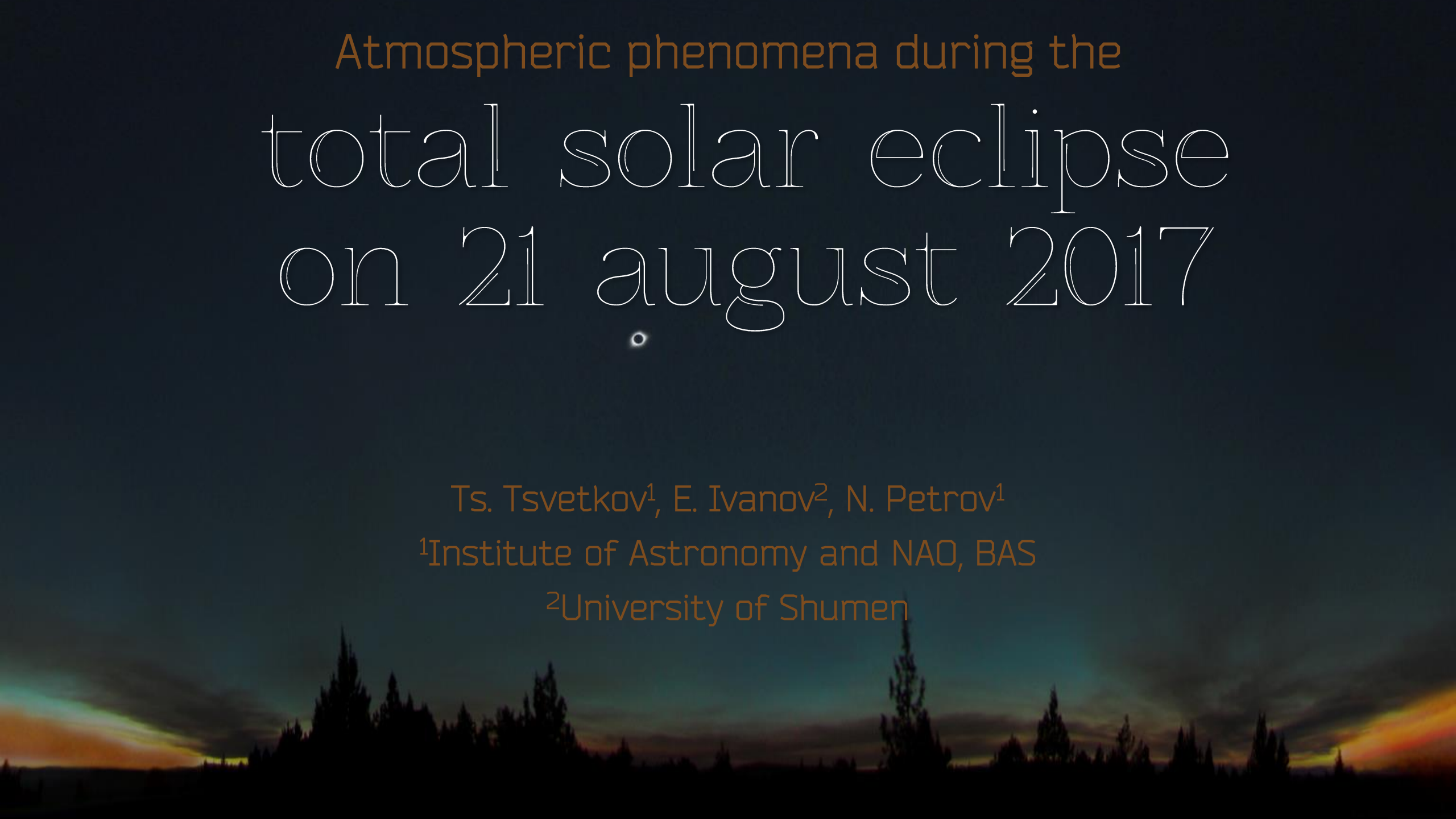




Atmospheric phenomena during the total solar eclipse on 21 august 2017

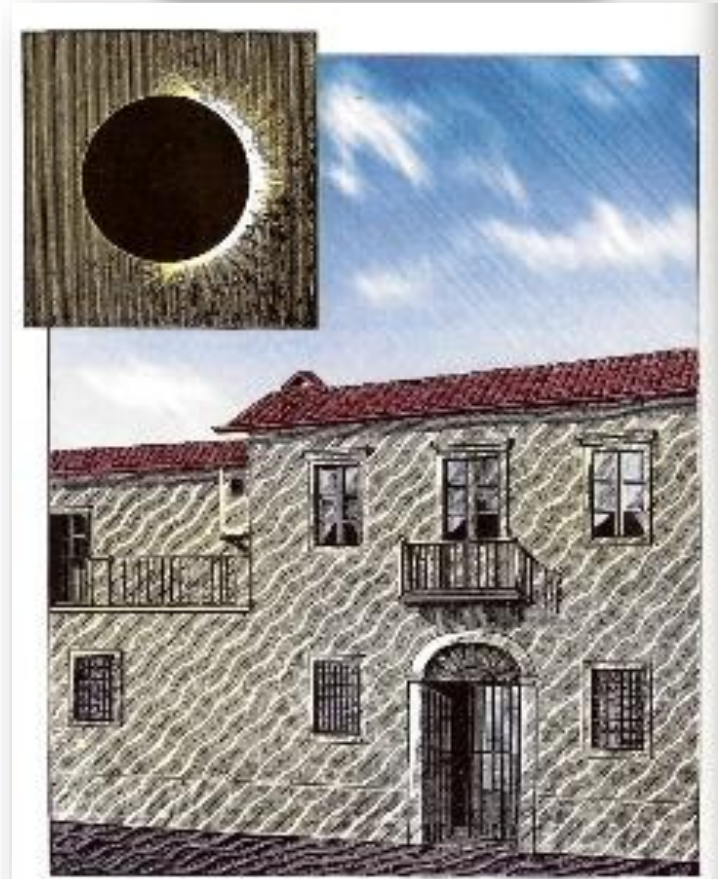
Ts. Tsvetkov¹, E. Ivanov², N. Petrov¹

¹Institute of Astronomy and NAO, BAS

²University of Shumen

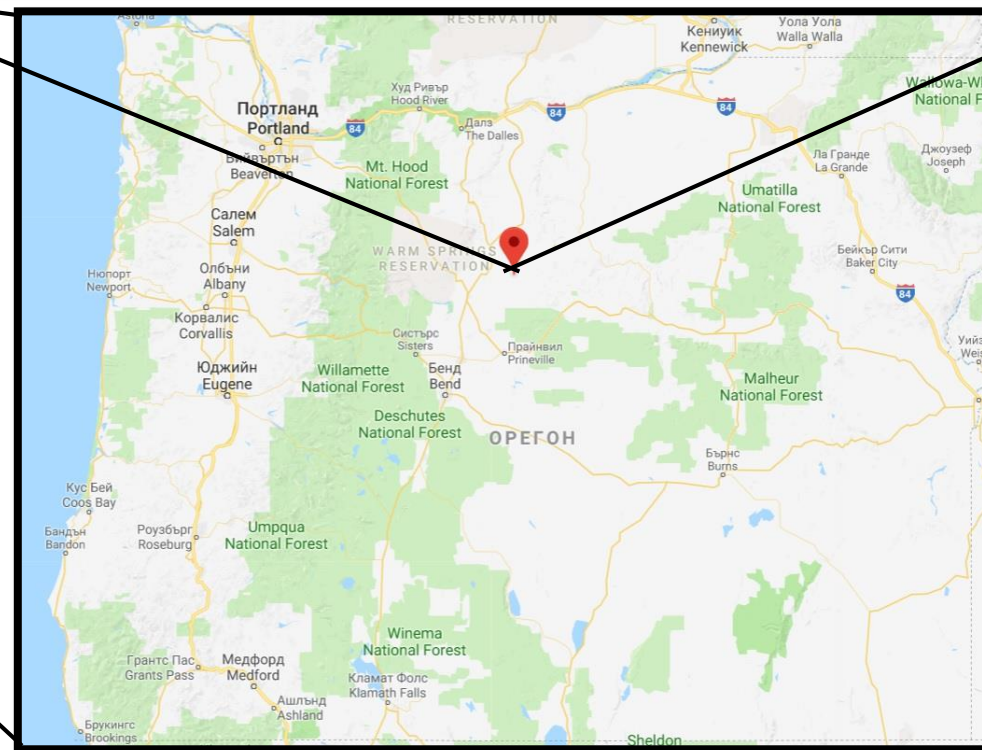
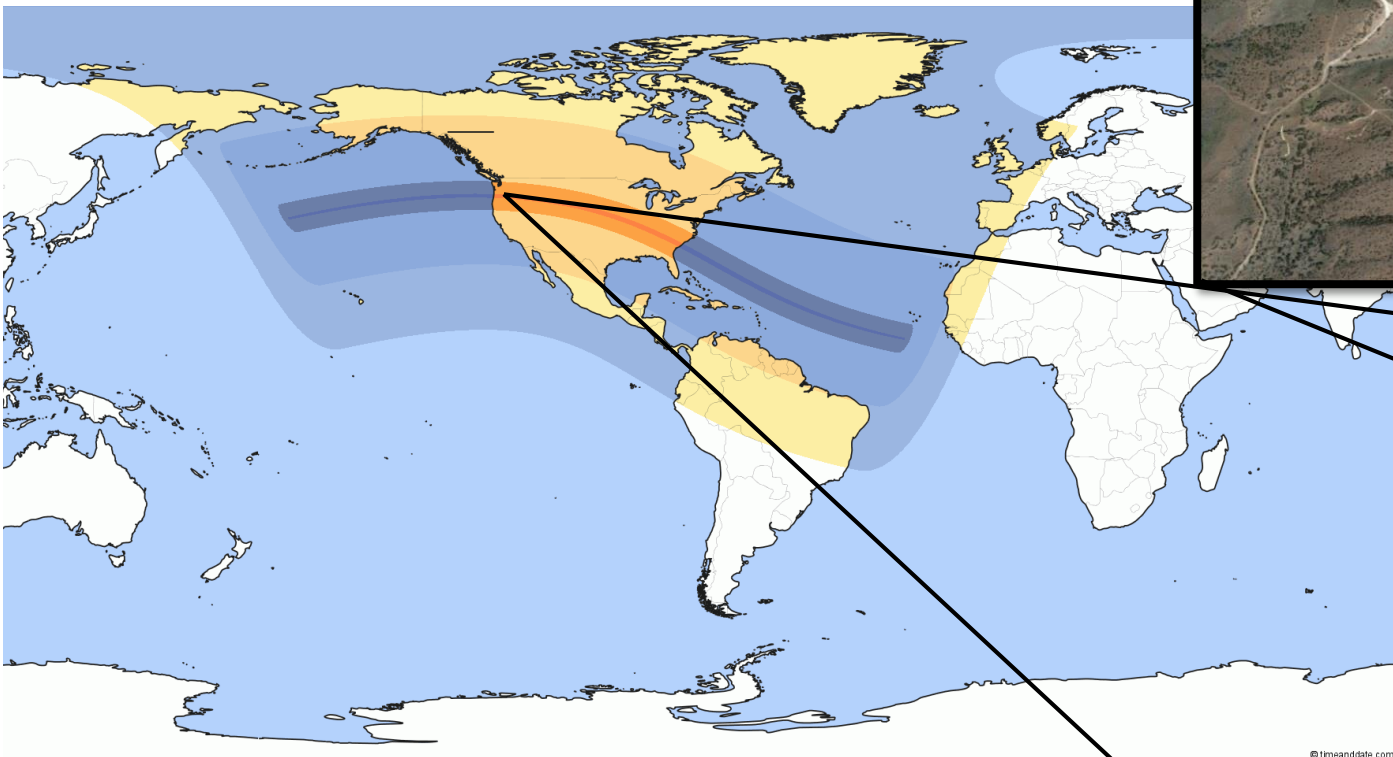
Contents*

- Location
- Eclipse details
- Equipment
- Photographing the eclipse:
 - Partial phases
 - Projected crescents
 - Diamond ring
 - Solar corona
- Wind velocity
- Shadow bands



*Some of the images may not appear properly in PDF version since they are originally GIF or video animations

Location



Ashwood, OR, USA

Location



Solar eclipse details

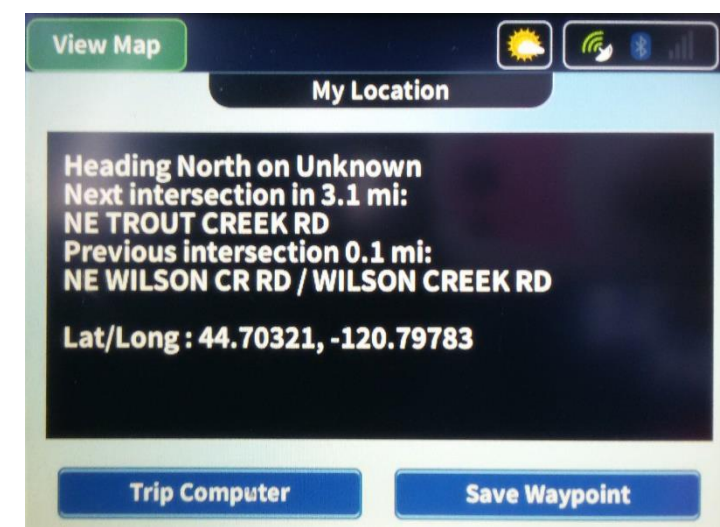
Path width: 101.0 km

Moon/Sun size ratio: 1.02700

Umbral velocity: 1.002 km s⁻¹

Total eclipse duration: 2m 04.1s

Eclipse duration: 2h 34m 35.8s



	Time (LT)	Altitude	Azimuth
Start of partial eclipse (C1):	09:07:04.2	+29.7°	103.3°
Start of total eclipse (C2):	10:20:04.1	+41.7°	119.6°
Maximum eclipse (MAX):	10:21:05.9	+41.9°	119.9°
End of total eclipse (C3):	10:22:07.9	+42.0°	120.2°
End of partial eclipse (C4):	11:41:40.0	+52.5°	144.6°

Equipment

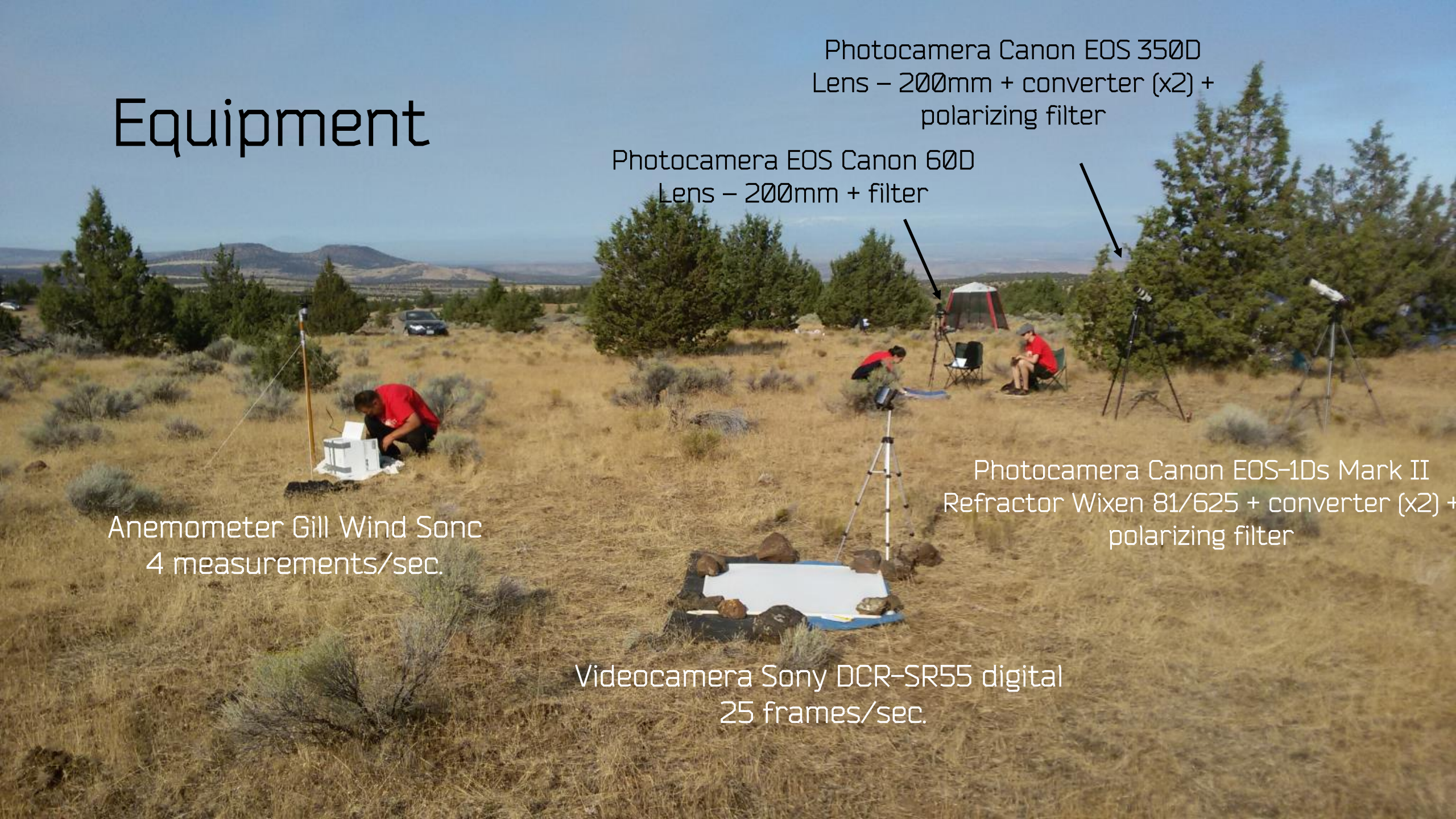
Photocamera Canon EOS 350D
Lens – 200mm + converter (x2) +
polarizing filter

Photocamera EOS Canon 60D
Lens – 200mm + filter

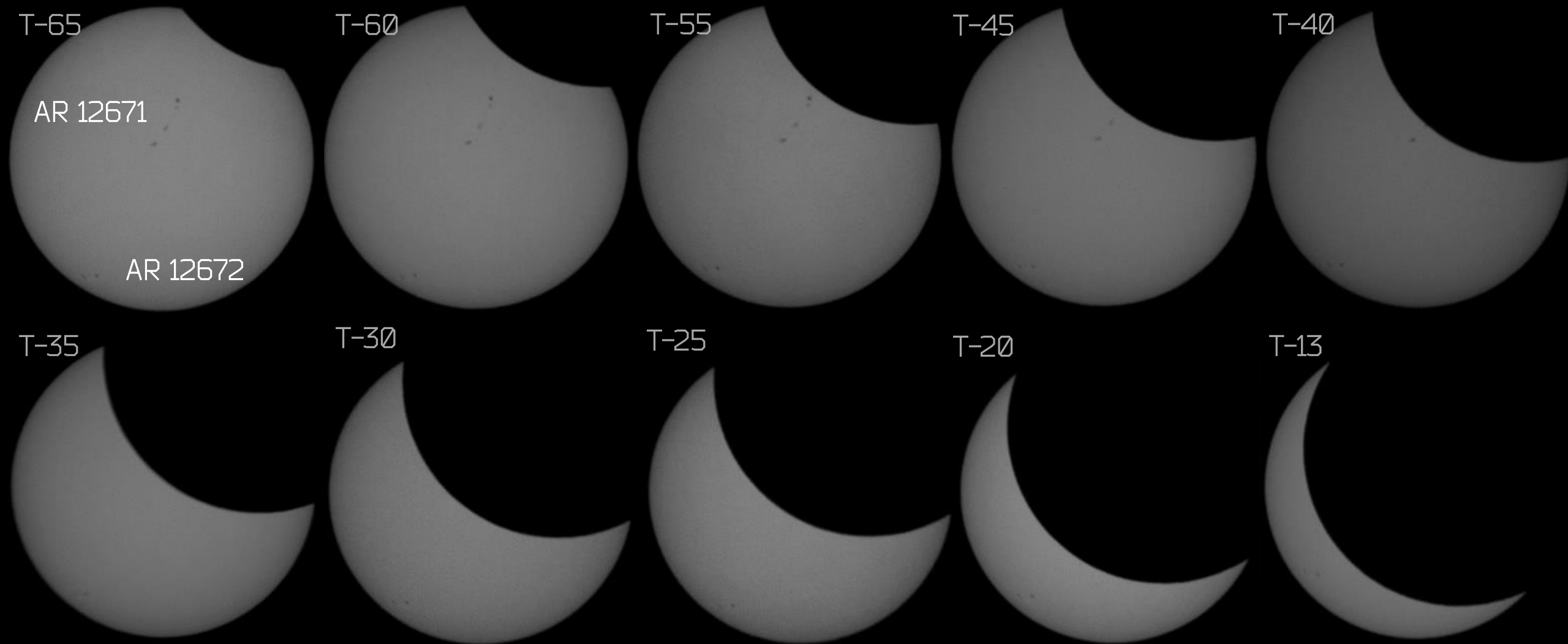
Photocamera Canon EOS-1Ds Mark II
Refractor Wixen 81/625 + converter (x2) +
polarizing filter

Anemometer Gill Wind Sonic
4 measurements/sec.

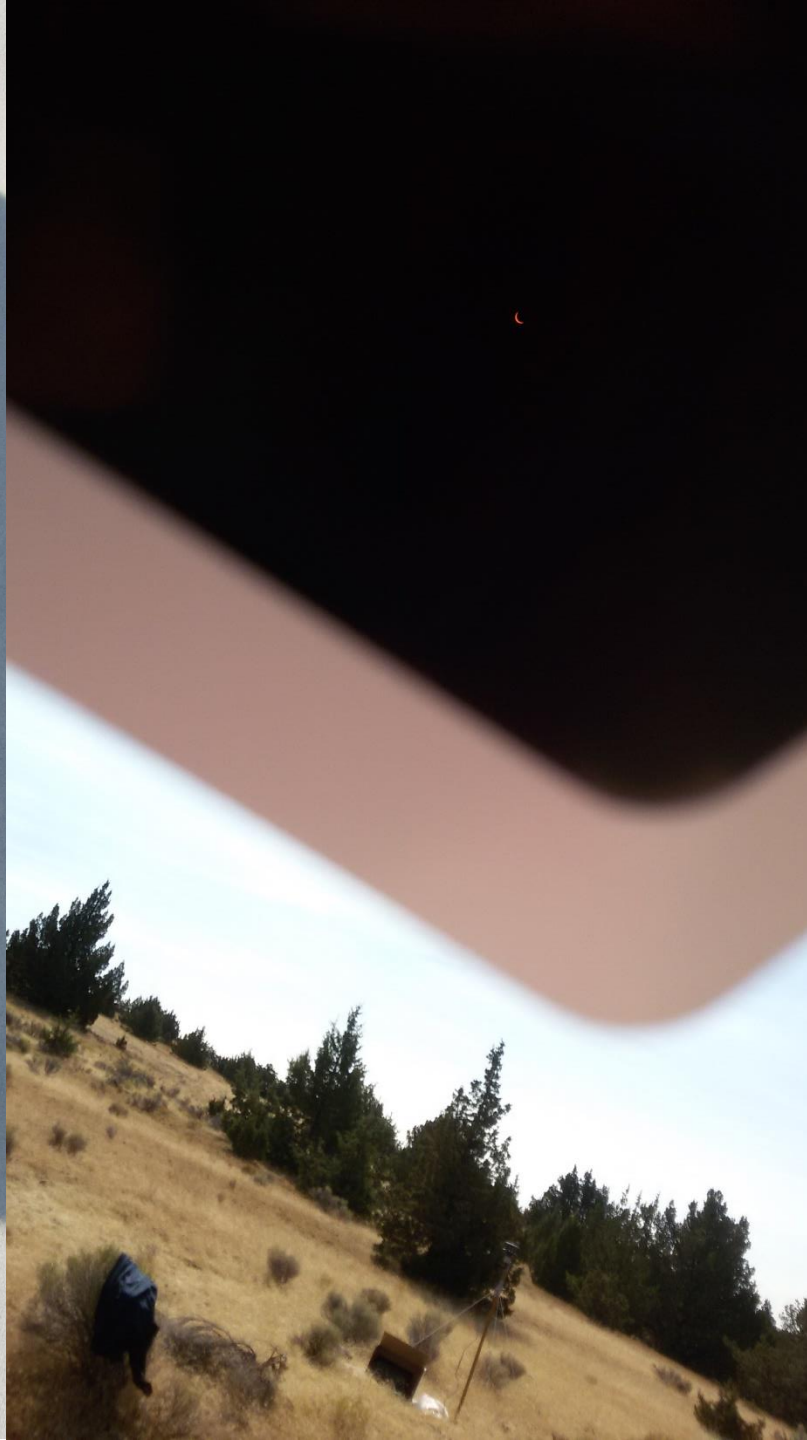
Videocamera Sony DCR-SR55 digital
25 frames/sec.



Partial phases



Projected crescents



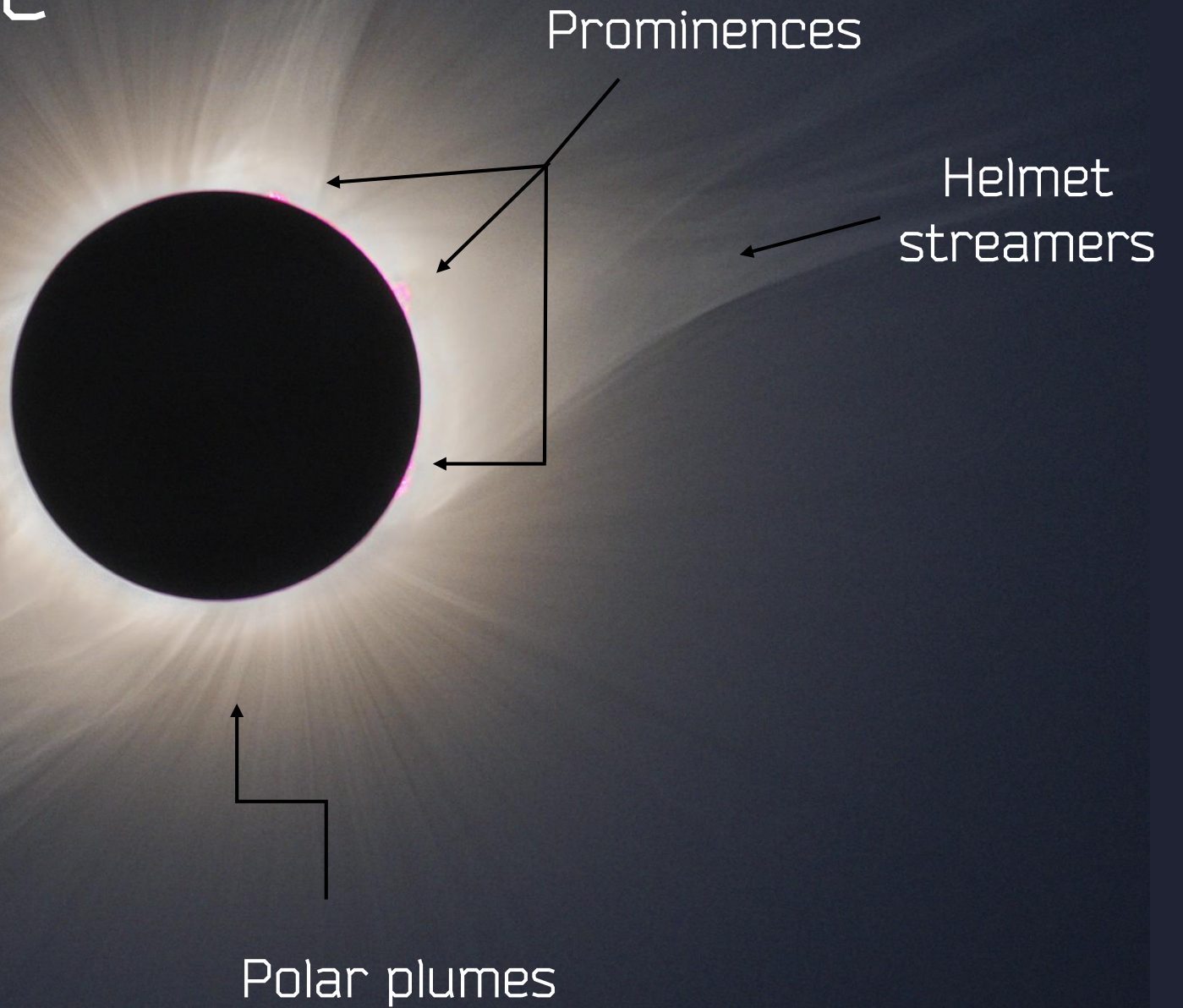
T-20

Diamond ring



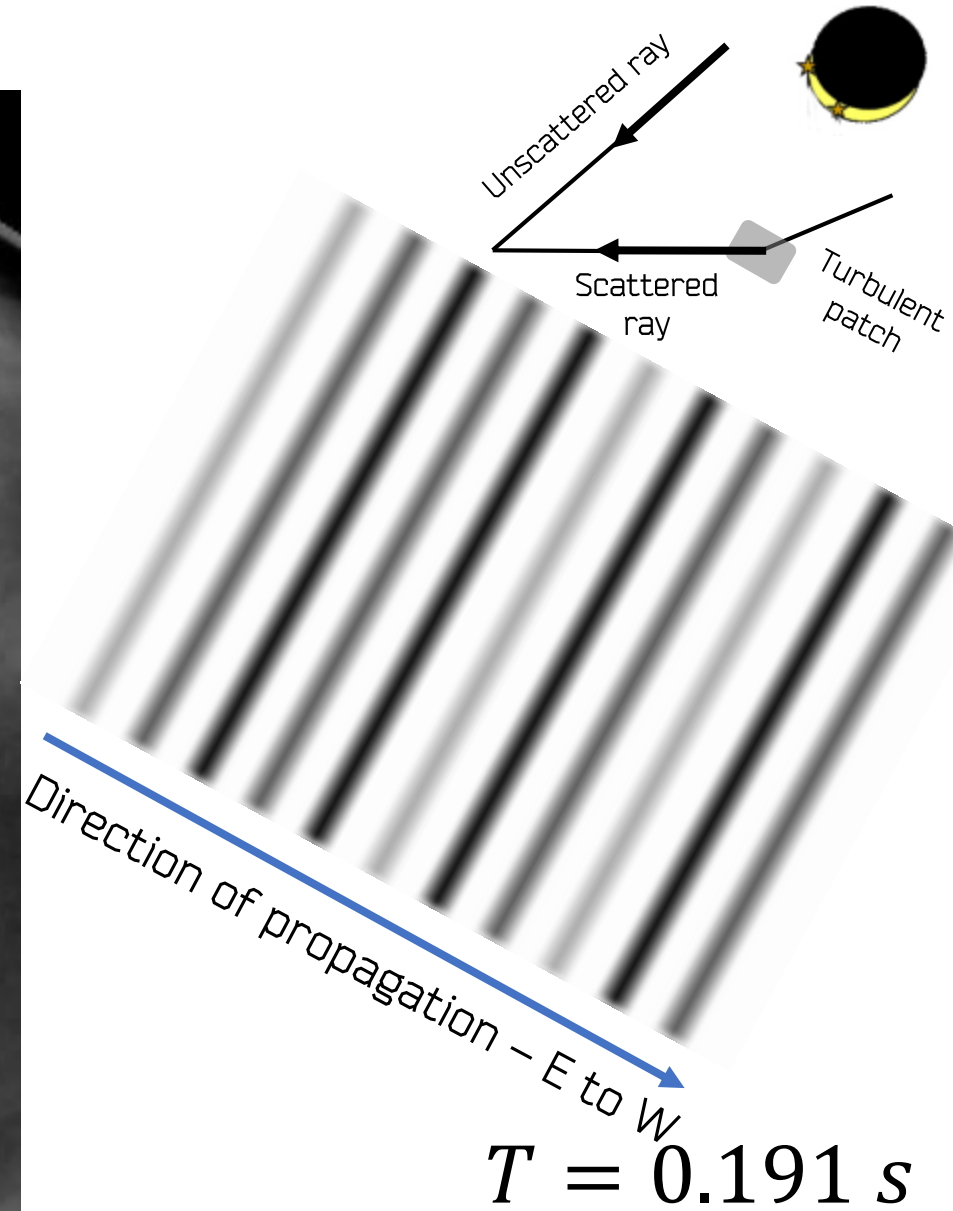
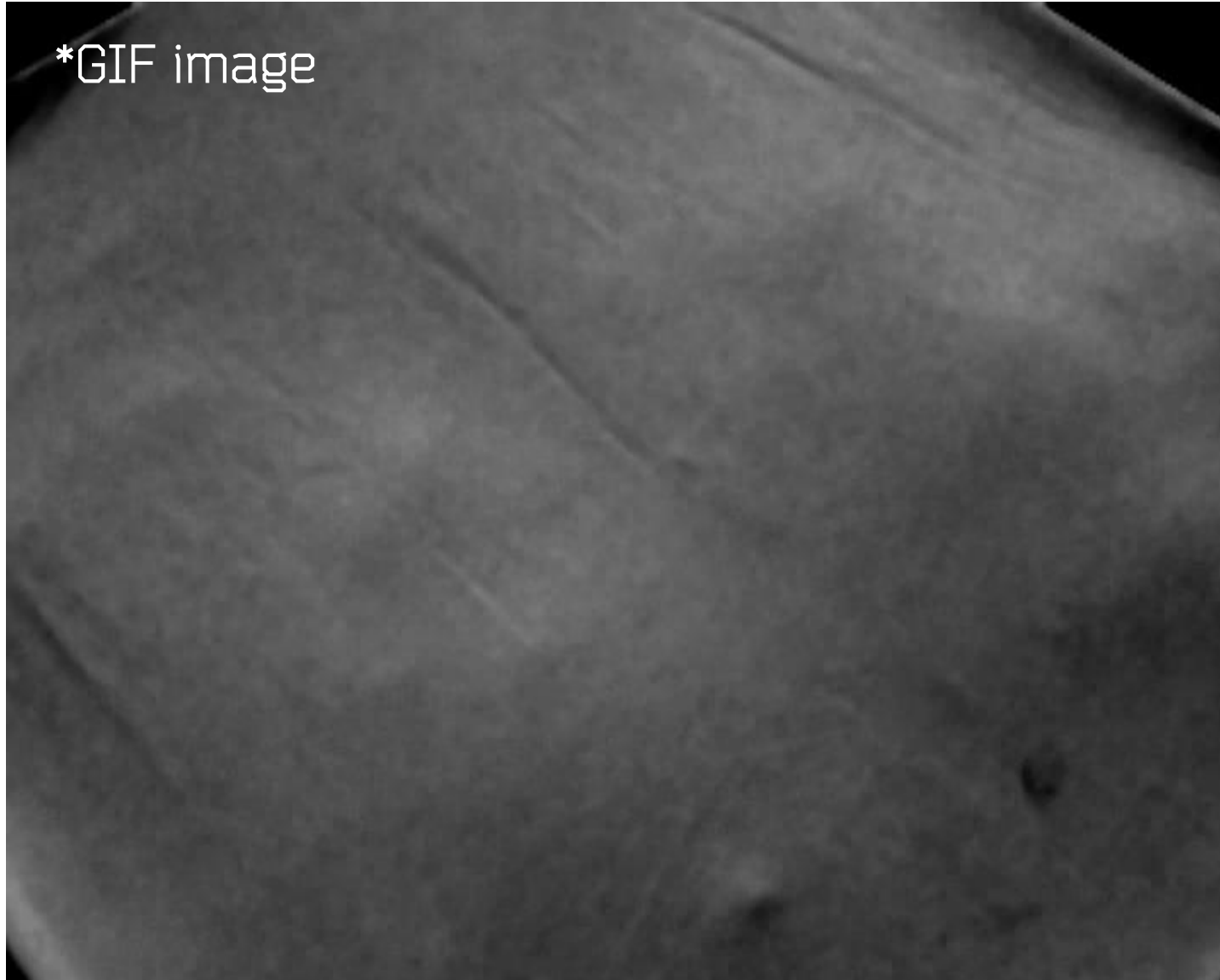
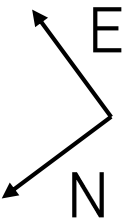
T0 (almost C2)

Coronal structure



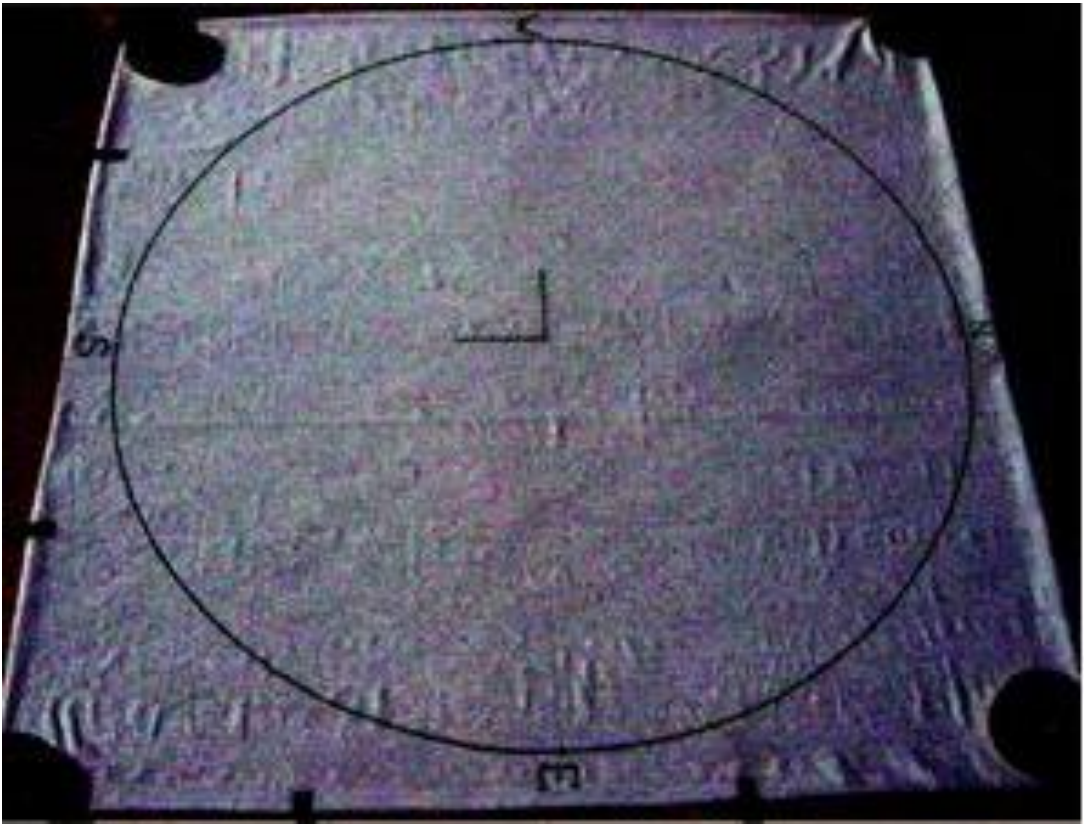
Shadow bands 2017

*GIF image



Previous results

TSE	Characteristics	Before T.	After T.
1961	Direction	E-SE	
	Velocity	1.1-1.4 m s ⁻¹	
1999	Duration	1m 28s	1m 02s
	Width	10-17 mm	10-17 mm
	Distance	62 mm	57 mm
	Direction (measured from North clockwise)	18°	13°
	Velocity	0.5 m s ⁻¹	0.5 m s ⁻¹
2006	Duration	2m 13s	2m 38s
	Width	18 mm	16 mm
	Distance	30-80 mm	13-55 mm
	Direction (measured from North clockwise)	330°	307°
	Velocity	2-4 m s ⁻¹	2-4 m s ⁻¹



29 March 2006, Side, Turkey (10:54:22 UT)
Canon PowerShot A80, ISO 400, 1/30
(G. Nikolov)

Wind velocity measurements

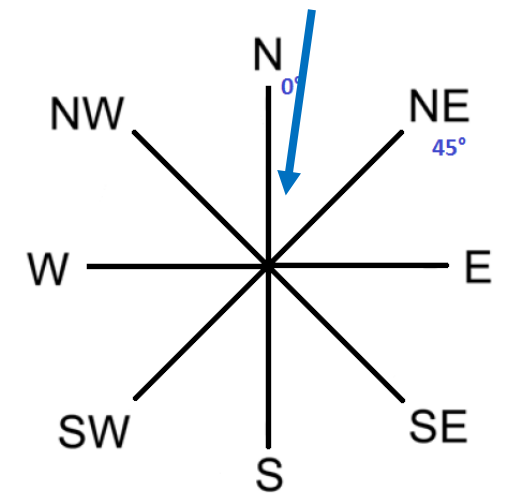
- WindSonic Ultrasonic Wind Sensor

Wind Speed	
Range	0-60 m s ⁻¹
Accuracy	±2% @ 12m s ⁻¹
Resolution	0.01m/s (0.02 knots)
Response Time	0.25 s
Threshold	0.01 m s ⁻¹
Wind Direction	
Range	0-359° (no dead band)
Accuracy	±2° @ 12m/s
Resolution	1°
Response Time	0.25 s

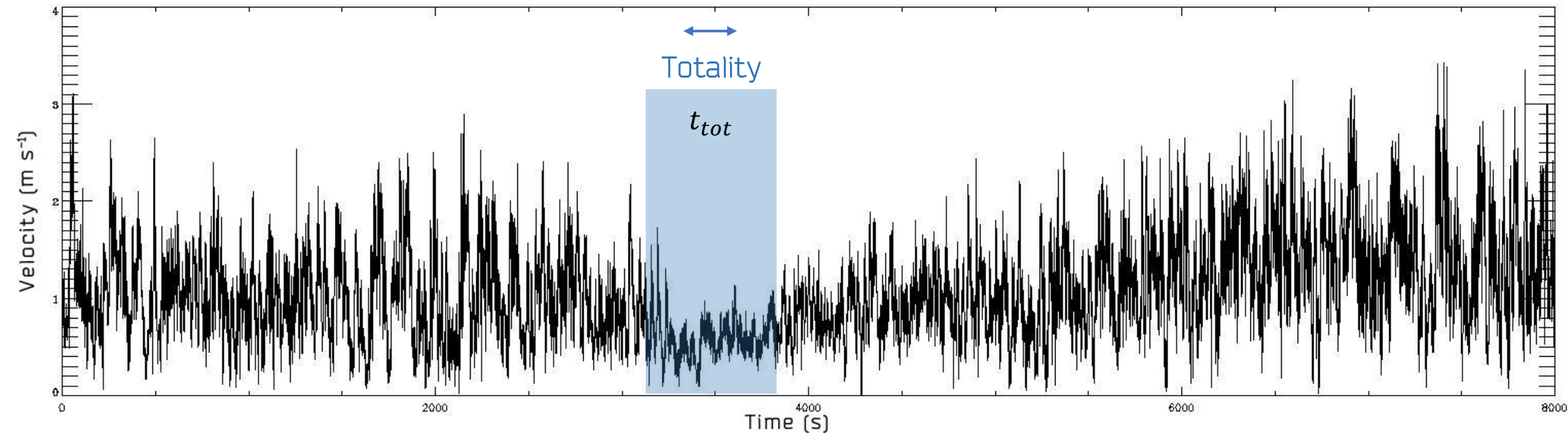


Wind velocity

$t_{par1}[LT] \rightarrow 09:23 - 10:15$ $v_{par1} = 1.025 \text{ m s}^{-1}$
 $t_{tot}[LT] \rightarrow 10:15 - 10:27$ $v_{tot} = 0.603 \text{ m s}^{-1}$
 $t_{par2}[LT] \rightarrow 10:27 - 11:36$ $v_{par2} = 1.191 \text{ m s}^{-1}$



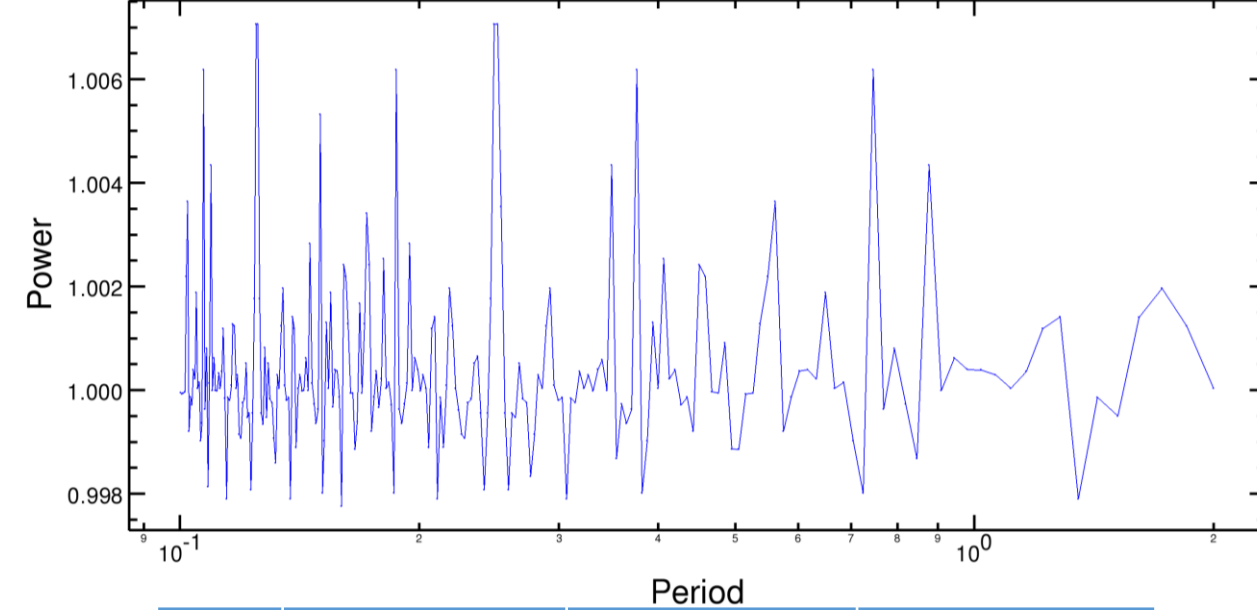
Wind direction - N (9.4° E)



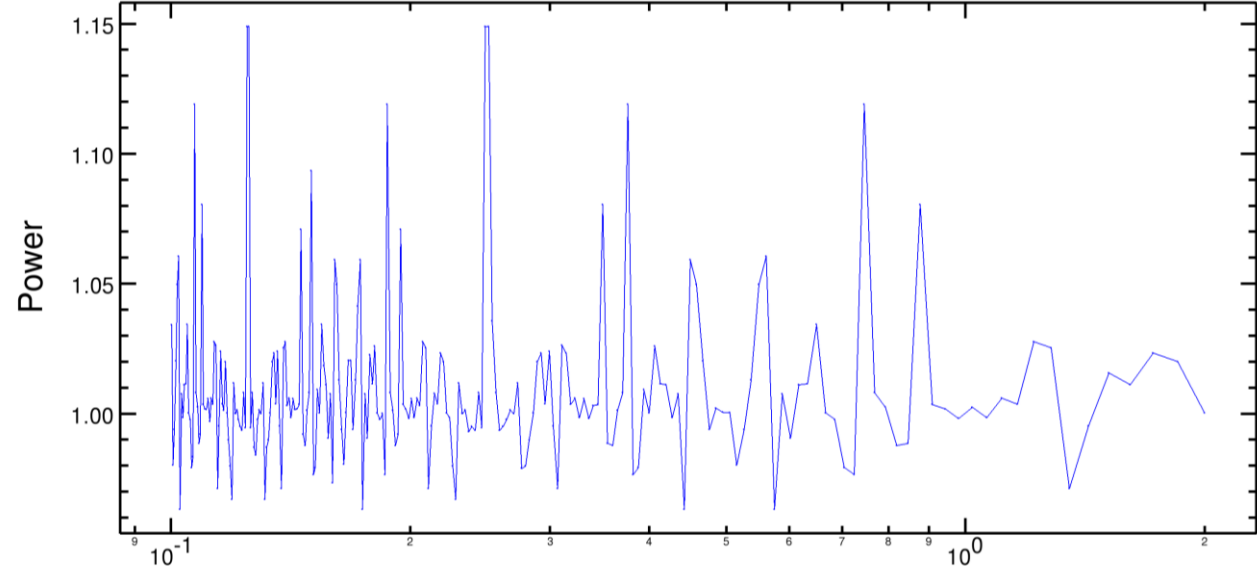
Periodograms

Plavchan, P., Jura, M., Kirkpatrick, J. D., Cutri, R.M., and Gallagher, S.C.: 2008, *ApJS* 175:191-228

during entire eclipse



during totality only



Period			
Peak	Period	Power	Frequency
1	0.2512562814	1.0070591752	3.9800000001
2	0.1253132832	1.0070591752	7.9800000005
3	0.7462686567	1.0061864714	1.3400000000
4	0.3759398496	1.0061864714	2.6600000002
5	0.1872659176	1.0061864714	5.3400000001
6	0.1070663812	1.0061864714	9.3399999962
7	0.1501501502	1.0053211302	6.6599999978
8	0.8771929825	1.0043377615	1.1399999999
9	0.3496503497	1.0043377615	2.8599999996

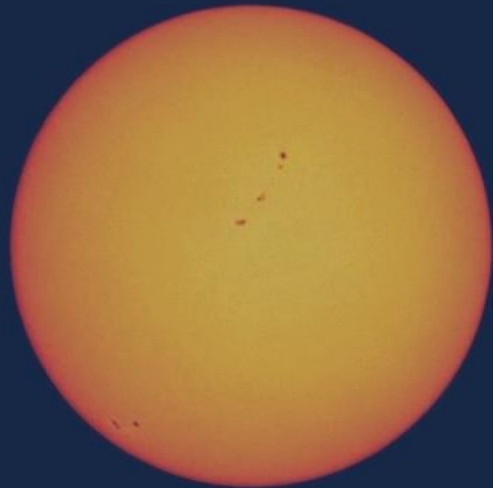
Period			
Peak	Period	Power	Frequency
1	0.2512562814	1.1488558431	3.9800000001
2	0.1253132832	1.1488558431	7.9800000005
3	0.7462686567	1.1189281946	1.3400000000
4	0.3759398496	1.1189281946	2.6600000002
5	0.1872659176	1.1189281946	5.3400000001
6	0.1070663812	1.1189281946	9.3399999962
7	0.1501501502	1.0934783232	6.6599999978
8	0.8771929825	1.0804100645	1.1399999999
9	0.3496503497	1.0804100645	2.8599999996

Team members



The expedition was realized thanks to the following scientific projects:

- BNSF contract N° DNTS/Russia 01/6 (23-Jun-2017)
- International Bulgarian-Polish project on "Destabilization and Eruption of Quiescent and Active Region Prominences: Observations and Analysis"
- BNSF contract DN08-20, DN08-1/2016



*Video

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- CNSYS PLC, Sofia
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- Damar textile company, Varna
- Acad. T. Nikolov, BAS
- Zlatarski International School of Sofia