SAMNet: Solar Activity Monitor Network

The University Of Sheffield.

Flare & CME forecasting in 3D solar ARs
From theory to SAMNet facility

[1]R Erdélyi, M Mathioudakis, S Matthews

[1]M B Korsós, [1]N Gyenge, [1]C N Nelson, [2]S Yu, [3]S Bios, [4]P Chatterjee, [5]S Poedts, [6]M K Georgoulis, [3]Y Yan, [1]M S Ruderman, [7]M Stangalini, R Piazzesi, R Speziali, [8]L Dal Sasso, [9]K Petrovay, [10]B Belucz, [10]A Elek, et al., Gyula City Council + Node PIs

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[3]NAOC, Chinese Academy of Sciences, Beijing
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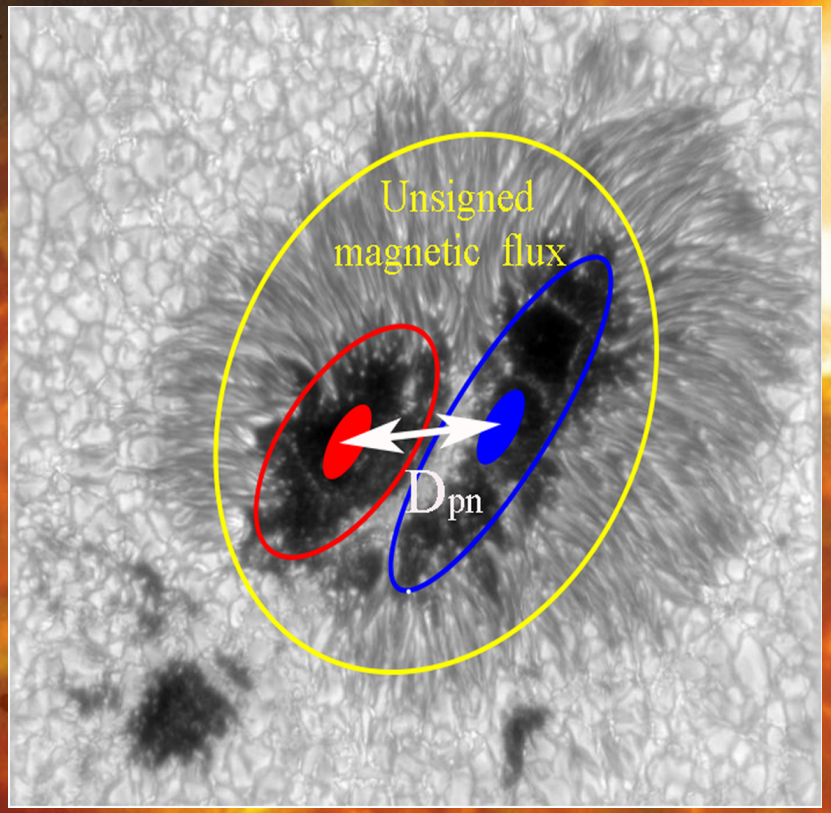
[6]Research Center for Astronomy and Applied Mathematics of the Academy of Athens
[7]INAF Team at Rome Observatory & [8]Avalon Instruments, Italy
[9]Eotvos University & [10]HSPF, Hungary

Weighted horizontal magnetic gradient – WG_M – method

Korsós, M. B., et al. 2015, ApJL, 802, L21



Gradient of LoS magnetic field at Polarity Inversion Line

From 61 ARs with above M5 flare:

- estimate the expected largest flare intensity
- flare onset time estimation
- One or more flares?

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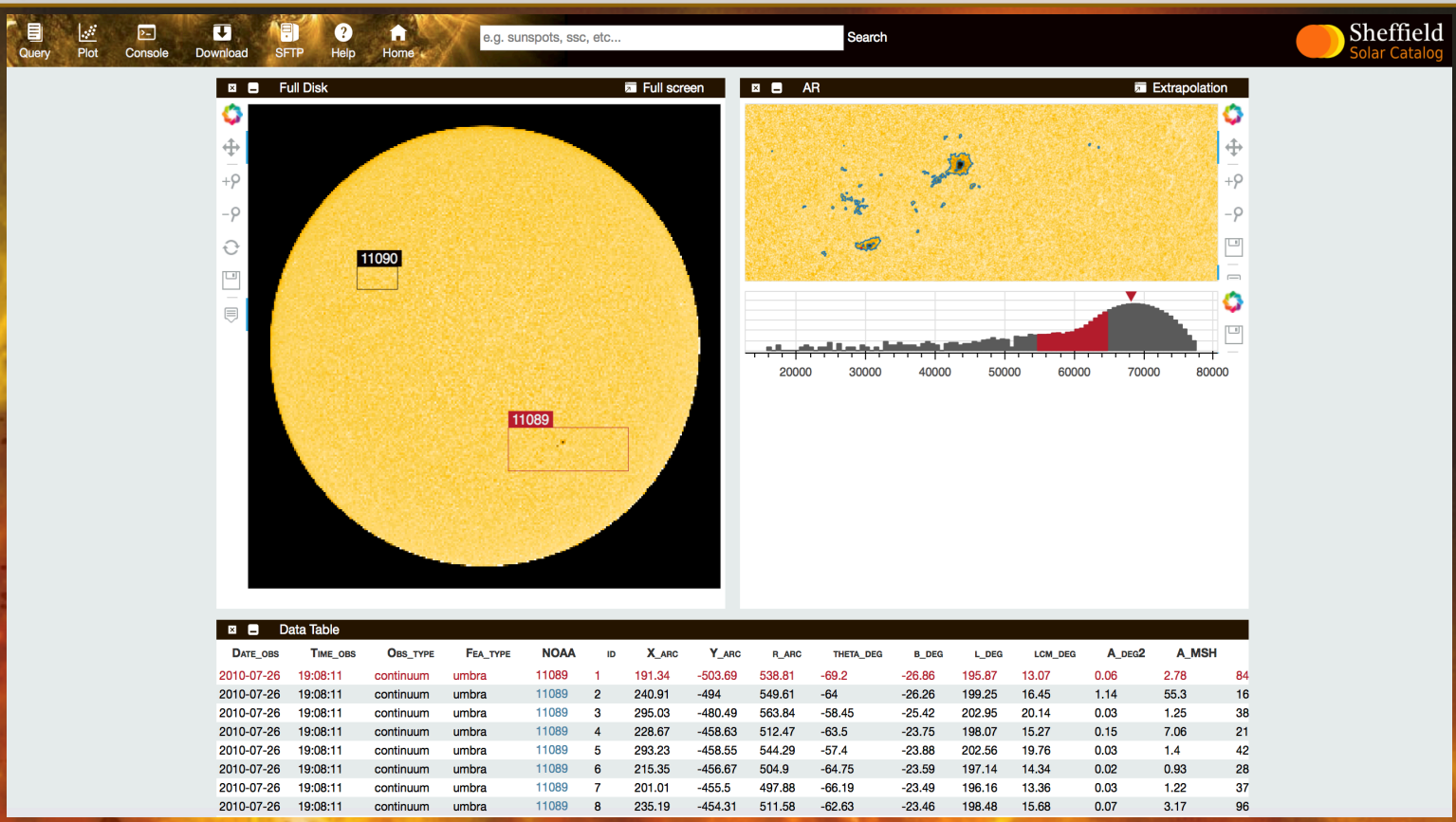
Sheffield Solar Catalogue (SSC)



Data Table

DATE_OBS	TIME_OBS	OBS_TYPE	FEA_TYPE	NOAA	ID	X_ARC	Y_ARC	R_ARC	THETA_DEG	B_DEG	L_DEG	LCM_DEG	A_DEG2	A_MSH	
2010-07-26	19:08:11	continuum	umbra	11089	1	191.34	-503.69	538.81	-69.2	-26.86	195.87	13.07	0.06	2.78	84
2010-07-26	19:08:11	continuum	umbra	11089	2	240.91	-494	549.61	-64	-26.26	199.25	16.45	1.14	55.3	16
2010-07-26	19:08:11	continuum	umbra	11089	3	295.03	-480.49	563.84	-58.45	-25.42	202.95	20.14	0.03	1.25	38
2010-07-26	19:08:11	continuum	umbra	11089	4	228.67	-458.63	512.47	-63.5	-23.75	198.07	15.27	0.15	7.06	21
2010-07-26	19:08:11	continuum	umbra	11089	5	293.23	-458.55	544.29	-57.4	-23.88	202.56	19.76	0.03	1.4	42
2010-07-26	19:08:11	continuum	umbra	11089	6	215.35	-456.67	504.9	-64.75	-23.59	197.14	14.34	0.02	0.93	28
2010-07-26	19:08:11	continuum	umbra	11089	7	201.01	-455.5	497.88	-66.19	-23.49	196.16	13.36	0.03	1.22	37
2010-07-26	19:08:11	continuum	umbra	11089	8	235.19	-454.31	511.58	-62.63	-23.46	198.48	15.68	0.07	3.17	96

http://sp2rc.group.shef.ac.uk

http://ssc.shef.ac.uk

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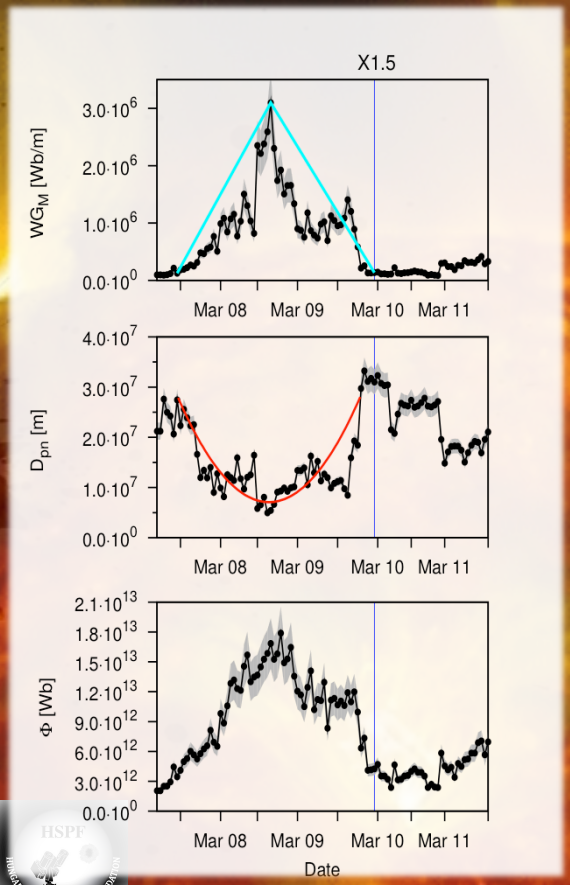
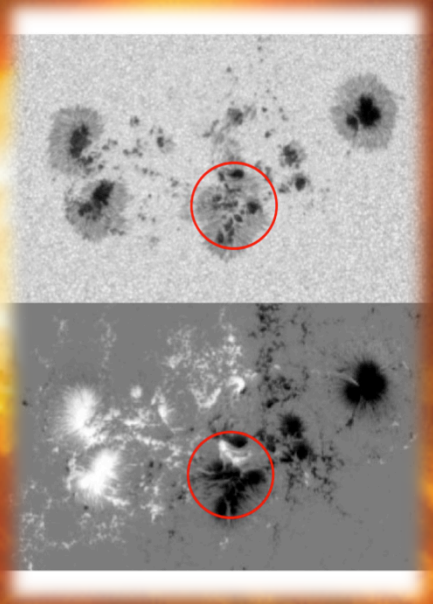
Photospheric discovery

AR 11166 for the X-class case





AR	Flare			WG_M			D_{pn}			$WG_M^{\%}$
	GOES-class	Date	Time	%	T_{Inc} [h]	WG_M^{Max} [Wb/m]	%	T_{Dec} [h]	$T_{Inc+flare}$ [h]	%
11166	X1.5	09/03/2011	23:23	3111%	37	$3.1 \cdot 10^6$	64%	17	31	95%

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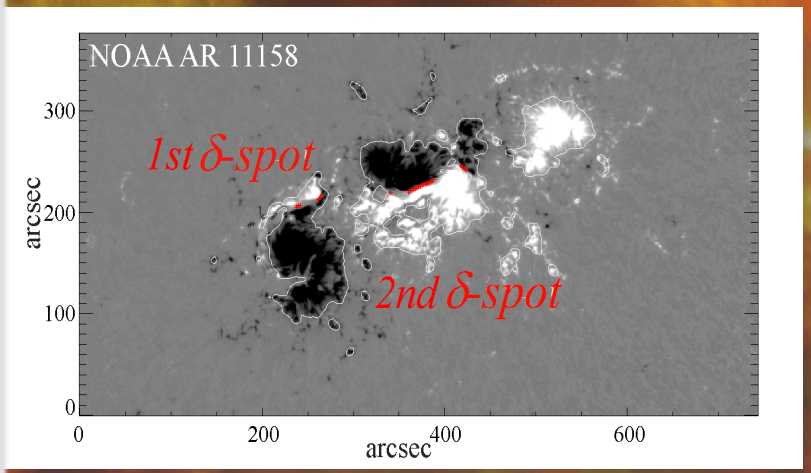
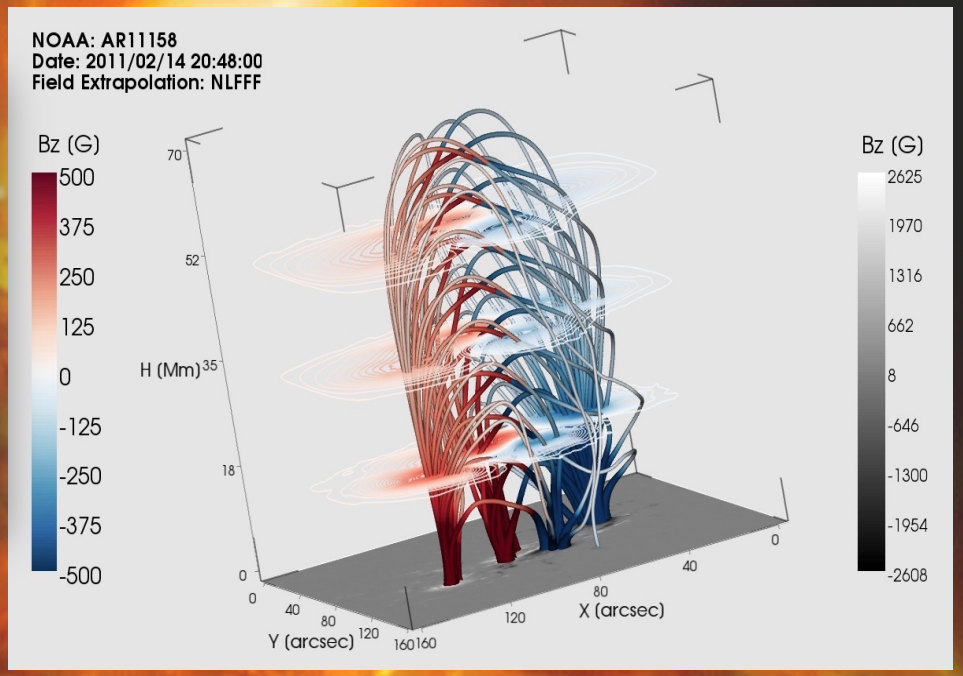
WG_M method in the lower solar atmosphere

Korsós, M. B., et al. 2019, JSWSC

X2.2 flare at 01:56 on 15/02/2011



Automatic PIL recognition program
Horizontal gradient of the longitudinal magnetic field is larger than |50|G/Mm



MONAMI tool: http://sp2rc.group.shef.ac.uk

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Synoptic solar telescope based on Magneto Optical Filter (MOF) technology: SAMM

MOF technology →

- Dopplergrams
  Magnetograms
- Fixed wavelength but high stability and sensitivity

Synoptic →

- 2 observation lines at 2 altitudes in the solar atmosphere:
  Na D2 (600-700 km)
  K I (300-400 km)
  Future: Ca I (1000 km), He 1083
- Full-disk or near-full-disk monitoring of solar activity

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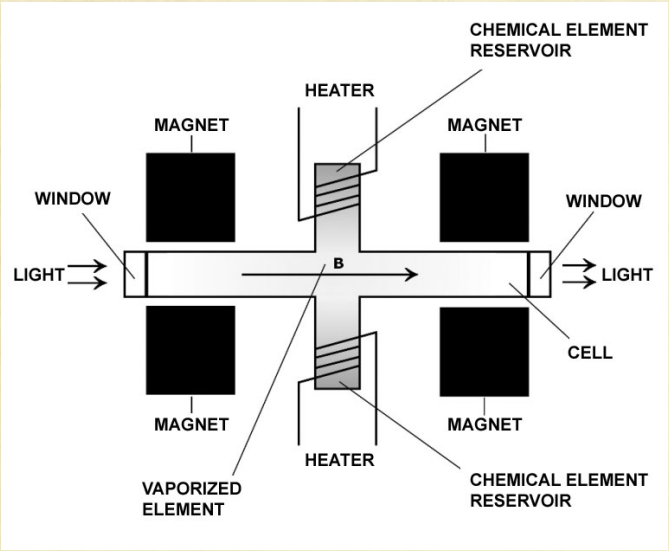
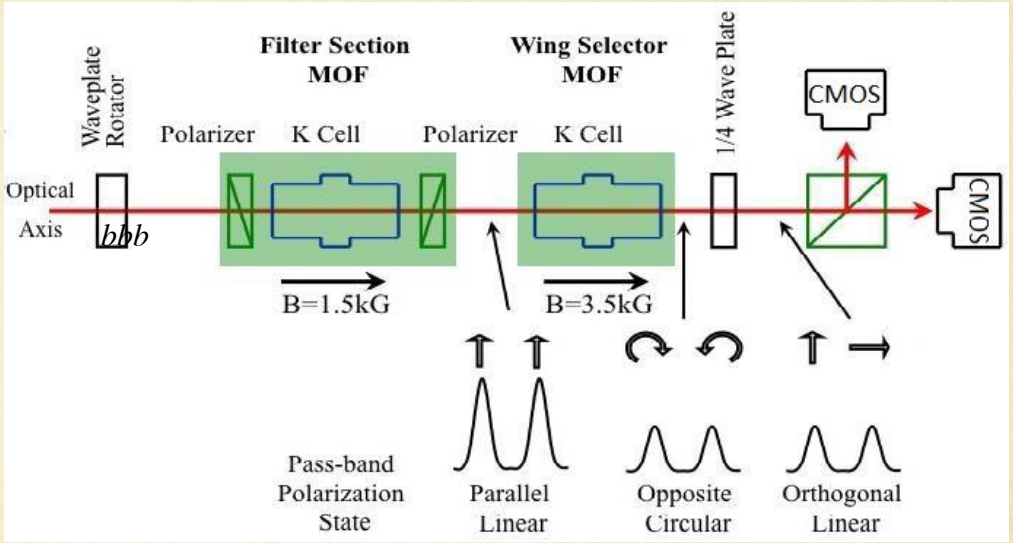




$$B_{LOS} \propto (R^{+}-B^{+})/(R^{+}+B^{+})-(R^{-}-B^{-})/(R^{-}+B^{-})$$

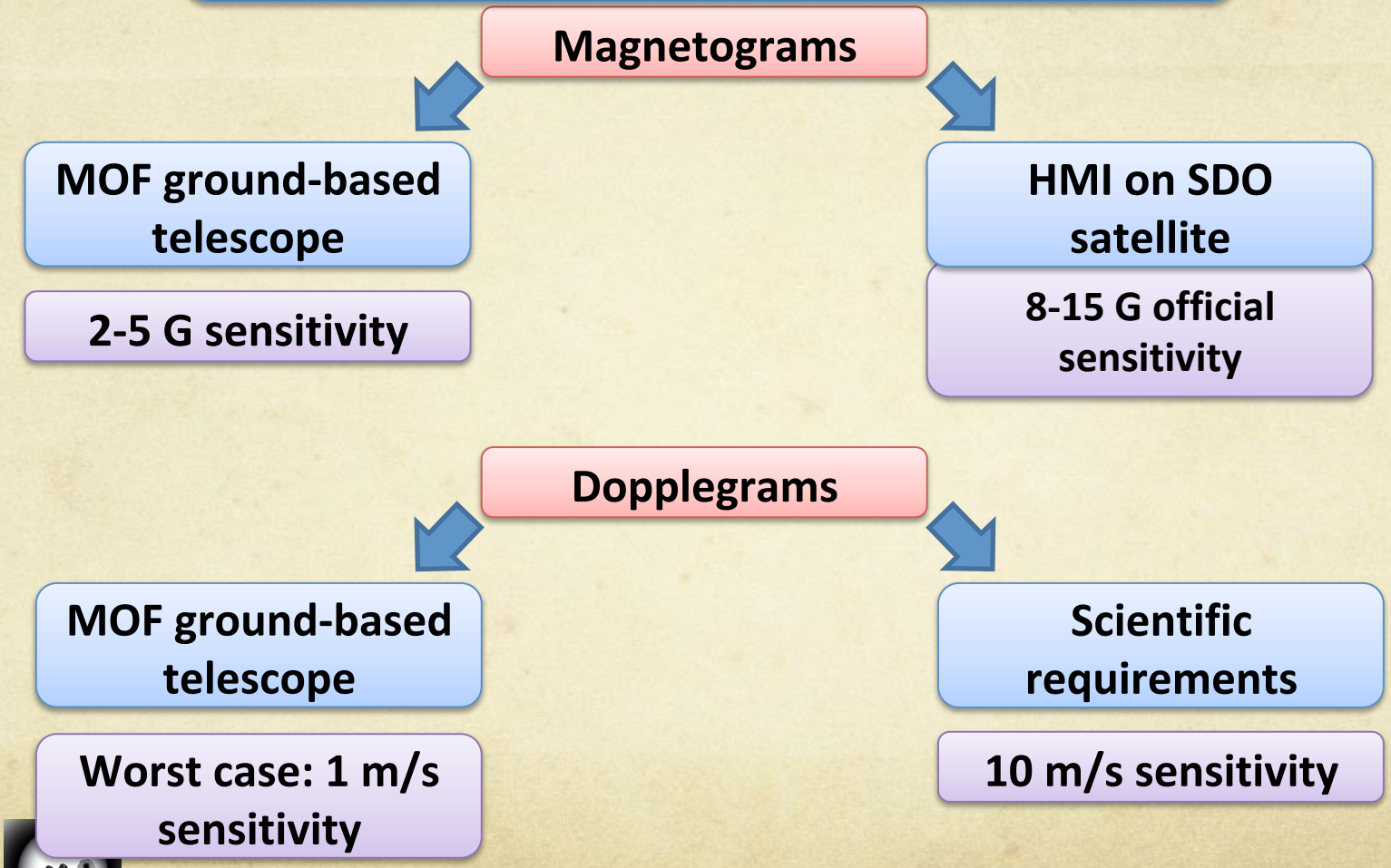
Cacciani et al. 1990

Stangalini et al. 2018

$$v_{LOS} \propto (R^{+}-B^{+})/(R^{+}+B^{+})+(R^{-}-B^{-})/(R^{-}+B^{-})$$

Heritage: Jeffries et al, **MOTH I**, **MOTH II**

SAMM: Putting the thechnology into perspective...



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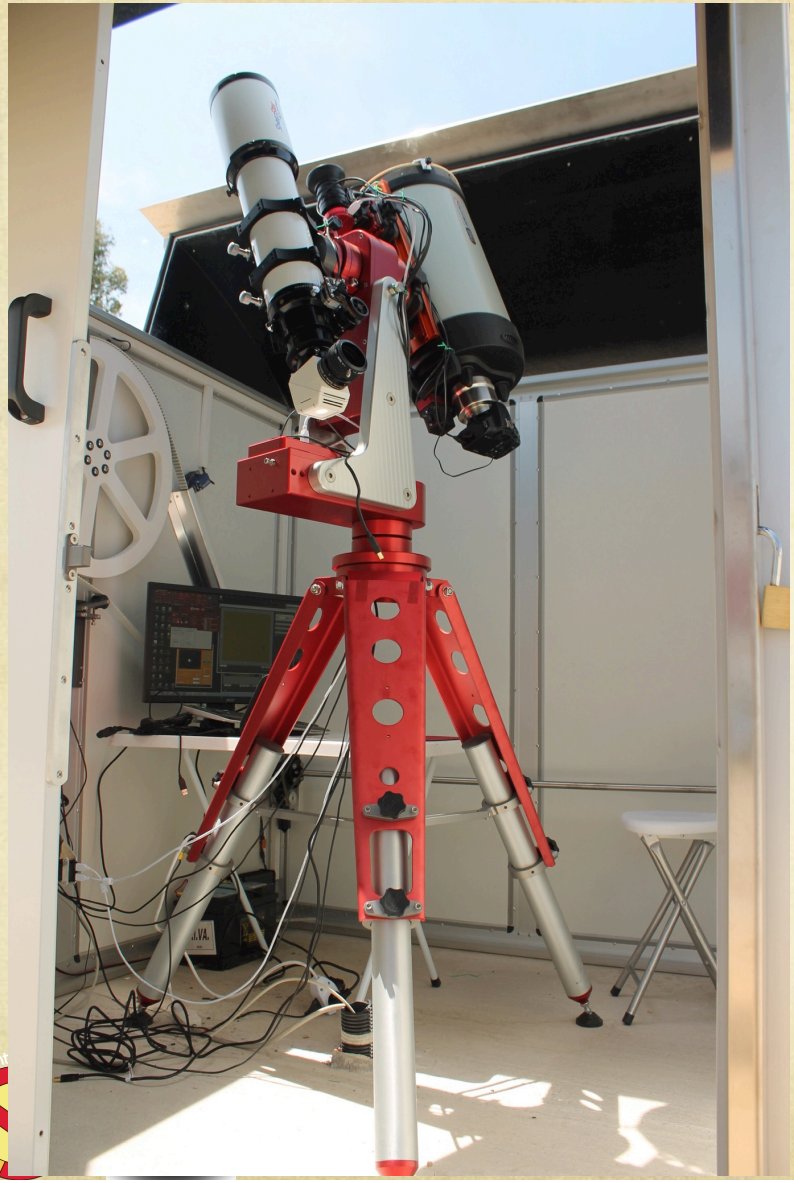
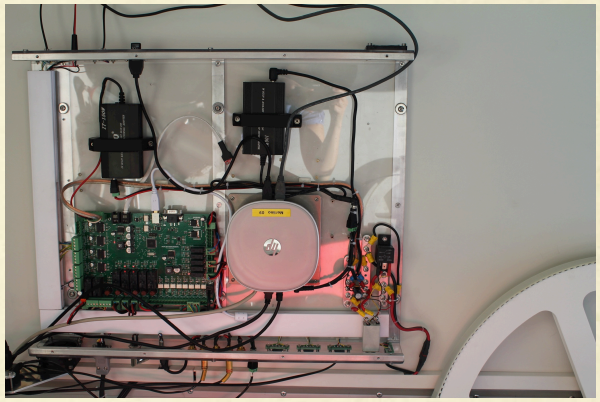
SAMM: Realisation

Hungarian Solar Physics Foundation
www.hspf.eu





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sity
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SAMM: Realisation – Gyula SO

Hungarian Solar Physics Foundation
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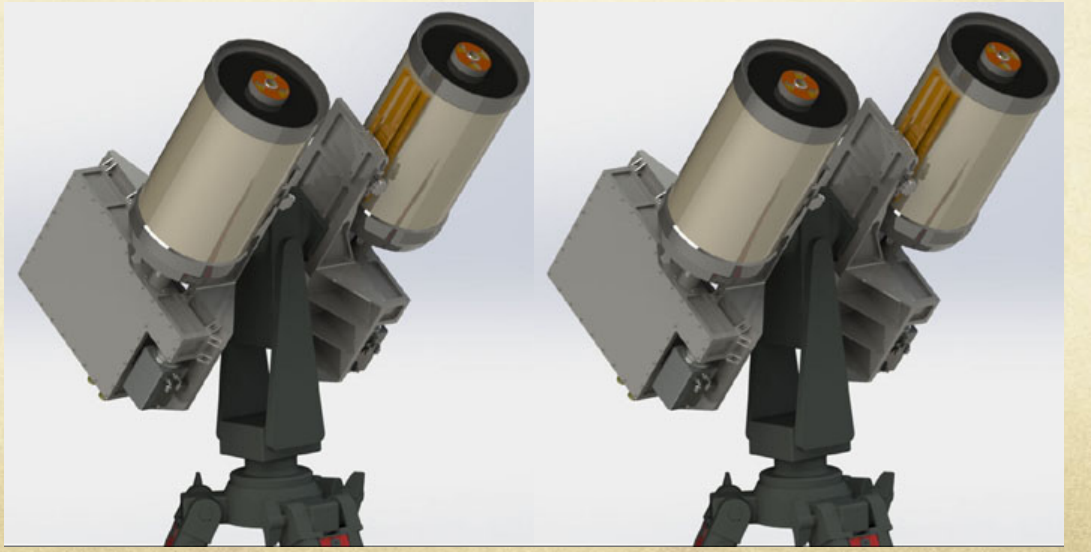
Near Future

- **SAMM+:**

4x observation lines at 4 altitudes in the solar atmosphere:
Na D2 (589 nm, 600-700 km)
K I (770 nm, 300-400 km)
Ca I (422 nm, 1000 km)
He 1083 nm (1900 km)



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Thank you for your attention!
SAMNet Team
The University Of Sheffield.
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