The star field in the Eddington eclipse

In the 1919 total eclipse the Sun was near the Hyades, giving the opportunity to measure the gravitational bending of the light to the astronomers in two expeditions in Brazil, Sobral, and in the Atlantic Ocean.
This stellar field has geometrical properties particularly adapt to this experiment of General Relativity, and a novel replica of this observation is presented and discussed in the context of the International Year of Light 2015.

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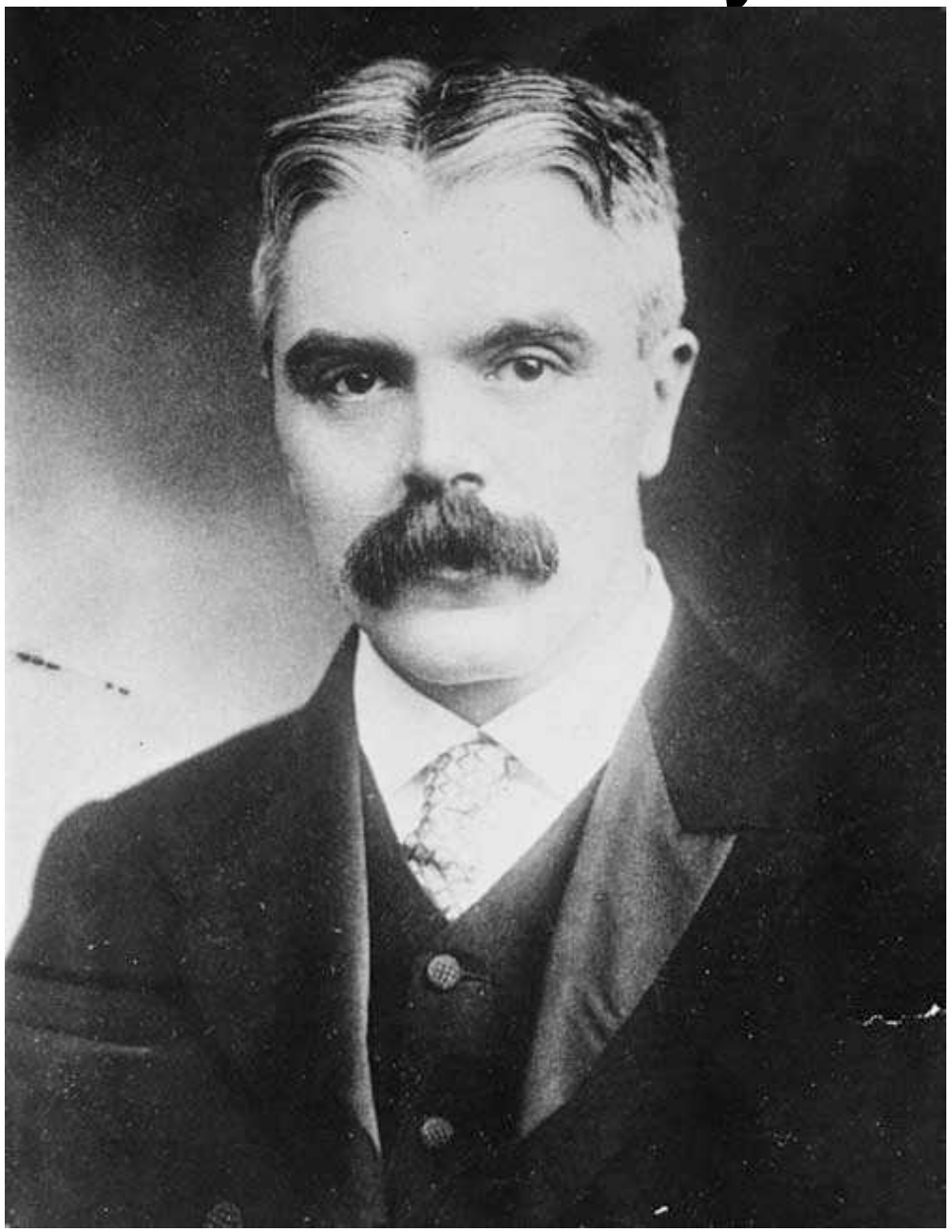
101° congresso SIF Sapienza,
24 settembre 2015

Eclipse of 29 may 1919: the Sun near the Hyades

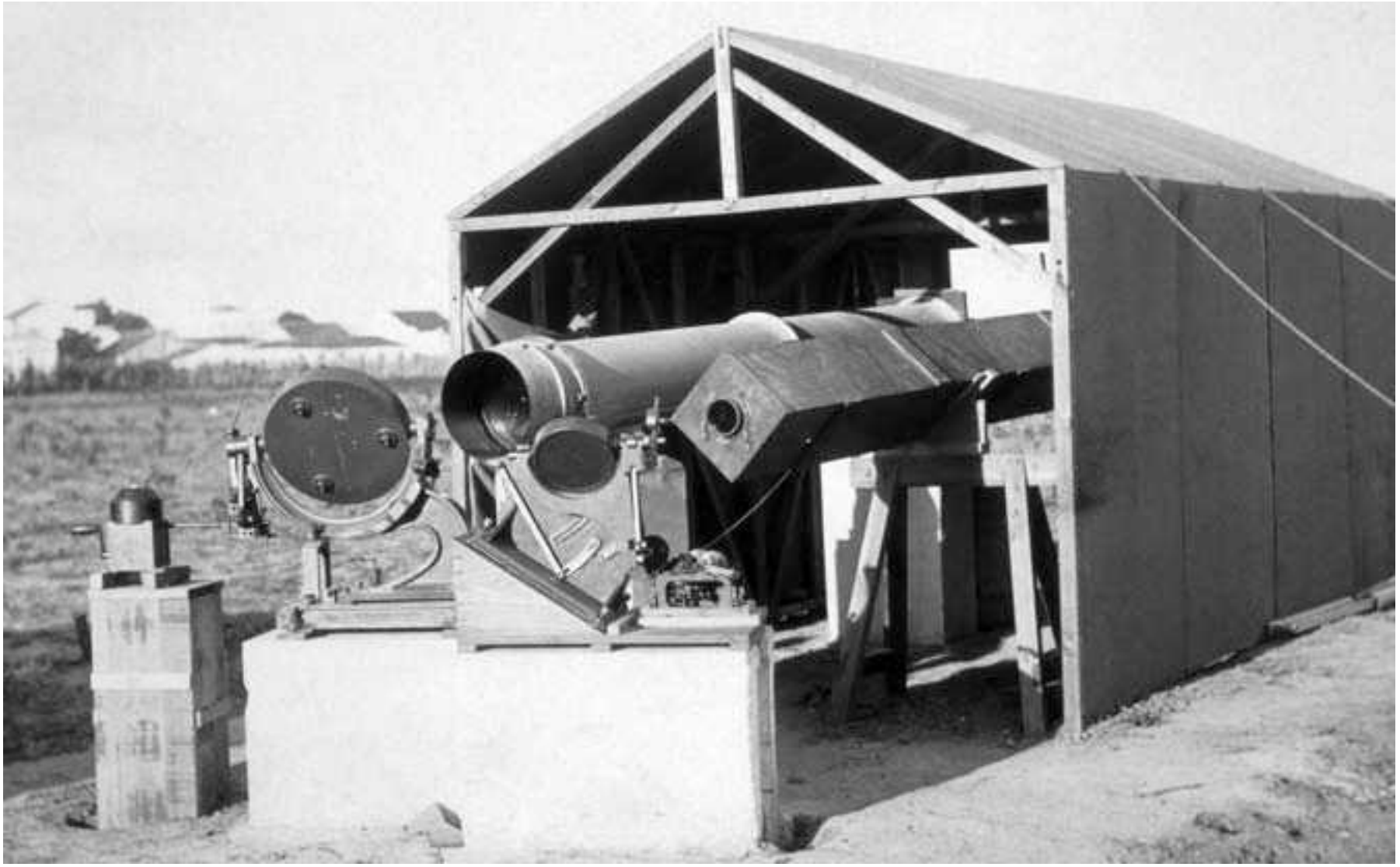
Sir Arthur S. Eddington
(1882-1944)

The Royal Astronomer

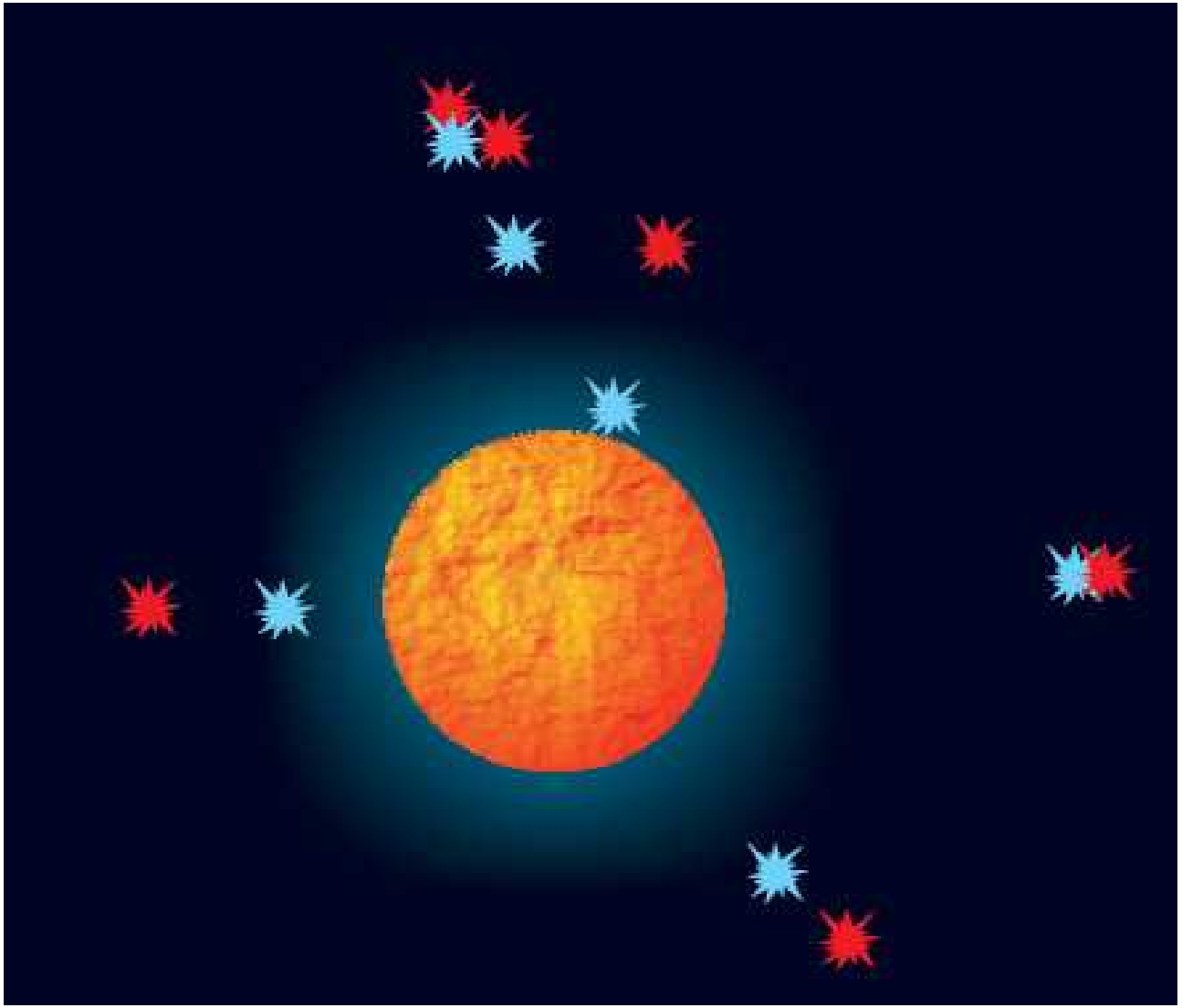


Frank Watson Dyson
(1868-1939)

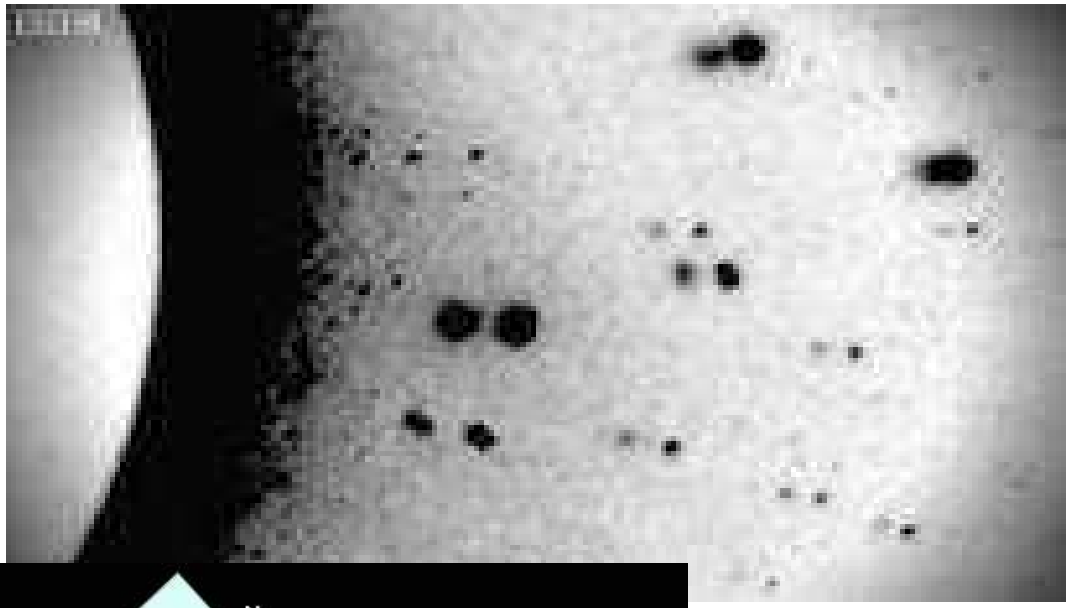
The 4" astrograph f=5.8 m in Sobral

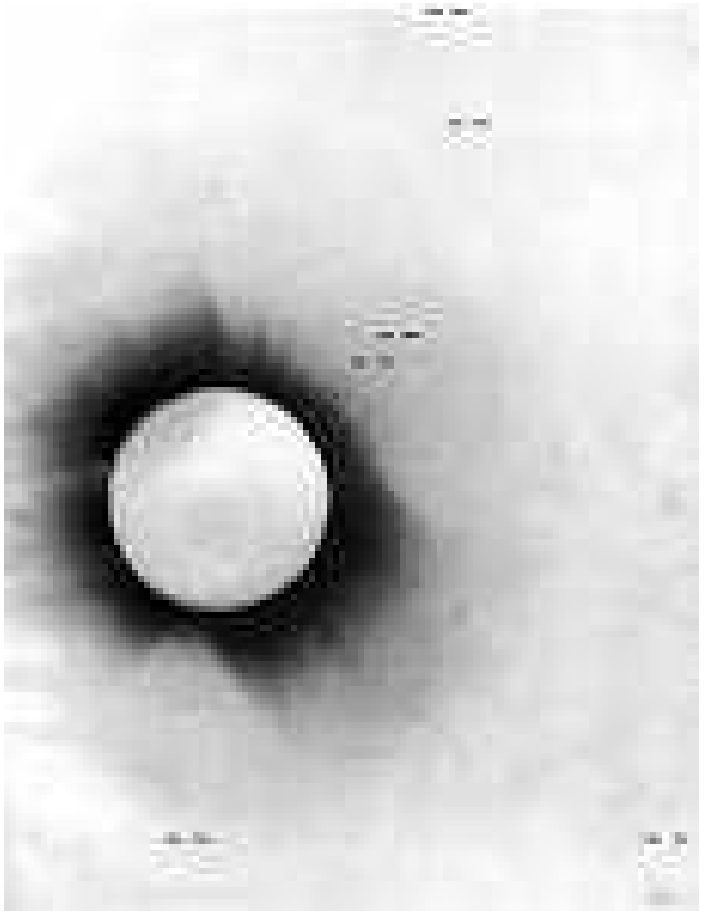


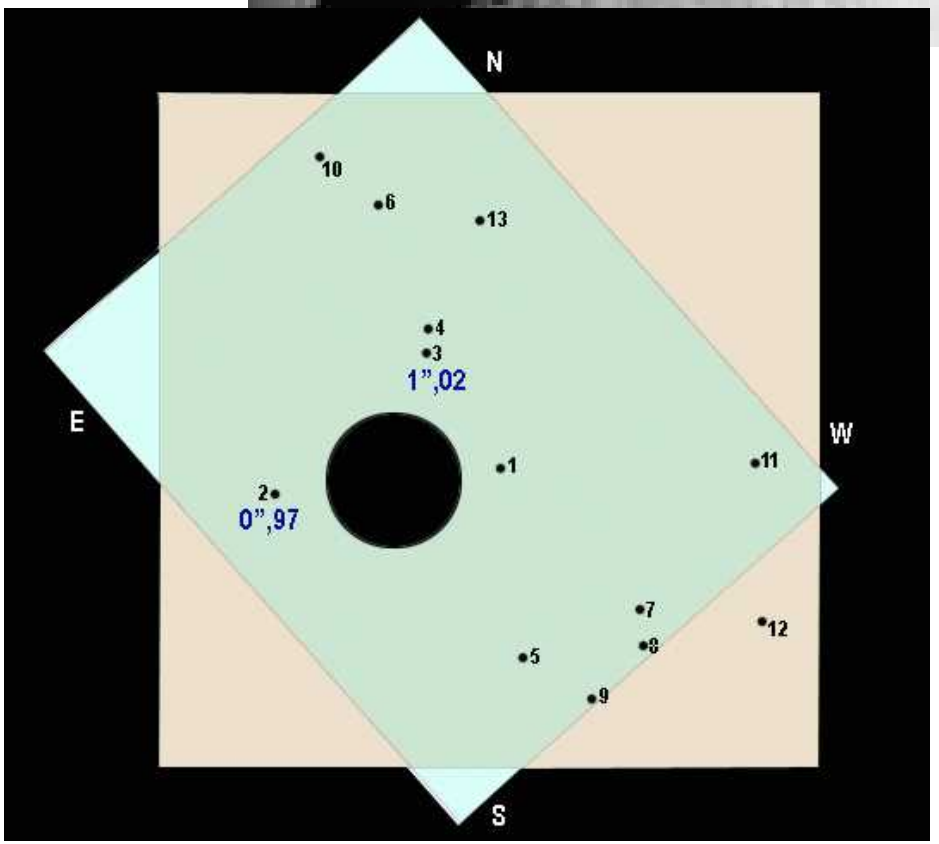
Light deflection around the solar gravitational field



The continuum of the photo vs discrete pixels







Same data re-analyzed in 1979

A comparison of data		
Instrument	**1919 result**	**1979 result**
4-inch lens	1.98″ ± 0.18″	1.90″ ± 0.11″
Astrographic lens	0.93″	1.55″ ± 0.34″

Few other eclipses used to confirm the 1919 observation (D. Sciama, 1979)

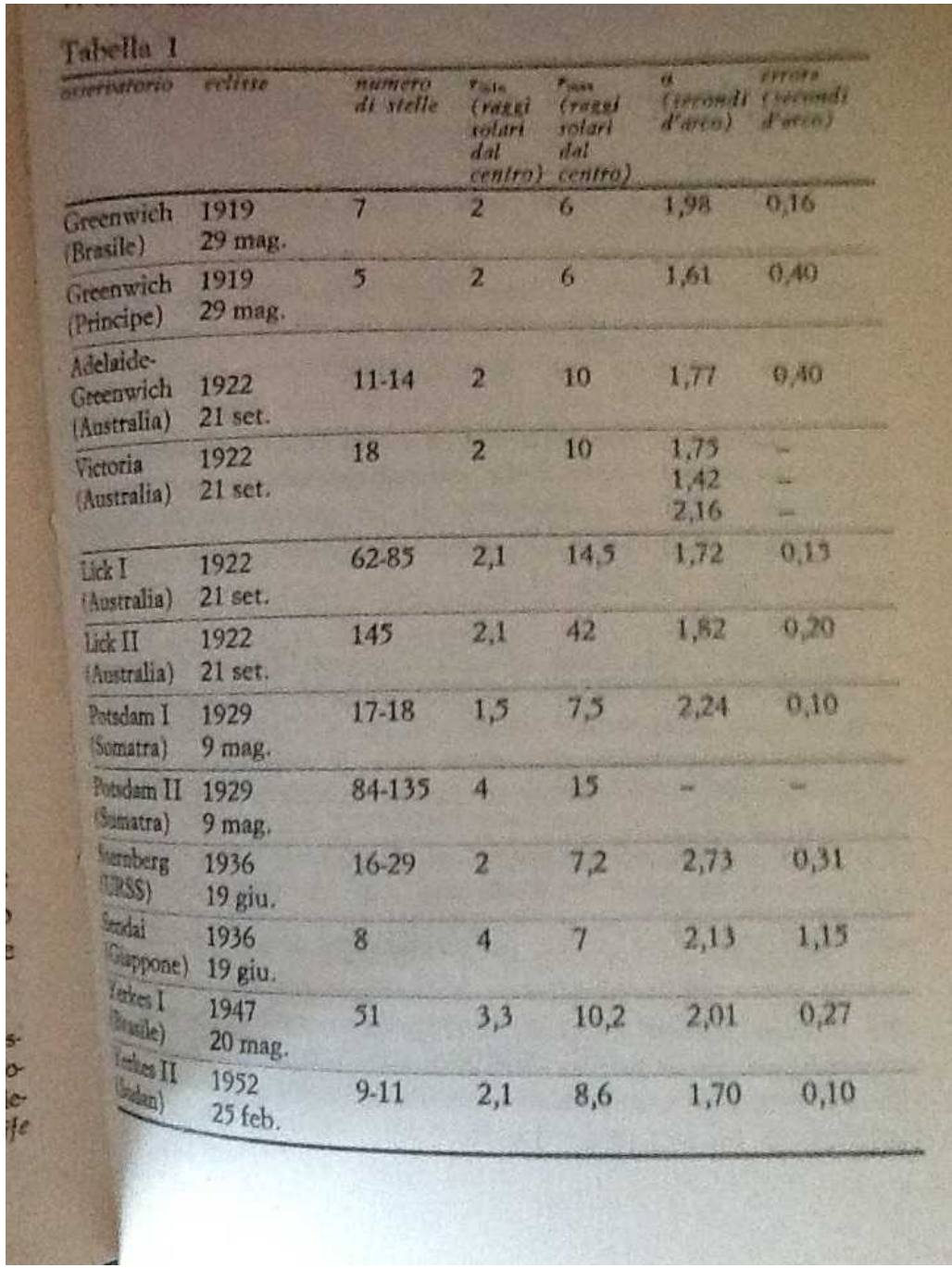
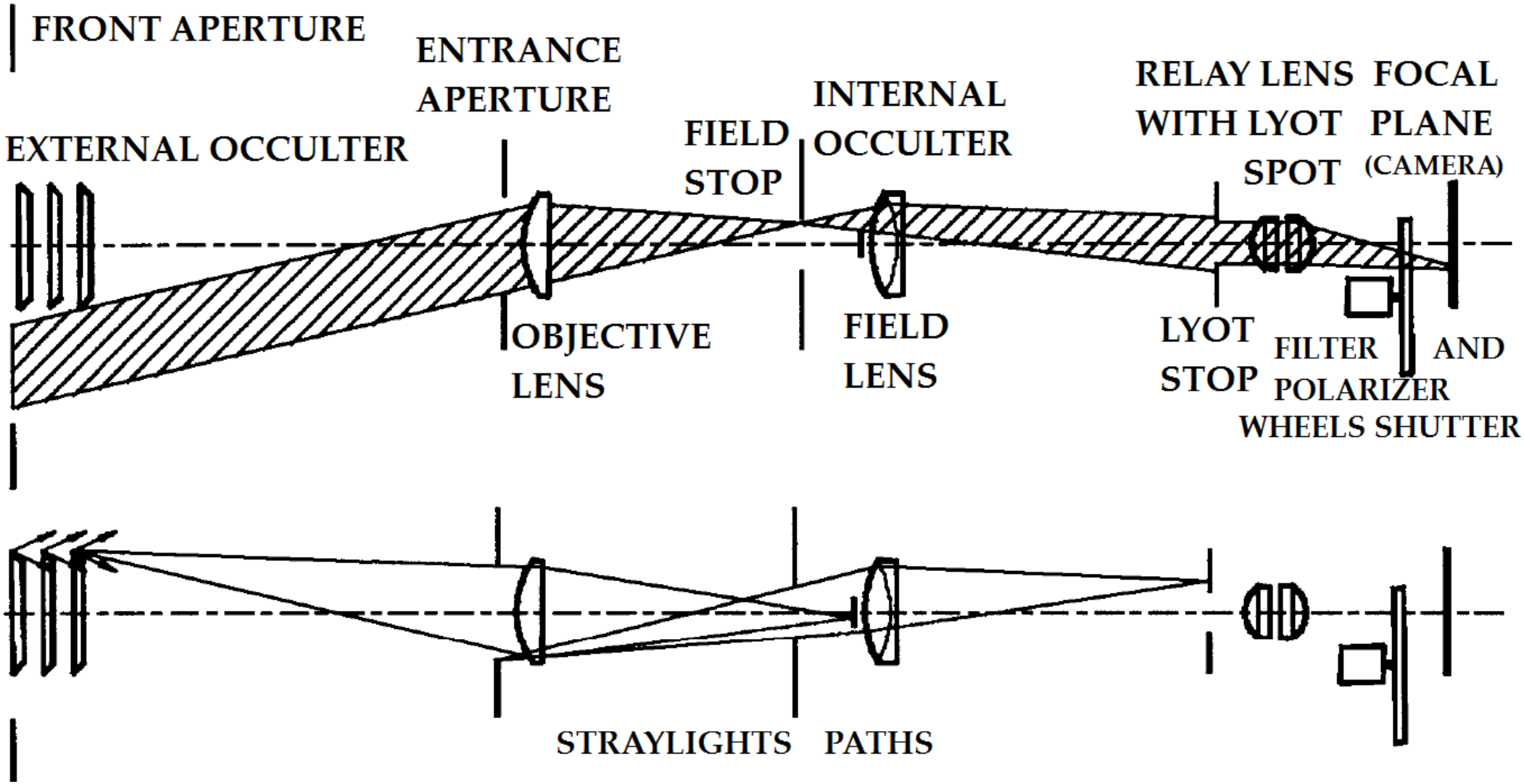


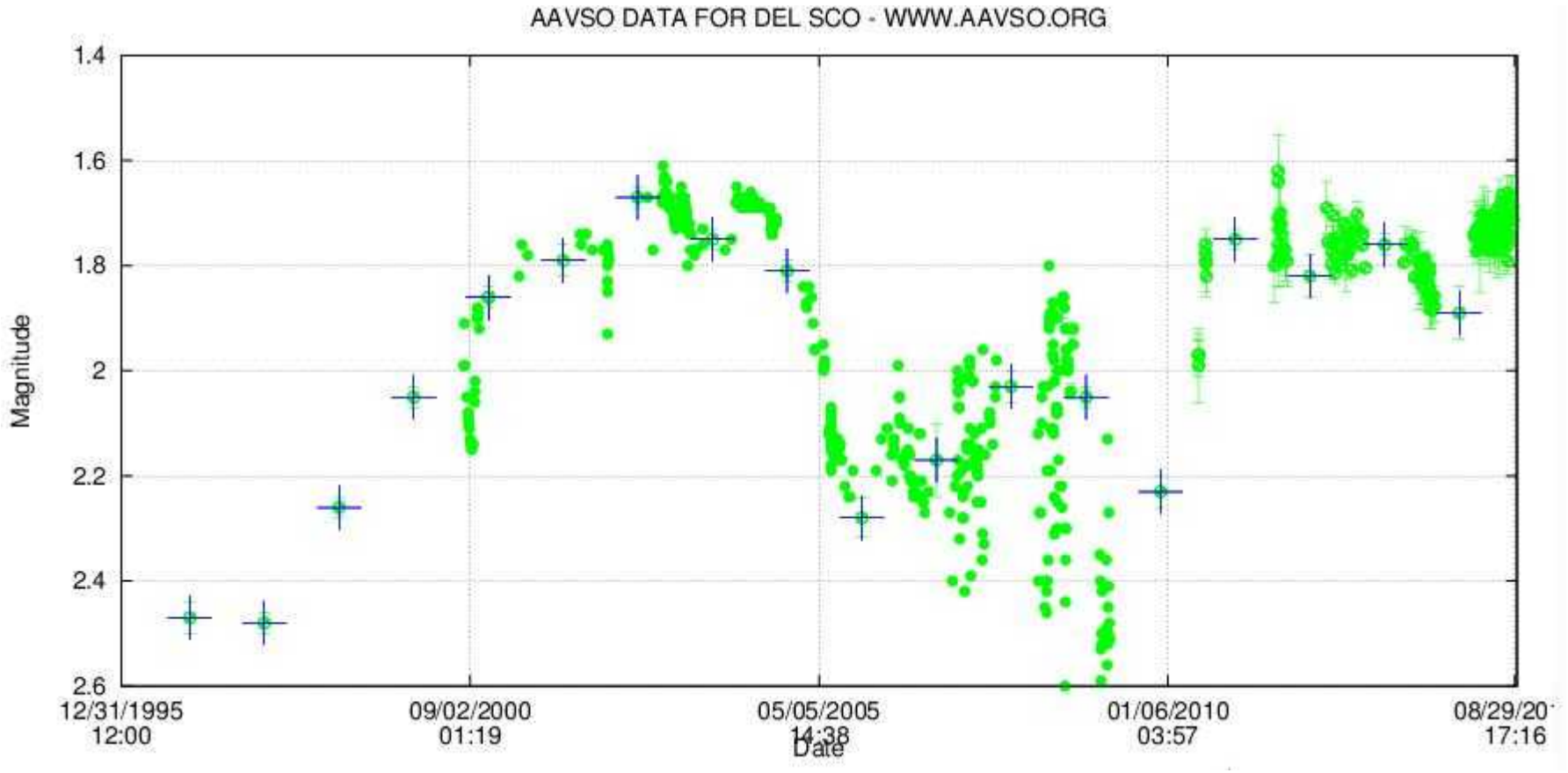
Tabella 1

osservatorio	eclisse	numero di stelle	r_{oss} (raggi solari dal centro)	r_{teo} (raggi solari dal centro)	α (secondi d'arco)	errore (secondi d'arco)
Greenwich (Brasile)	1919 29 mag.	7	2	6	1,98	0,16
Greenwich (Principe)	1919 29 mag.	5	2	6	1,61	0,40
Adelaide-Greenwich (Australia)	1922 21 set.	11-14	2	10	1,77	0,40
Victoria (Australia)	1922 21 set.	18	2	10	1,75 1,42 2,16	– – –
Lick I (Australia)	1922 21 set.	62-85	2,1	14,5	1,72	0,13
Lick II (Australia)	1922 21 set.	145	2,1	42	1,82	0,20
Potsdam I (Sumatra)	1929 9 mag.	17-18	1,5	7,5	2,24	0,10
Potsdam II (Sumatra)	1929 9 mag.	84-135	4	15	–	–
Nizhnyi Novgorod (URSS)	1936 19 giu.	16-29	2	7,2	2,73	0,31
Sendai (Giappone)	1936 19 giu.	8	4	7	2,13	1,15
Yerkes I (Brasile)	1947 20 mag.	51	3,3	10,2	2,01	0,27
Yerkes II (Sudan)	1952 25 feb.	9-11	2,1	8,6	1,70	0,10

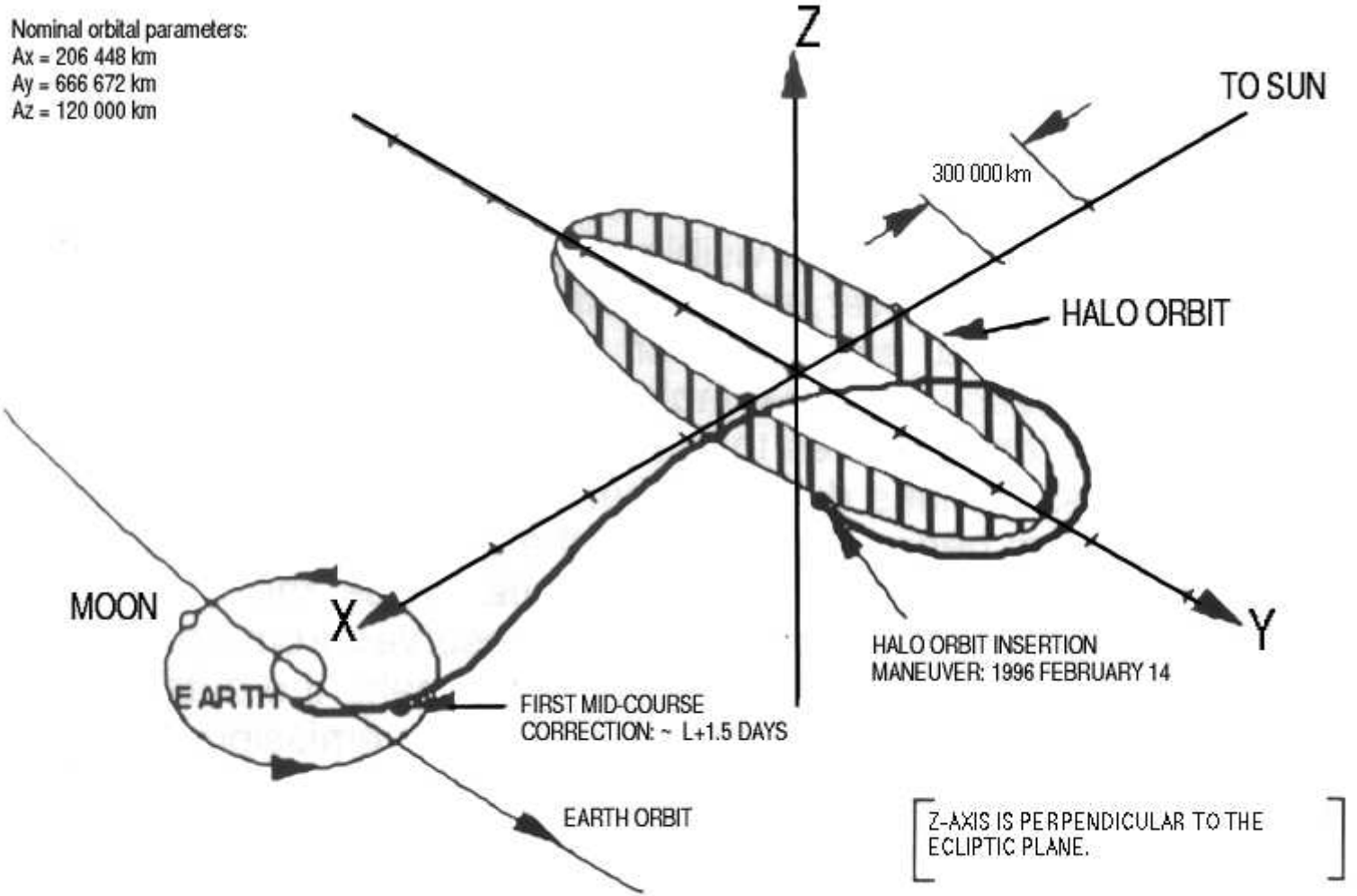
SOHO coronographs C2 and C3



Already used for monitoring del Sco near the conjunction with the Sun

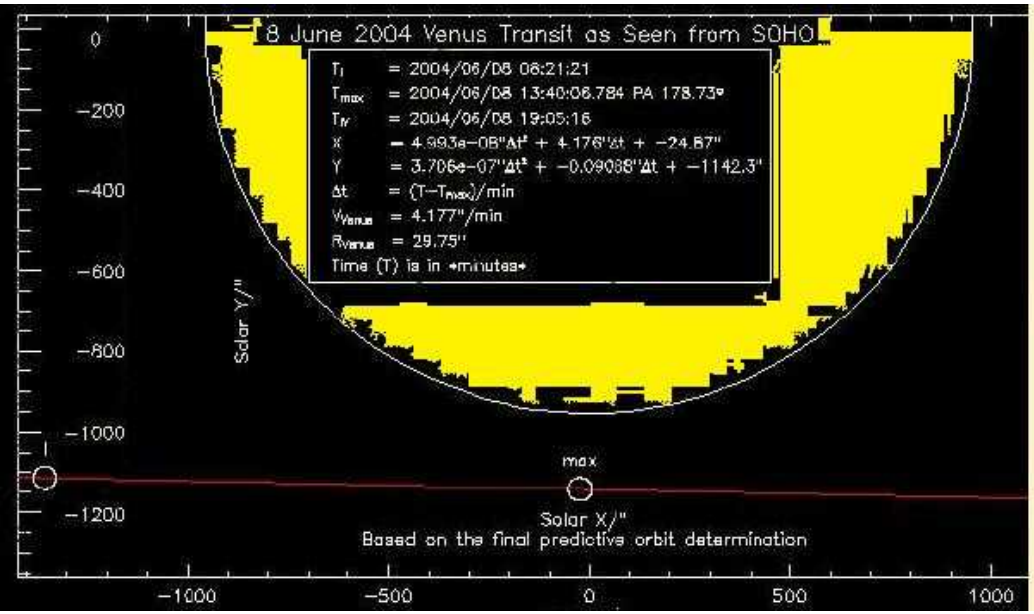


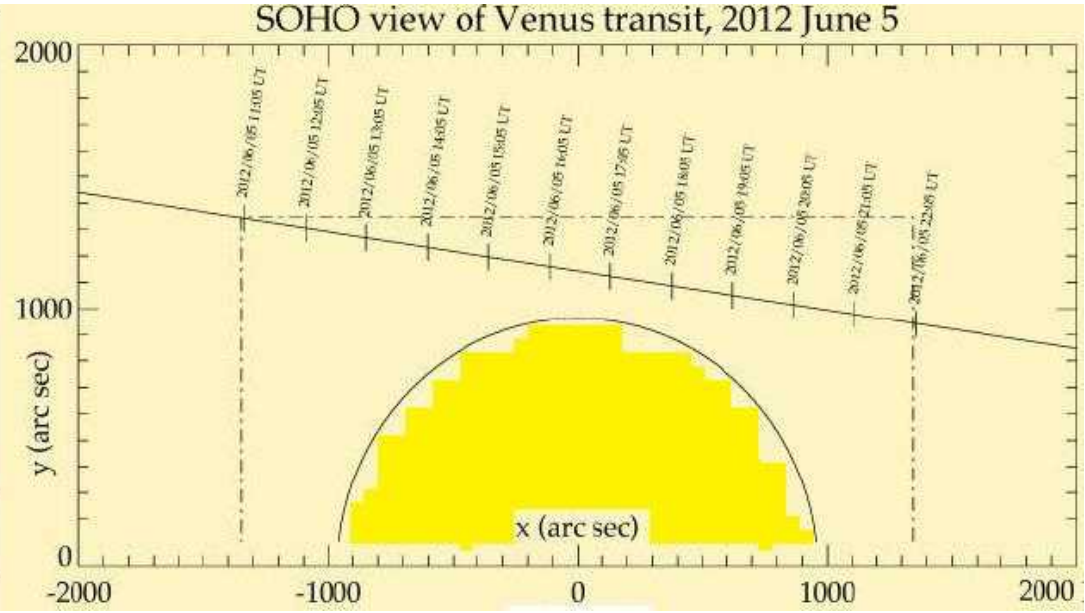
The field of view from L1 Lagrangian Point is not exactly the same of the Earth

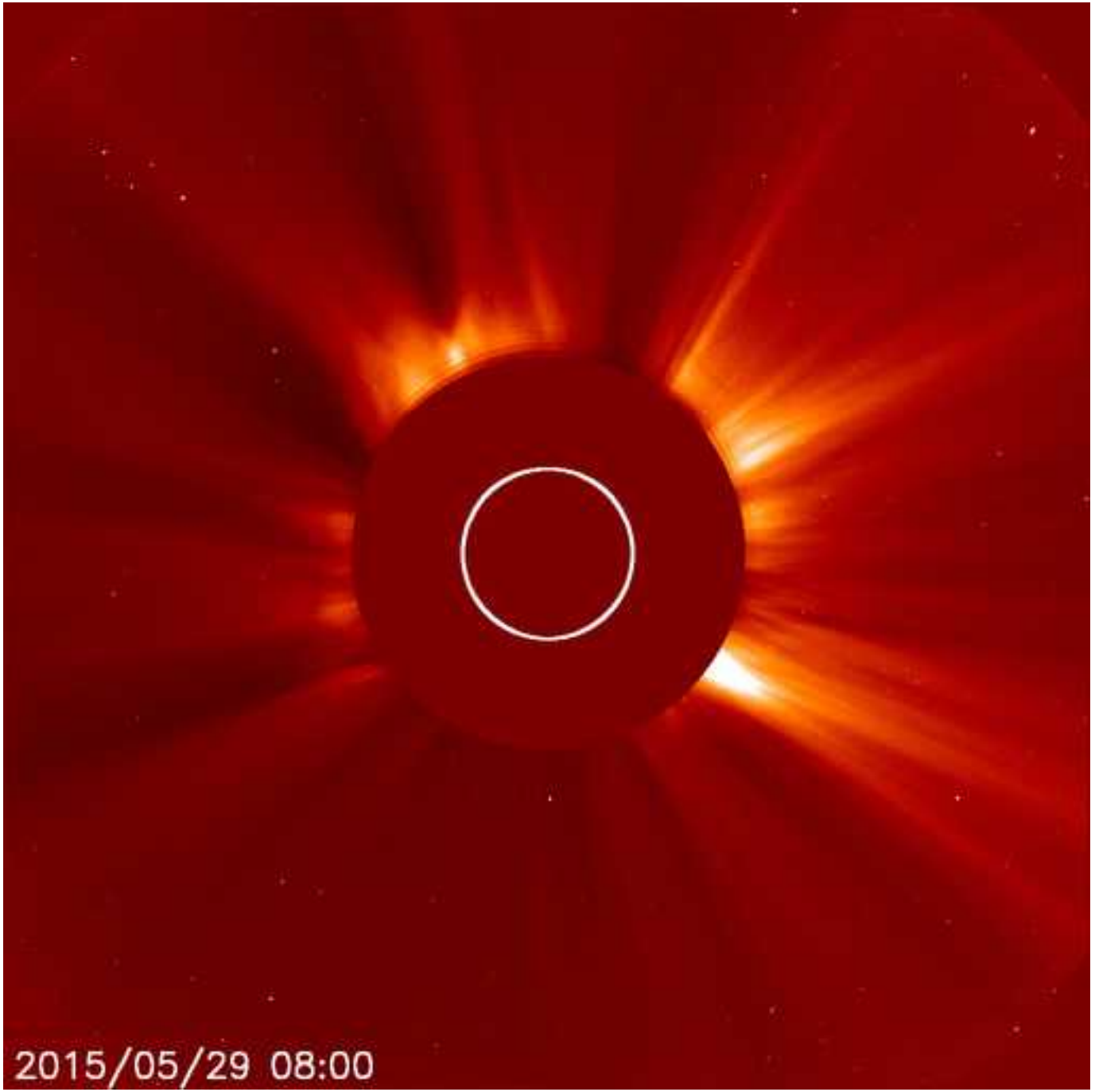


SOHO orbit schematic

e.g. Venus transits missed from L1 halo orbit of SOHO



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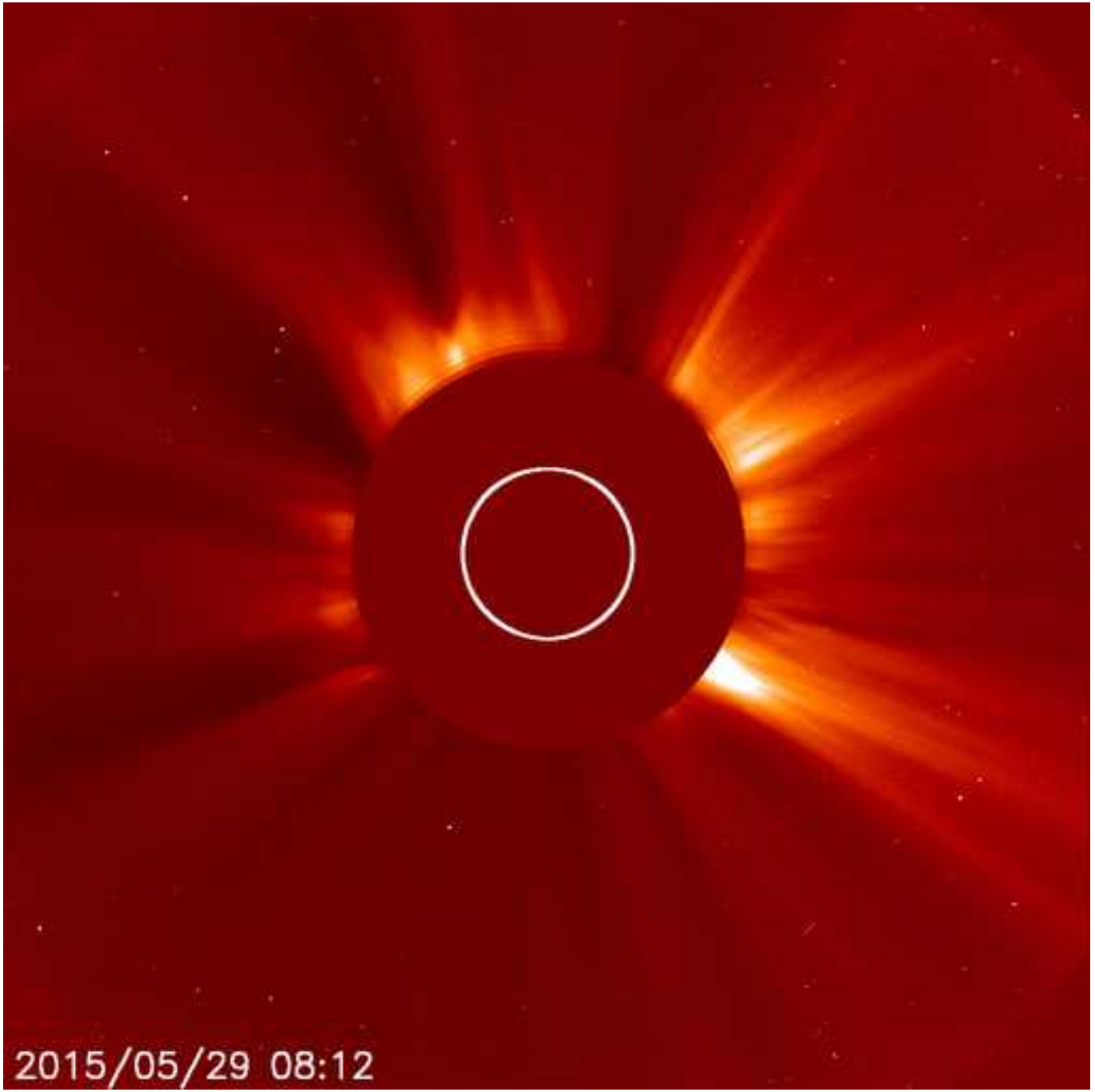
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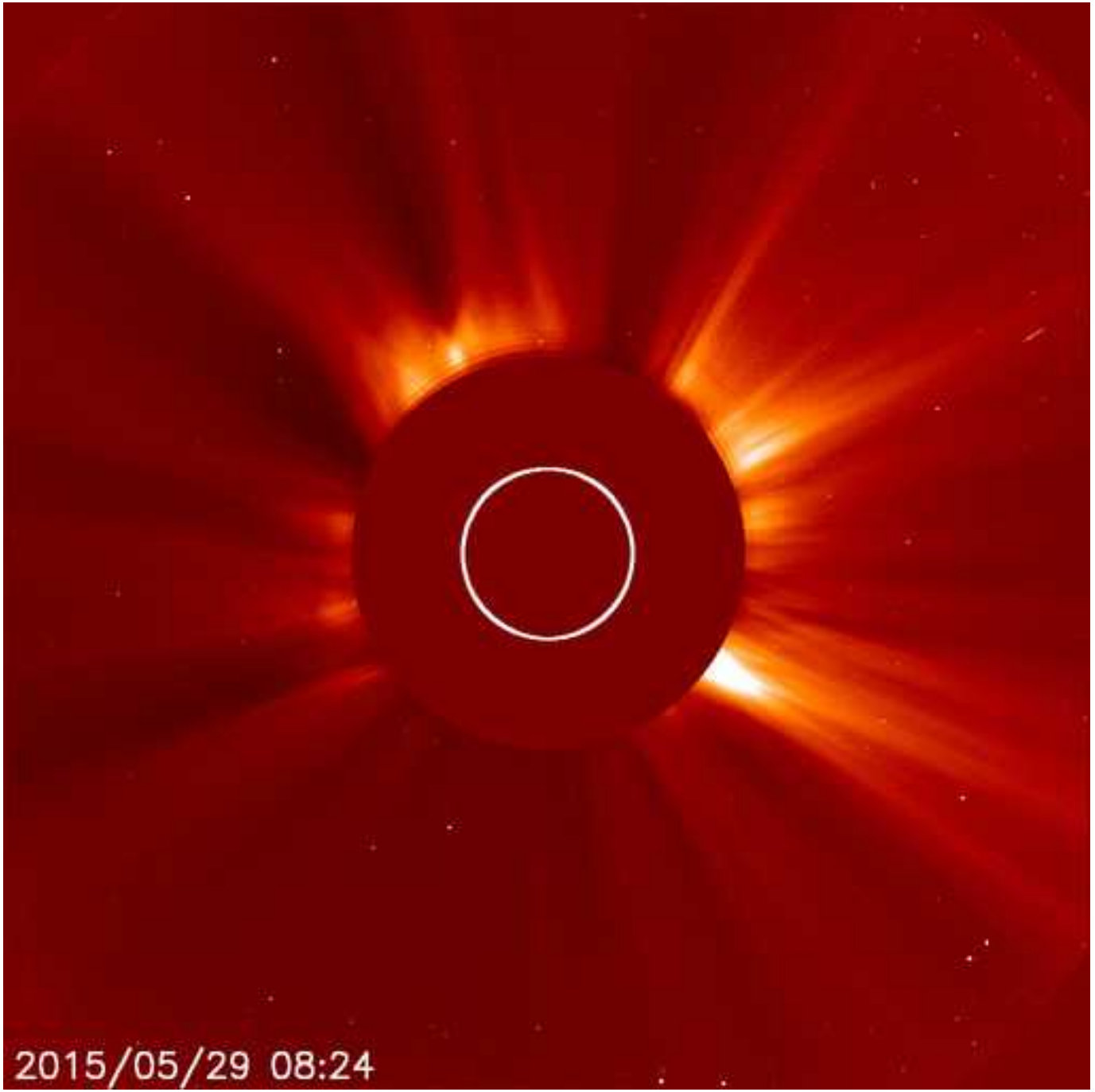
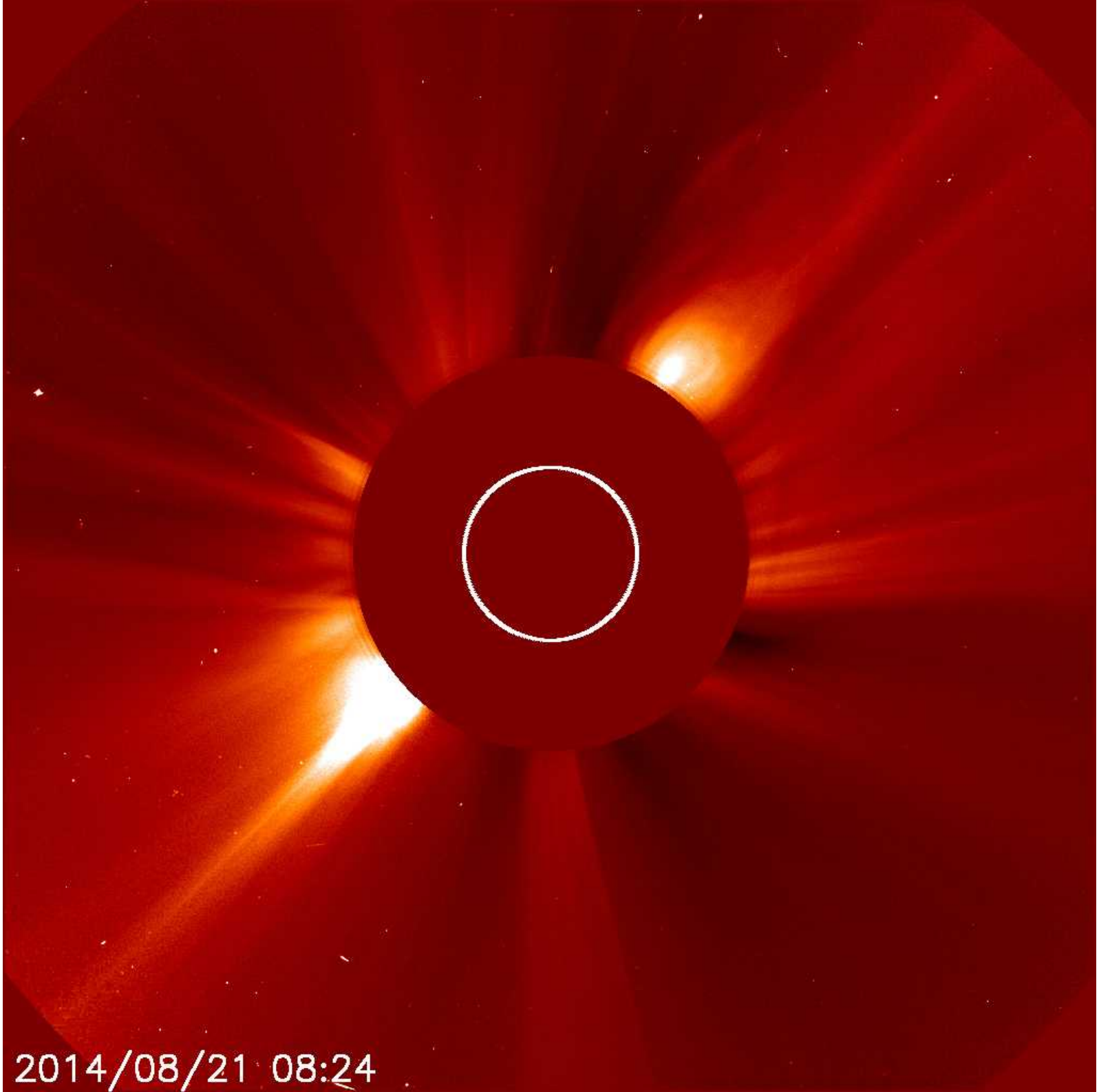
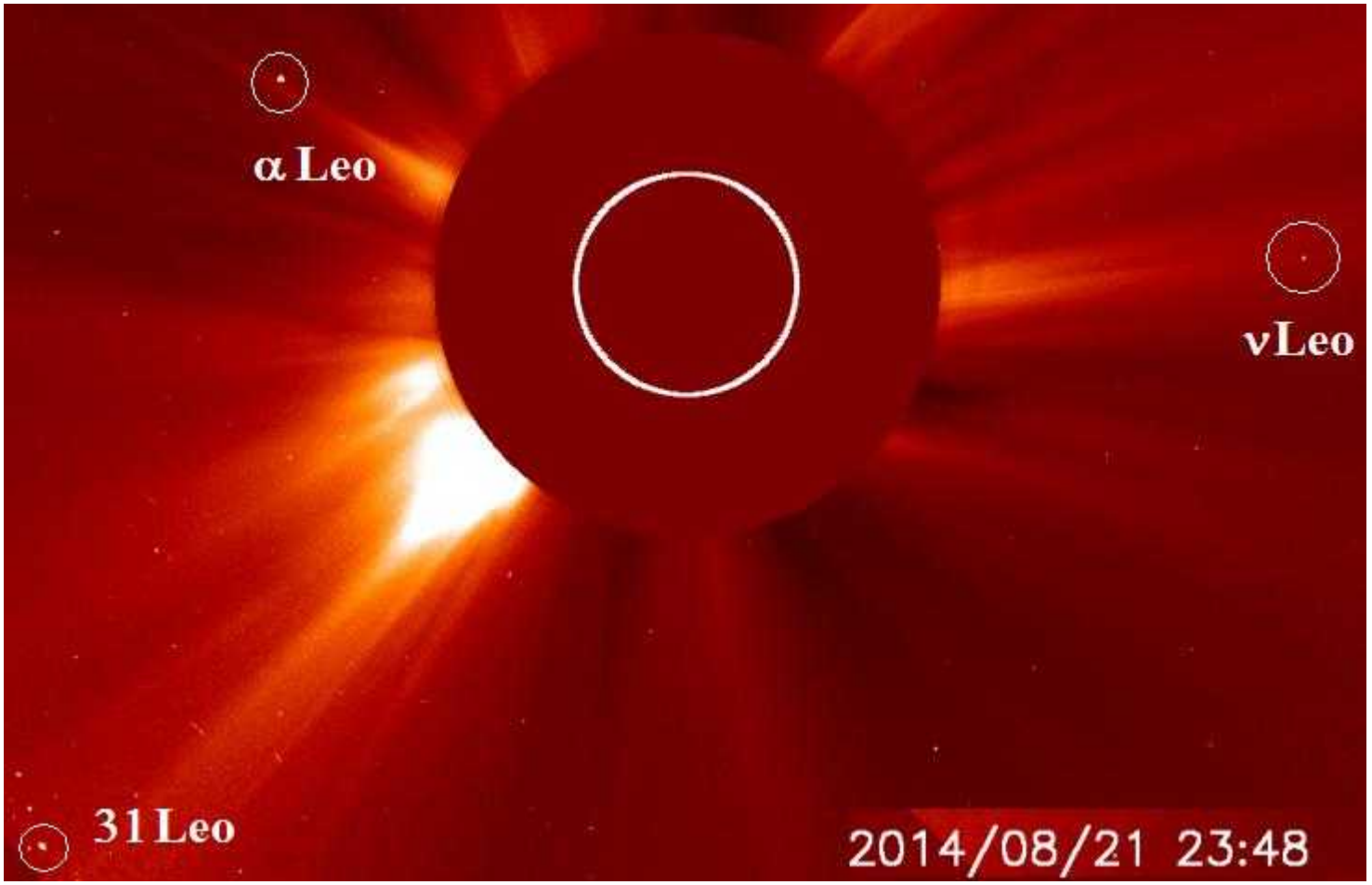

2015/05/29 08:24

Regulus

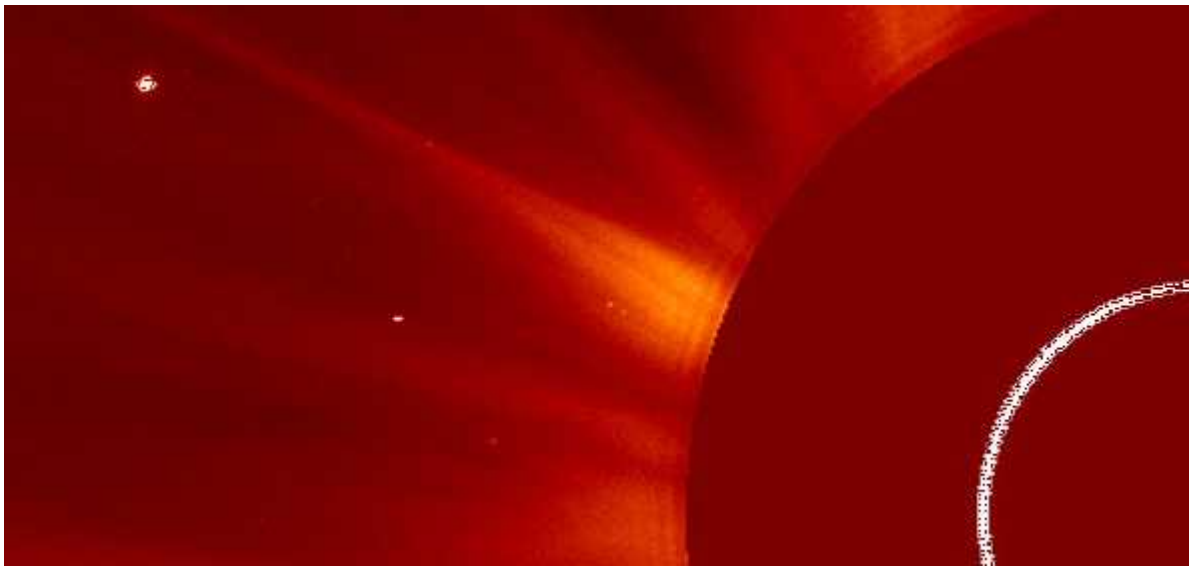
field
21-24
Aug
2014

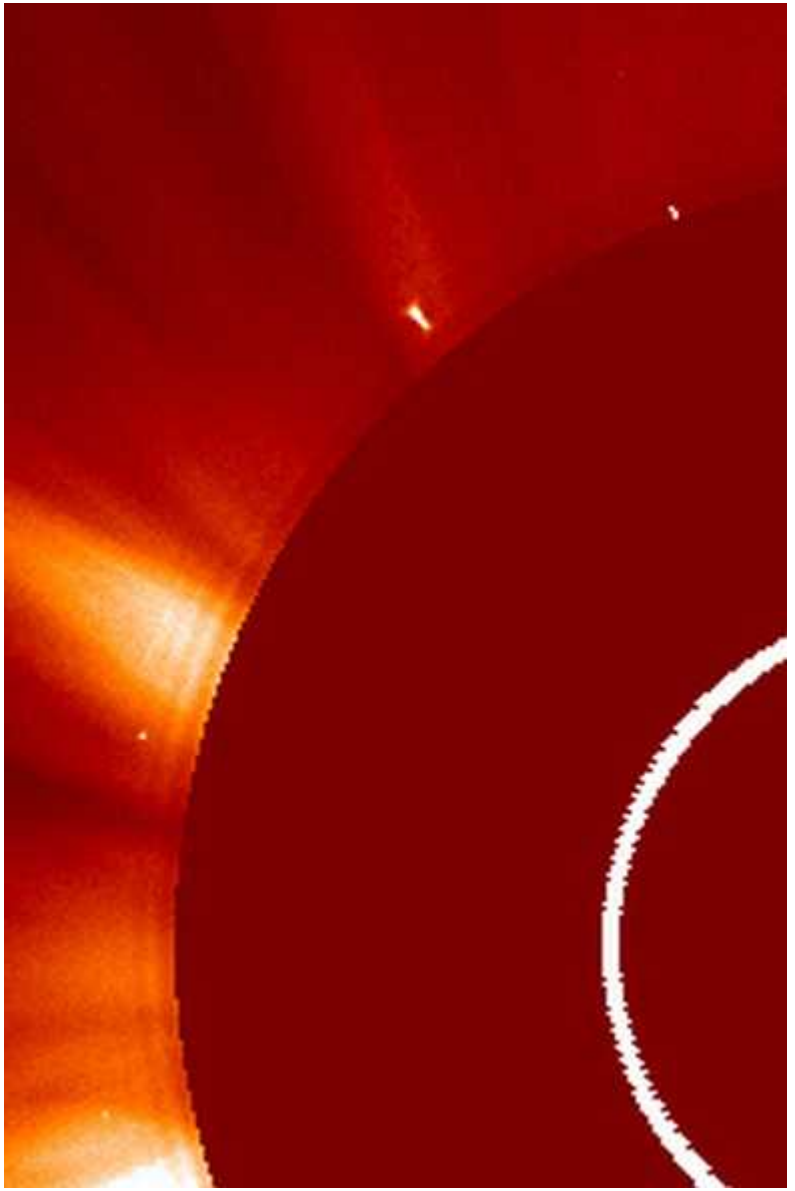


Differential astrometry

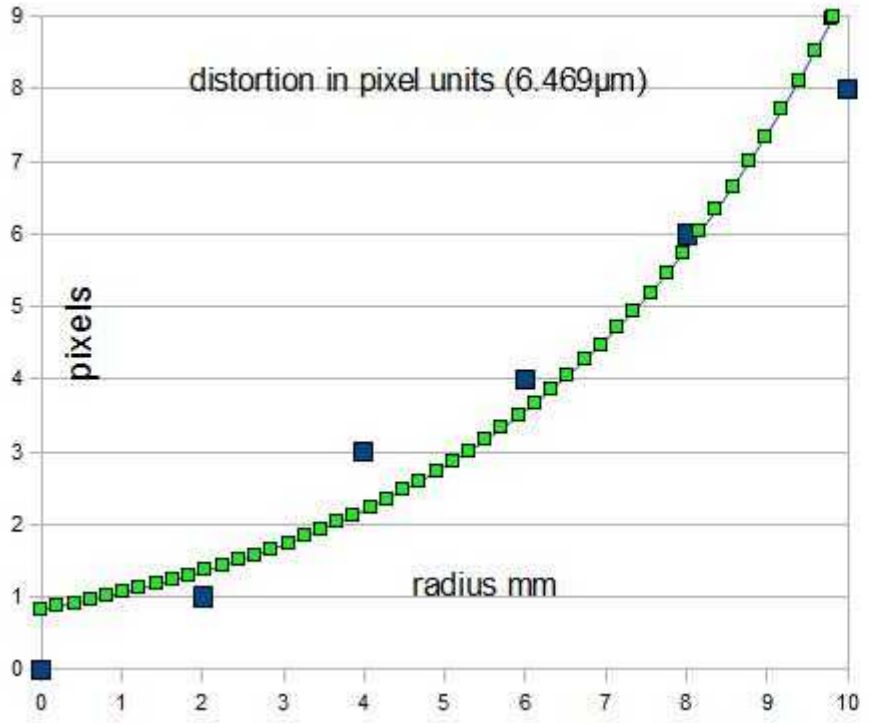


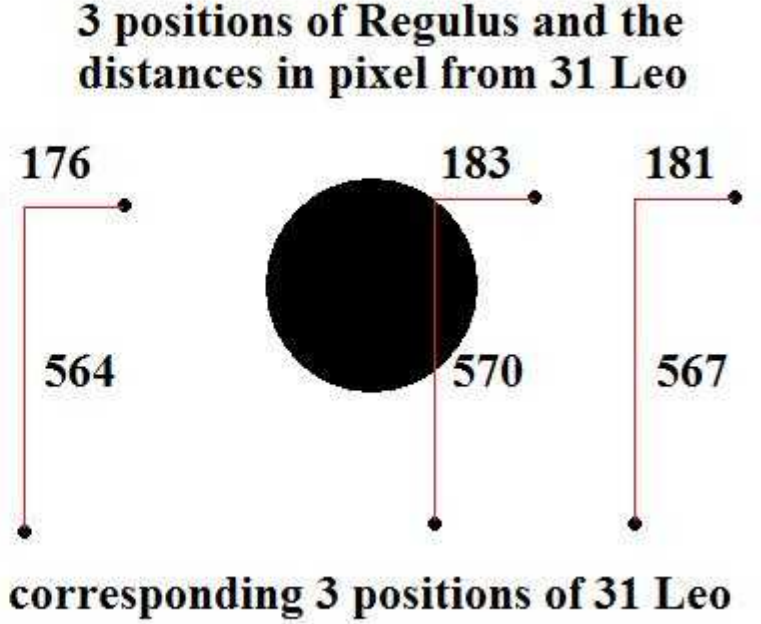
Pixel scale (11.91±0.08)"/px (12.09"/px from drift due to halo orbit) and PSF distortion (by diffraction)





Barrel-like deformation + central diffraction





Lack of « night sky vision » there is always the Sun at the center of the FOV

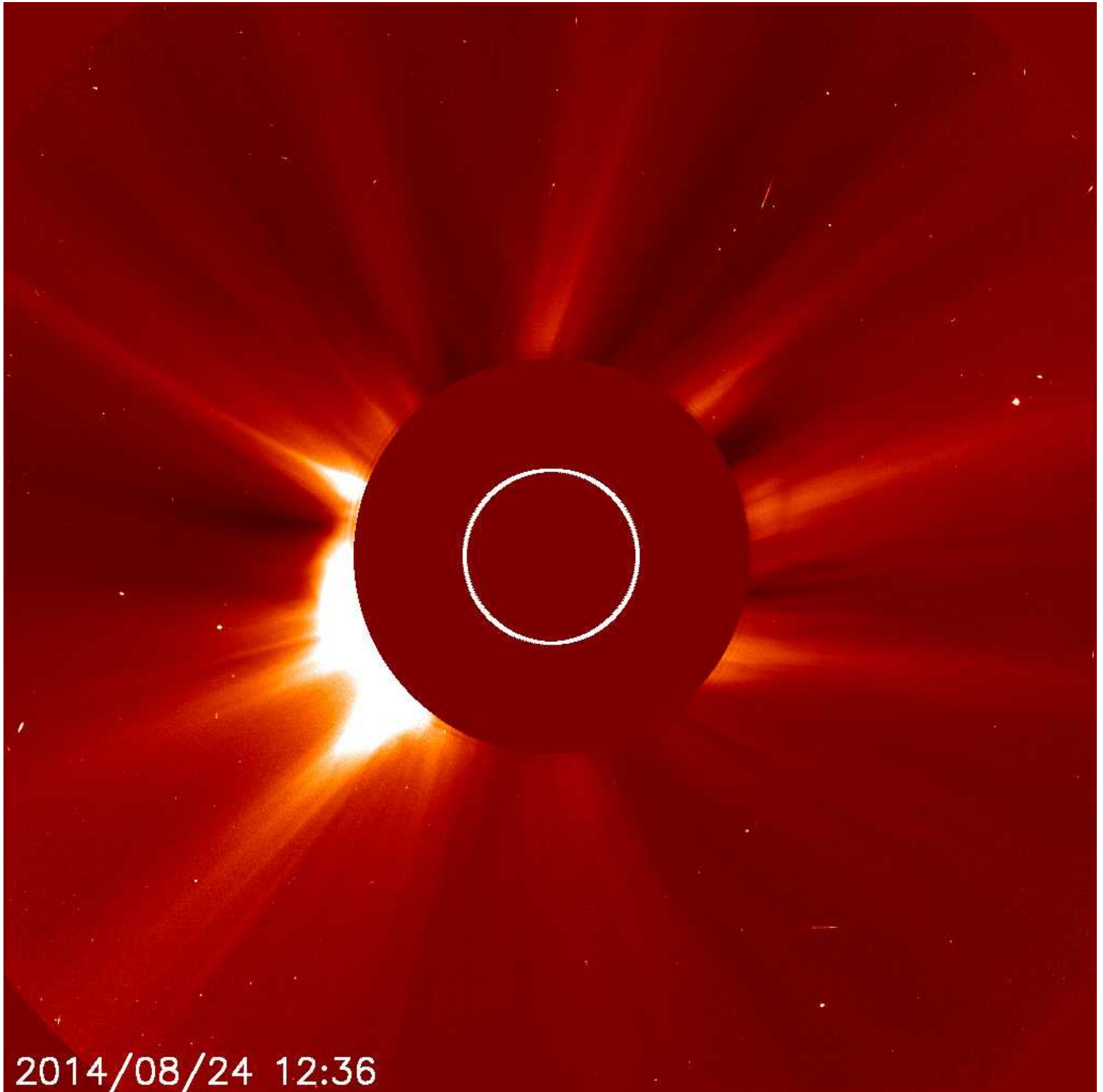
To get a sufficient resolution it would be needed 0.1 pixels, but also the absence of the Sun as a control, like in the Eddington's experiment

The constant pointing of SOHO to the Sun does not allow this comparison, but it could be done, in principle

« side effects of our experiment »

Cosmic Rays (3 images at least required to distinguish stars from hot pixels or CR)

Coronal Mass Ejections, triggered by Regulus :-)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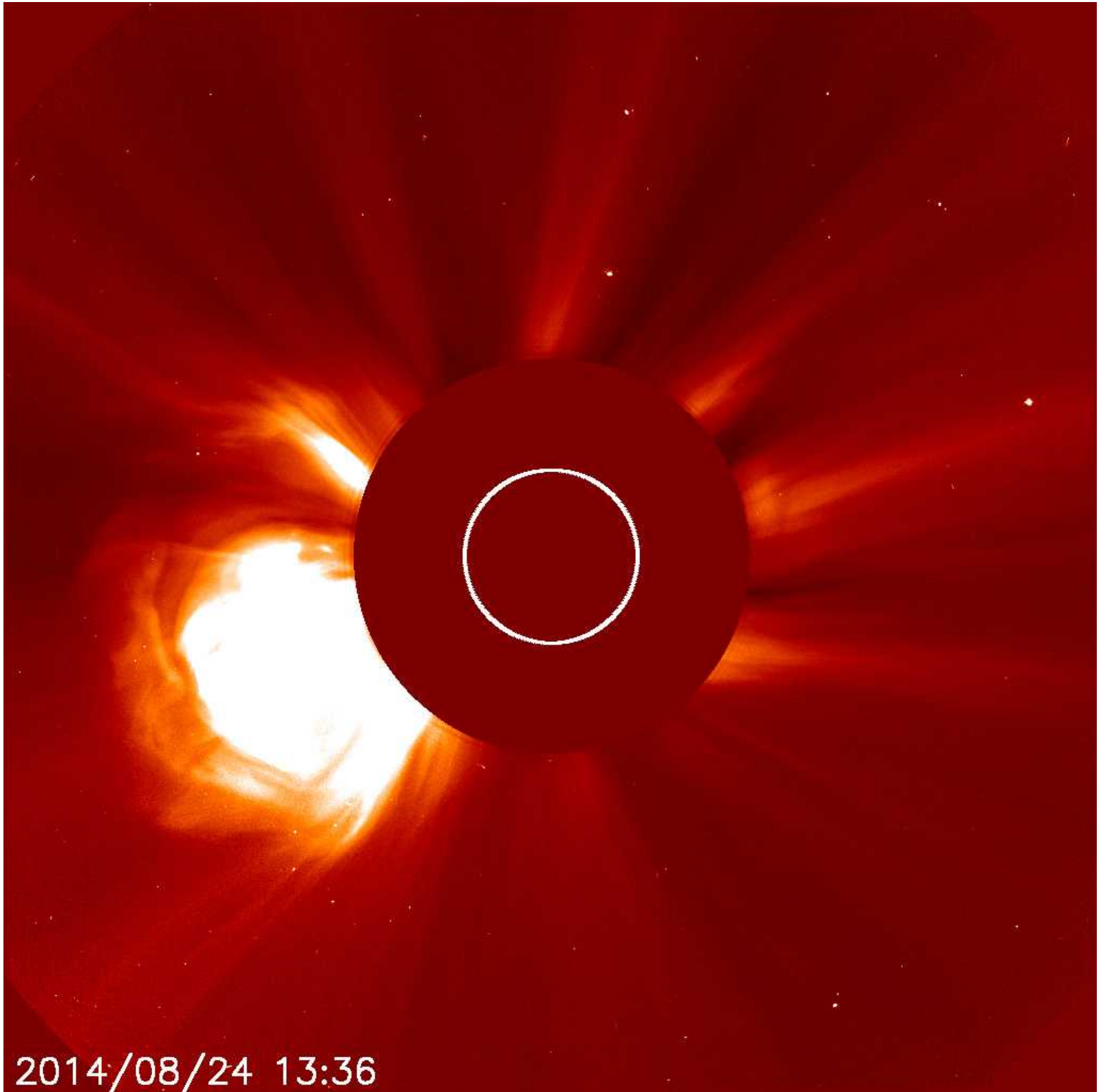
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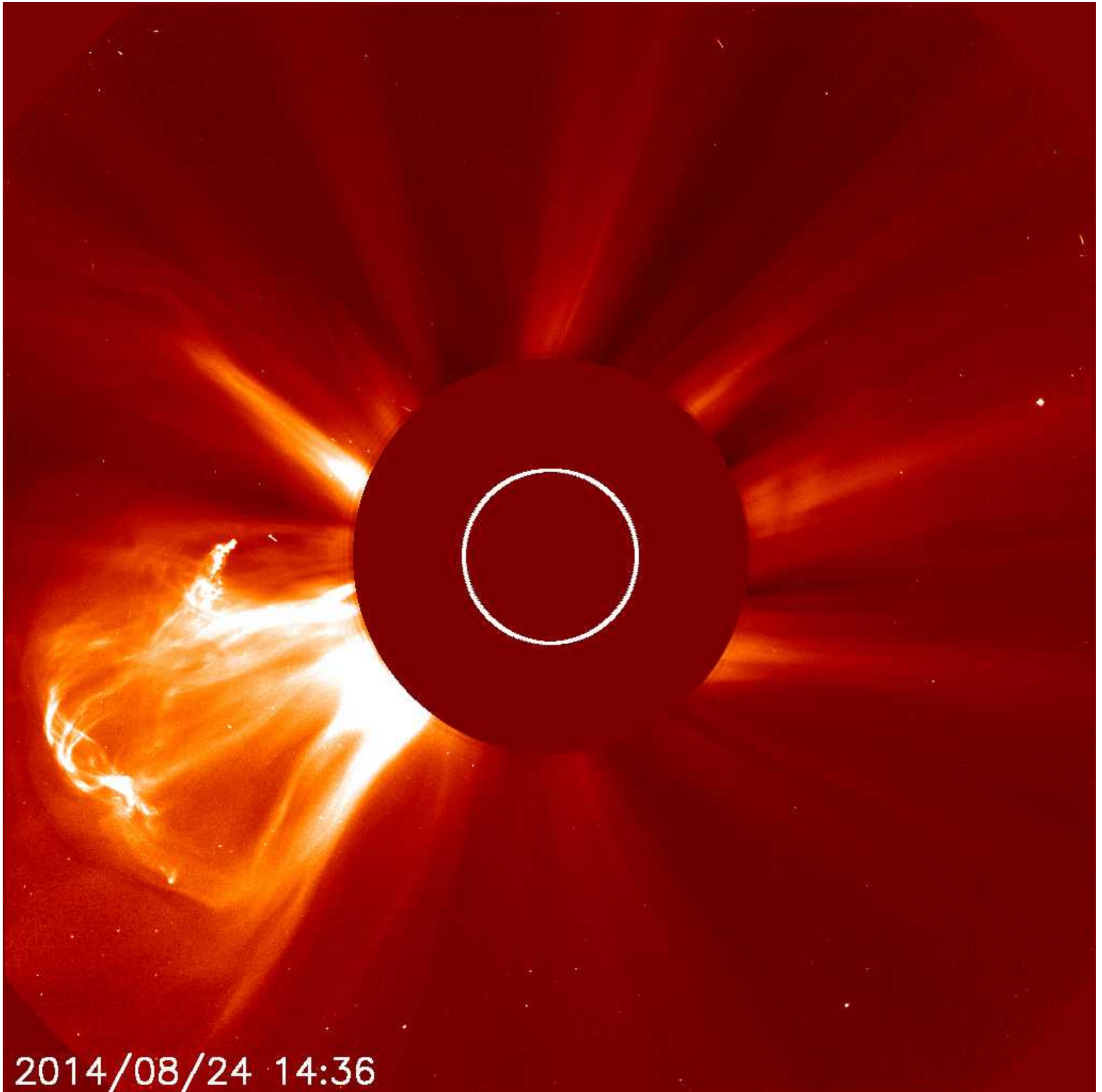
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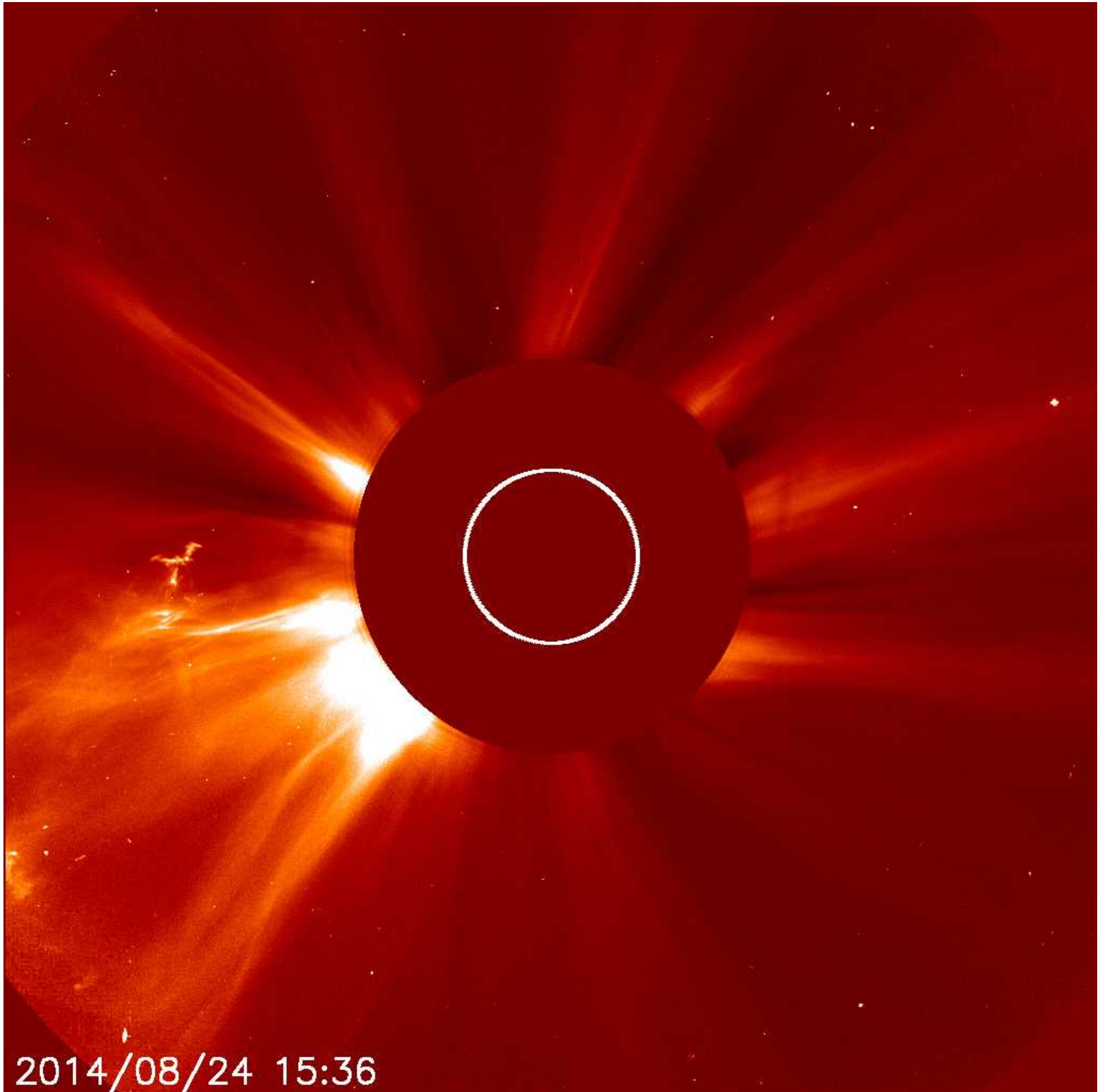
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