36	13:41	14:35	2+	13:38	13:43	14:25	2+	13:42	13:45	15:31	3	13:35	13:40	14:20	2	
30	?																						
30	?																						
30	C6.0																						
31	?																						
31	?																						
31	C4.6																						
31	C6.1						08:27	08:35	09:06	2					*08:33*	*08:38*	*09:18*	*2*					
31	?																						
31	C2.7																						
31	?																						
31	C5.3		10:58	11:08	11:33	2	10:55	11:07	11:40	2					10:01	11:08	12:04	3					
31	?																						
31	**M1.0**		12:26	12:28	12:47	1	12:24	12:28	13:29	2+					12:29	12:31	12:59	1+	12:25	12:28	13:00	2	
31	C2.9																						
31	?						13:44	13:49	14:12	1+					*13:48*	*13:53*	*14:16*	*1+*					
31	?																						
31	C2.5																						
31	?																						
31	C3.5																						
31	C9.6																						
31	C6.8																						
31	**M4.2**																						

BAA Radio Astronomy Section. **2023 MAY.**

	Xray class		Chris Bailey Spectrum Lab.				Colin Briden Spectrum Lab frame aerial. 1.2m										
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	START	PEAK	END (UT)	START PEAK END (UT)
1	C5.3																
1	C5.2																
1	C2.7																
1	?																
1	**M7.1**		13:03	13:10	13:50	2+											
1	C7.4																
1	C2.7																
2	C5.1																
2	C2.4																
2	C3.3																
2	C5.5																
3	C3.3																
3	**M4.2**		09:20	09:28	10:07	2+											
3	**M3.1**		10:07	10:14	10:37	1+											
3	**M7.2**		10:37	10:46	11:45	2+											
3	C3.9																
3	**M1.7**		12:32	12:36	13:15	2											
3	**M2.2**		13:46	13:50	14:30	2											
3	C3.1																
3	C3.0																
4	**M3.9**		08:05	08:45	10:00	3											
4	C2.8																
4	C2.5																
4	C6.3																
5	C9.5						07:00	07:09	?	-							
5	**M2.1**		07:27	08:05	09:05	3	?	07:40	07:50	-							
5	?																
5	**M1.2**		15:27	15:40	16:15	2+											
5	?																
6	C3.6																
6	C1.8																
7	C1.8																
7	?																
8	C3.6																
8	C4.6						09:59	10:02	10:12	1-							
8	C2.2																
8	C9.6		14:17	14:23	15:00	2	14:19	14:23	14:30	1-							
8	**M2.3**																
9	**M1.2**						06:10	06:14	06:18	1-							
9	C5.2						08:07	08:16	08:36	1+							
9	?																
9	C4.3						09:21	09:26	09:32	1-							
9	**M1.3**						10:09	10:23	10:38	1+							
9	C6.9						11:13	11:20	11:28	1-							
9	?																
9	C5.7																
9	C6.4						14:04	14:08	14:13	1-							
9	C7.3						14:33	14:45	14:56	1							
9	**M4.2**		18:27	18:55	19:25	2+											
9	**M5.0**																
10	**M2.2**		14:15	14:24	15:20	2+	14:16	14:22	14:45	1+							
10	C5.7																
10	C2.6																
10	C5.3																
11	**M2.1**		08:55	09:00	09:50	2+	08:56	09:03	09:22	1+							
11	?																
11	?																
11	C3.0																
11	C6.2						14:00	14:05	14:12	1-							
11	**M1.8**		18:20	18:29	18:45	1											
12	C2.0																
12	C4.6						11:35	11:42	12:00	1							
12	C4.4																
12	C5.6						13:28	13:38	13:57	1+							
12	C4.9																
12	C2.5																
12	?																
13	C4.9		10:18	10:30	10:55	2											
13	C2.1																
13	C2.0																
13	C4.3																
14	C7.0		09:15	09:22	09:38	1											
15	C2.9																
16	C2.0																
16	C4.5																
16	?																
16	C1.5																
16	**M9.6**		16:37	16:45	17:45	2+											
17	C2.1																
17	C2.3																
17	C6.4		14:35	14:45	15:15	2											
17	C4.3		15:15	15:33	16:00	2											
17	C7.4		16:15	16:30	17:03	2+											
17	C6.2		18:50	19:10	19:30	2											
17	C5.0																
18	**M1.0**		06:20	06:26	07:55	3											
18	**M1.2**		?	07:00	?	-											
18	?																
18	C5.2		10:16	10:19	10:48	1+											
18	?																
18	C4.2																
18	?																
18	**M2.2**		11:39	11:45	13:15	3											
18	?																
18	**M1.6**																
18	?																
18	?																
18	C4.0																
18	?																
18	**M1.1**		17:42	17:50	18:30	2+											
18	**M3.8**																
18	**M4.5**																
19	**M2.5**																
19	C5.7																
19	C4.7																
19	?																
19	C2.8																
19	C4.0																
19	?																
19	C6.1																
19	C2.9																
19	C5.9																

19	C4.1									
19	C5.3									
19	C5.1									
19	**M2.3**									
19	**M2.7**									
20	C6.9									
20	**M1.0**									
20	**M6.4**		07:23	07:32	08:15	2+				
20	?									
20	?									
20	**M1.1**									
20	?									
20	?									
20	**M1.6**									
20	?									
20	**M8.9**		12:32	12:37	13:35	2+				
20	C7.2									
20	**M5.6**		14:56	14:59	15:45	2+				
20	C3.3									
20	?									
20	C4.1									
20	C4.9									
20	C3.7									
20	C7.2									
20	**M1.1**									
20	C5.1									
21	C4.1									
21	?									
21	C4.5									
21	C4.9									
21	?									
21	?									
21	C5.4									
21	?									
21	?									
21	C4.6									
21	**M2.6**		15:55	16:05	16:30	2				
22	C4.9									
22	C3.2									
22	C3.2									
22	?									
22	?									
22	?									
22	?									
22	?									
22	C7.2									
22	**M1.9**		13:32	13:36	14:00	1+				
22	C6.3		14:14	14:15	14:30	1-				
23	C2.3									
23	C2.1									
23	C3.2									
23	C4.1									
23	?									
23	**M3.0**		12:11	12:13	12:50	2				
23	C2.9									
23	C6.8									
23	C4.4									
23	C3.2									
23	C4.0									
24	?									
24	?									
24	**M1.0**									
24	C6.7									
24	C2.0									
24	C2.4									
24	?									
24	**M1.8**		17:08	17:18	18:00	2+				
24	**M1.0**									
24	C5.1									
24	C5.1									
24	C3.5									
25	C7.4									
25	C3.5									
25	C3.2									
25	C1.3									
25	C2.0									
25	**M1.1**									
25	C1.8									
26	C2.1									
26	C3.0									
26	C5.5									
27	C2.1									
27	C2.9									
27	C6.2									
28	**M1.0**									
28	C2.0									
29	?									
29	C6.5									
29	?									
30	**M1.2**									
30	**M1.3**									
30	**M1.4**									
30	?									
30	?									
30	C6.0									
31	?									
31	?									
31	C4.6									
31	C6.1									
31	?									
31	C2.7									
31	?									
31	C5.3									
31	?									
31	**M1.0**									
31	C2.9									
31	?									
31	?									
31	C2.5									
31	?									
31	C3.5									
31	C9.6									
31	C6.8									
31	**M4.2**									