Early telescopic observations of sunspots by Simon Marius and other (1610-1620)

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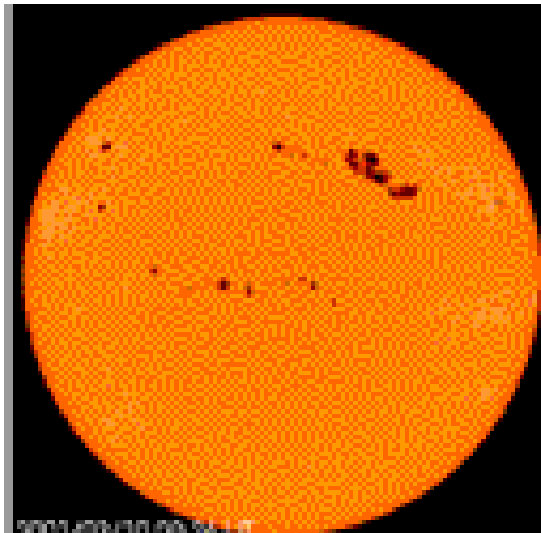
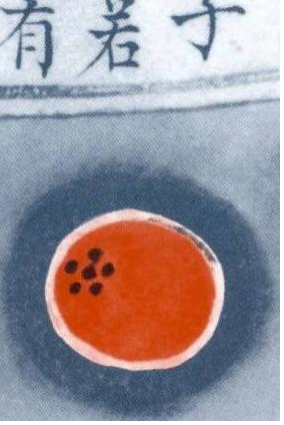
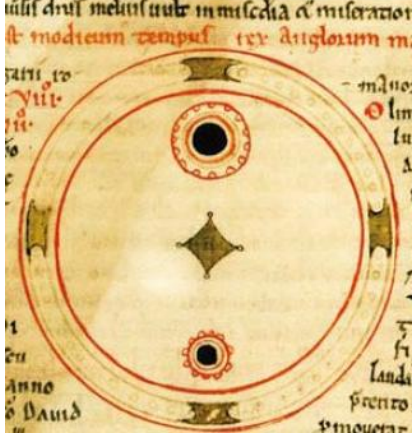
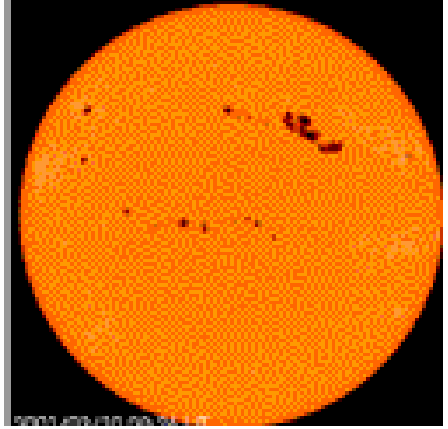
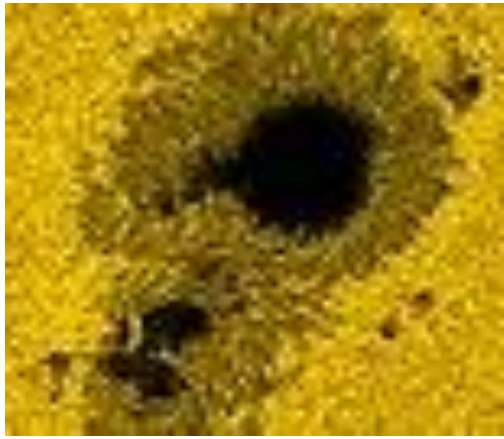


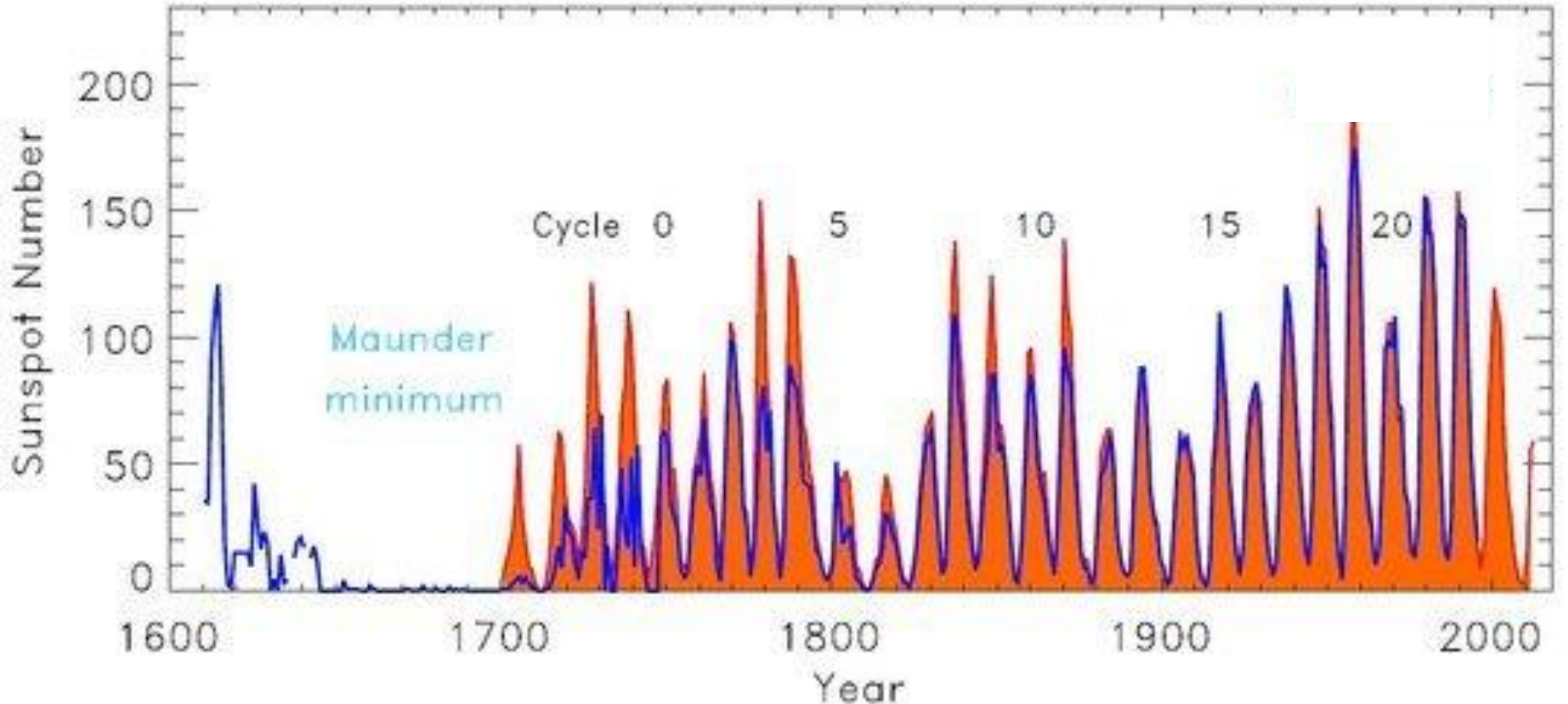




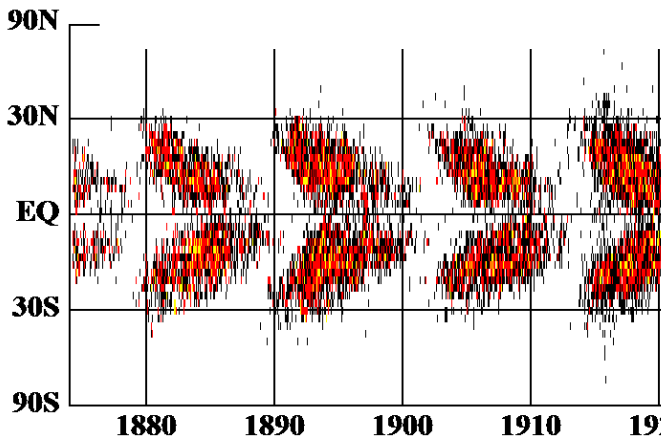


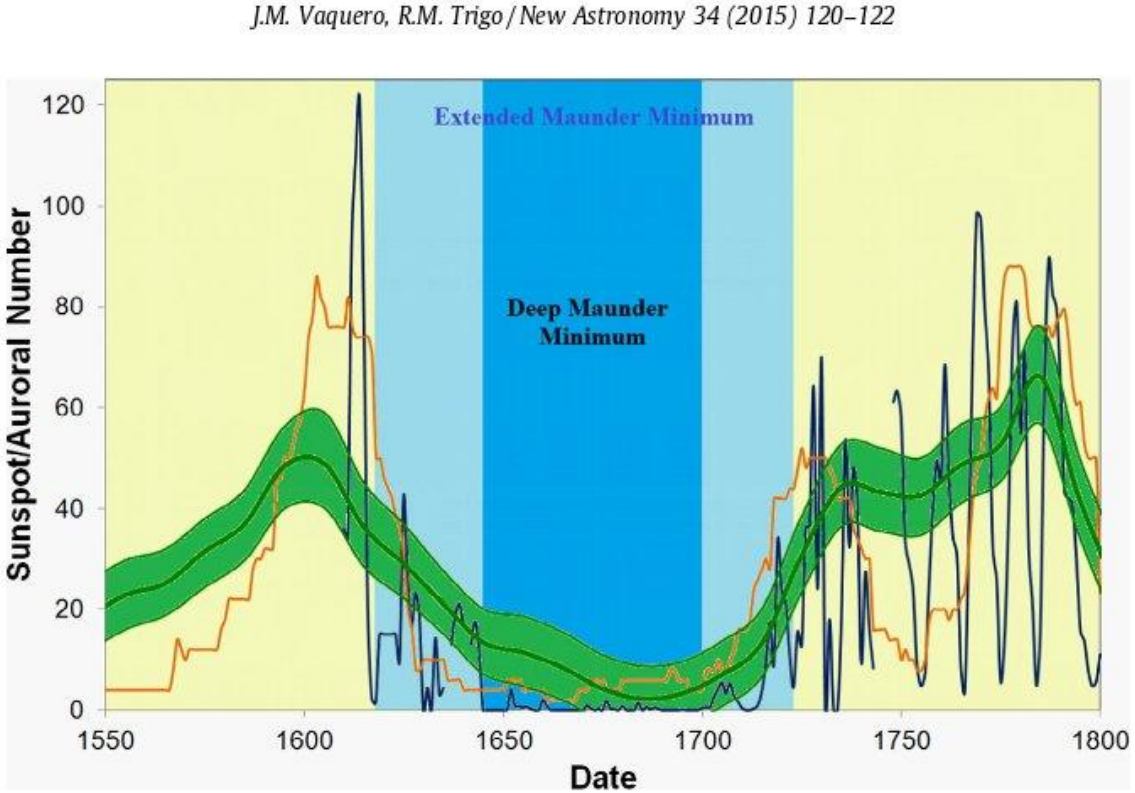


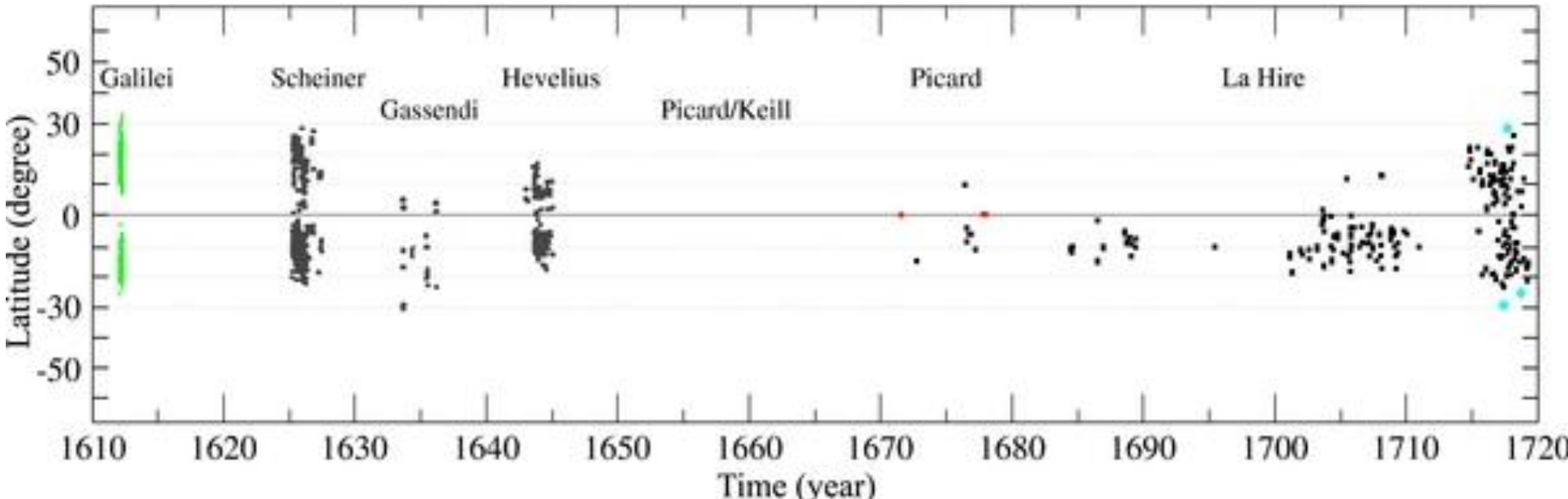
400 years telescopic sunspots. Schwabe cycle 10.4 ± 1.2 yr (since 1750)

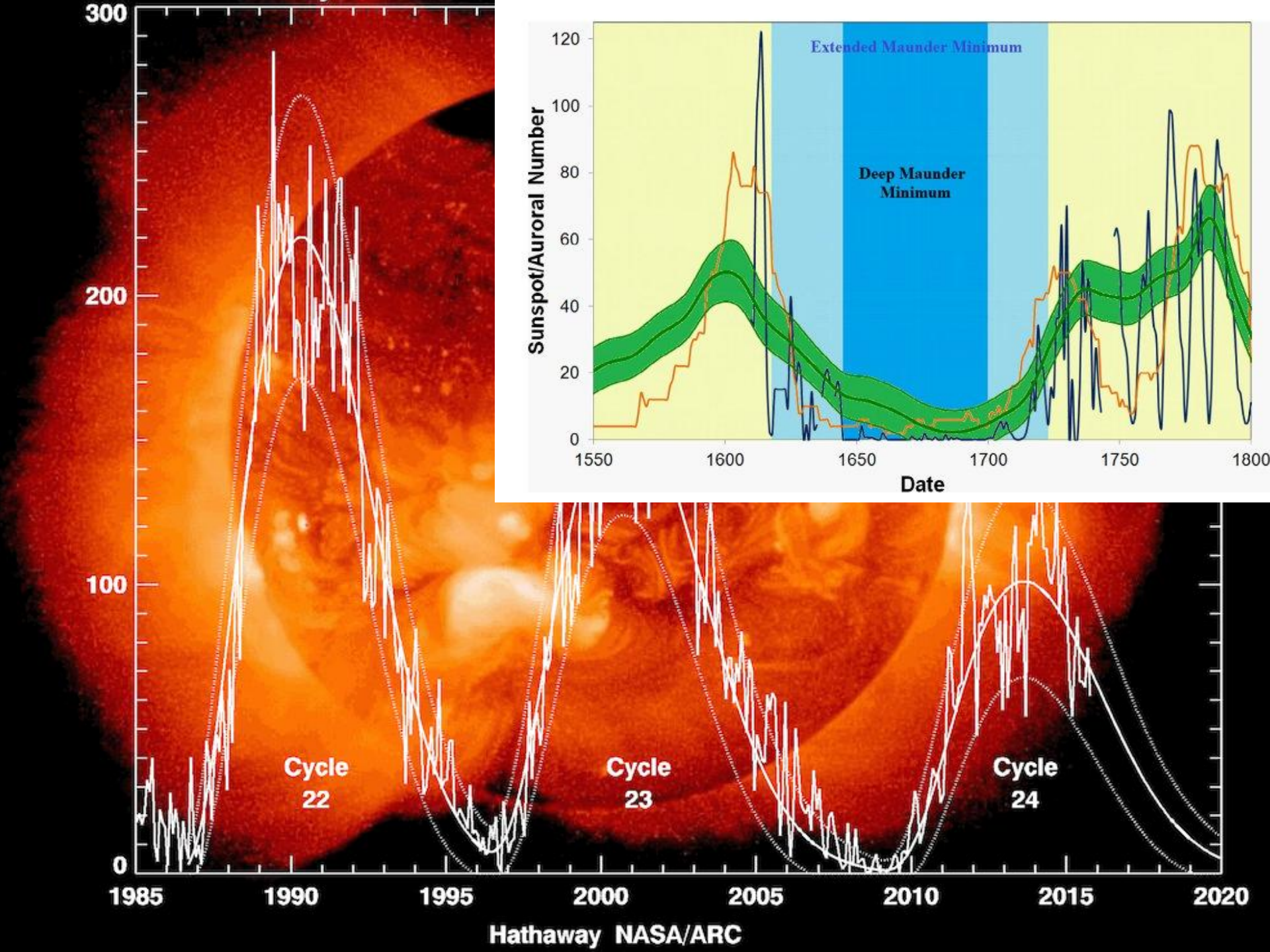


Schwabe cycle





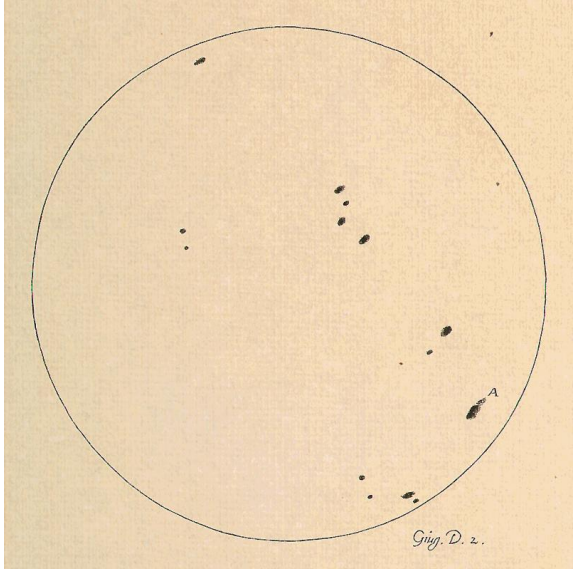



Extended Maunder Minimum
Deep Maunder Minimum
Sunspot/Auroral Number
Date
120
100
80
60
40
20
0
1550
1600
1650
1700
1750
1800
300
200
100
0
Cycle 22
Cycle 23
Cycle 24
1985
1990
1995
2000
2005
2010
2015
2020
Hathaway NASA/ARC

Sonnenflecken-Relativzahl (Rudolf Wolf 1816-1893):

$R_z = k \times (10 \times g + n)$

Anzahl der Einzelflecken n, Anzahl der Fleckengruppen g, individueller Gütefaktor des jeweiligen Beobachters k



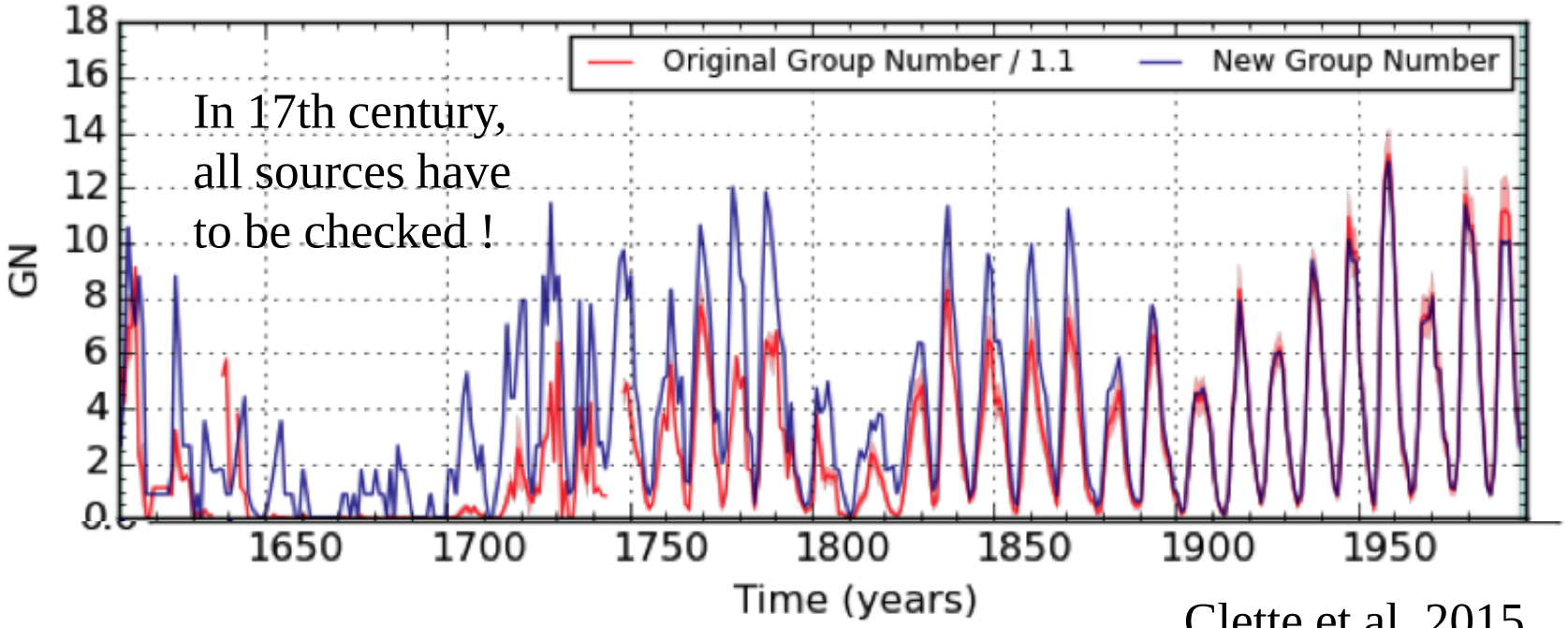
Hoyt & Schatten (1998): Sonnenflecken*gruppen*zahl

$R_G = (12.08 / N) \times \Sigma_i (k_i' \times G_i)$

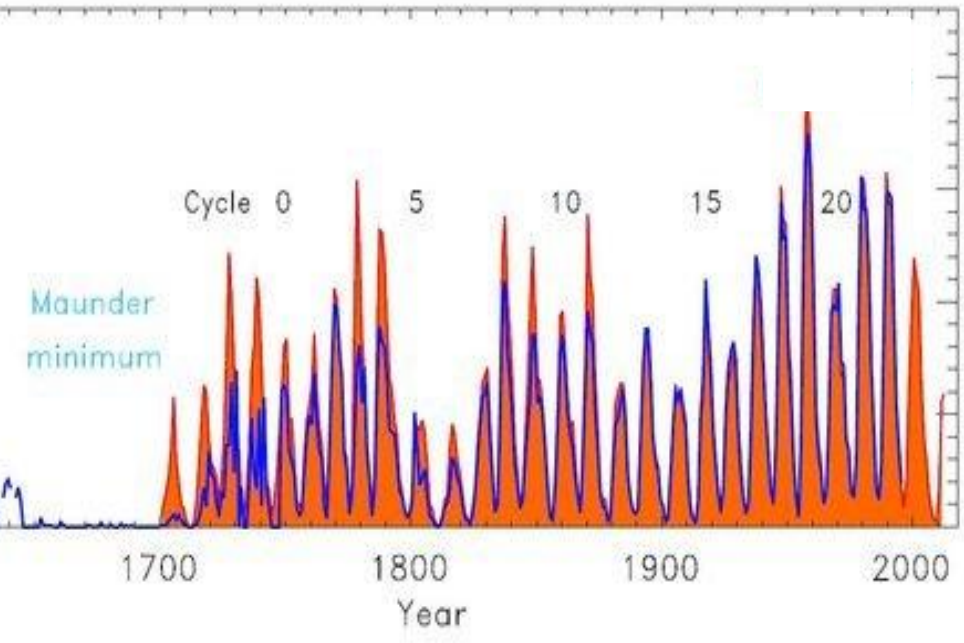
individueller Korrekturfaktor k_i' des i-ten Beobachters Gruppenzahl G_i am betreffenden Tag, N ist die Anzahl der Beobachter des entsprechenden Tages.

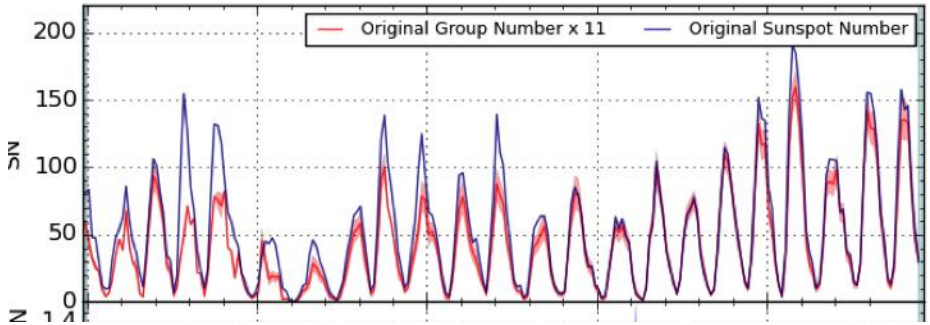
oder Fleckenfläche statt Fleckenanzahl

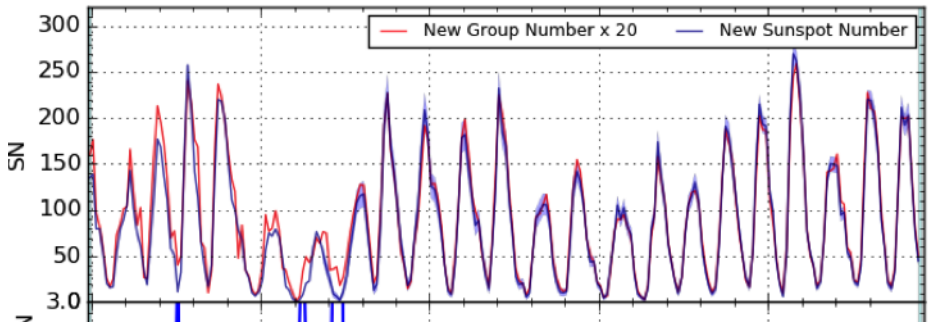
Active day fraction f = (aktive Tage) / (aktive + inaktive Tage)

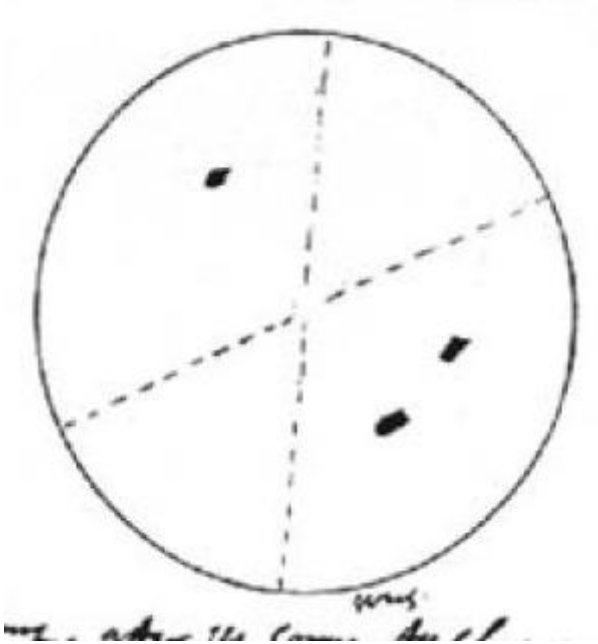


Clette et al. 2015









- **First telescopic observations of sun spots**

- Observations by Simon Marius 1611 – 1619

- More observations by Saxonius, Tarde, Malapert:
  Constraining the first telescopic Schwabe cycle (1620)

Erste teleskopische Beobachtungen von Flecken (ab 1609):

-Vorstufen als Lesestein um 1000 AD (Ibn al-Haytham)

- Linsen, Monokel, Brillen im Mittelalter (China, Italien)

- Teleskop 1608 (Hans Lipperdey, Holland)

- Galileo Galilei: erste Himmelsbeobachtungen (1609)
  Jupiter-Monde, Sterne in Milchstraße, Venus-Phasen, Sonnenflecken

- Kepler Fernrohr (1611)

➔ Kopernikanische Wende: Helio-Zentrismus

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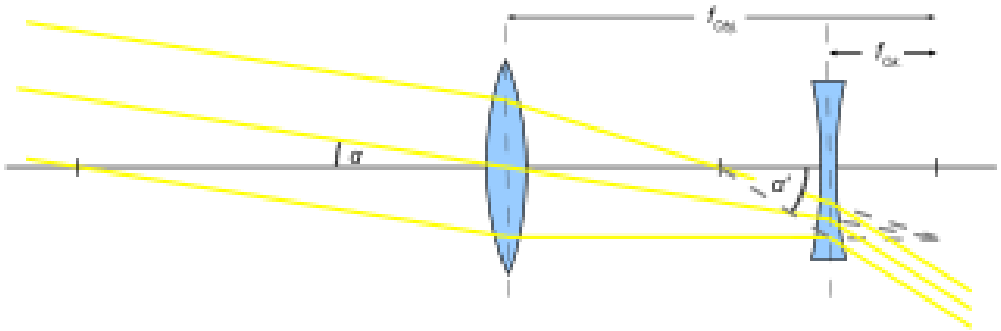
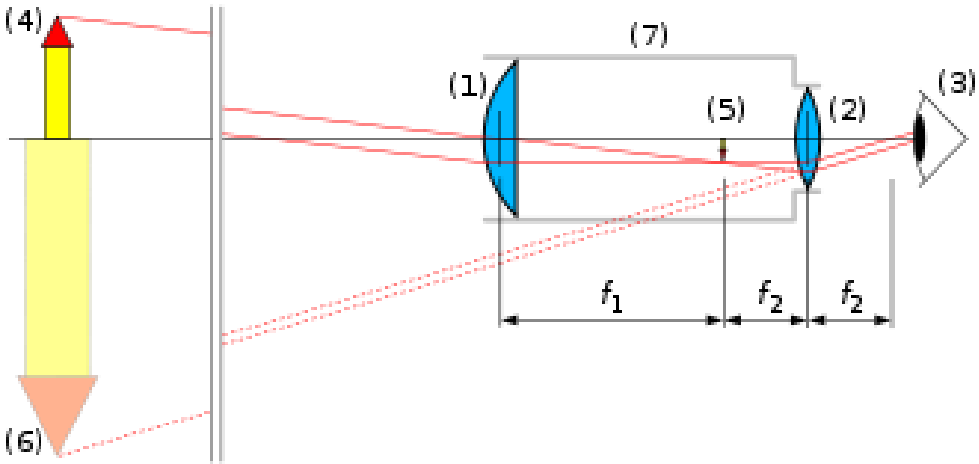


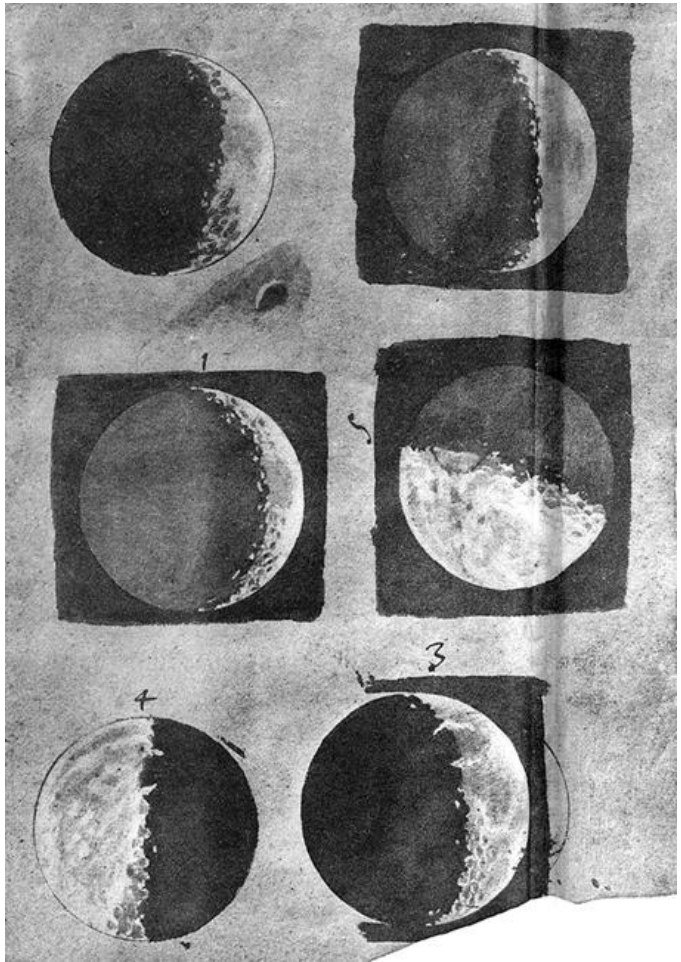
- Kepler Fernrohr (1611):

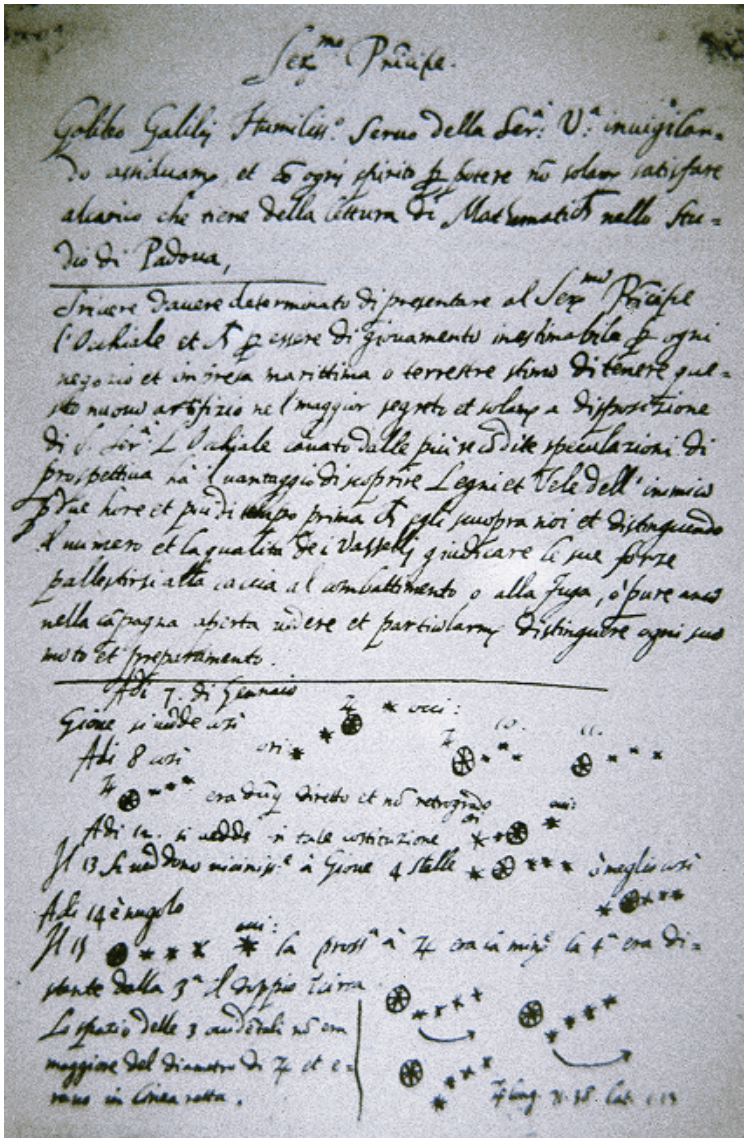


Galileo Galilei: erste Himmelsbeobachtungen (1609)

Jupiter-Monde, Sterne in Milchstraße, Venus-Phasen, Sonnenflecken

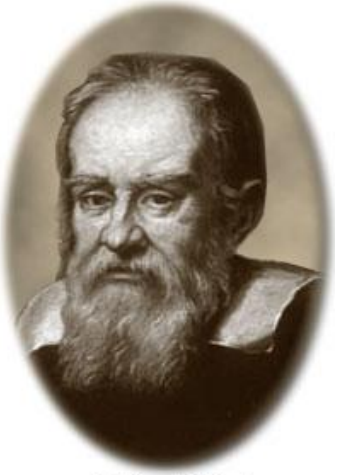
Galileo Galilei
(1564-1642)





Galileo Galilei:
Celestial observations with a telescope (1609)

Jupiter moons, stars in milky way,
Phases of Venus, ring around Saturn,
Craters on the moon, spots on the Sun



Galileo Galilei
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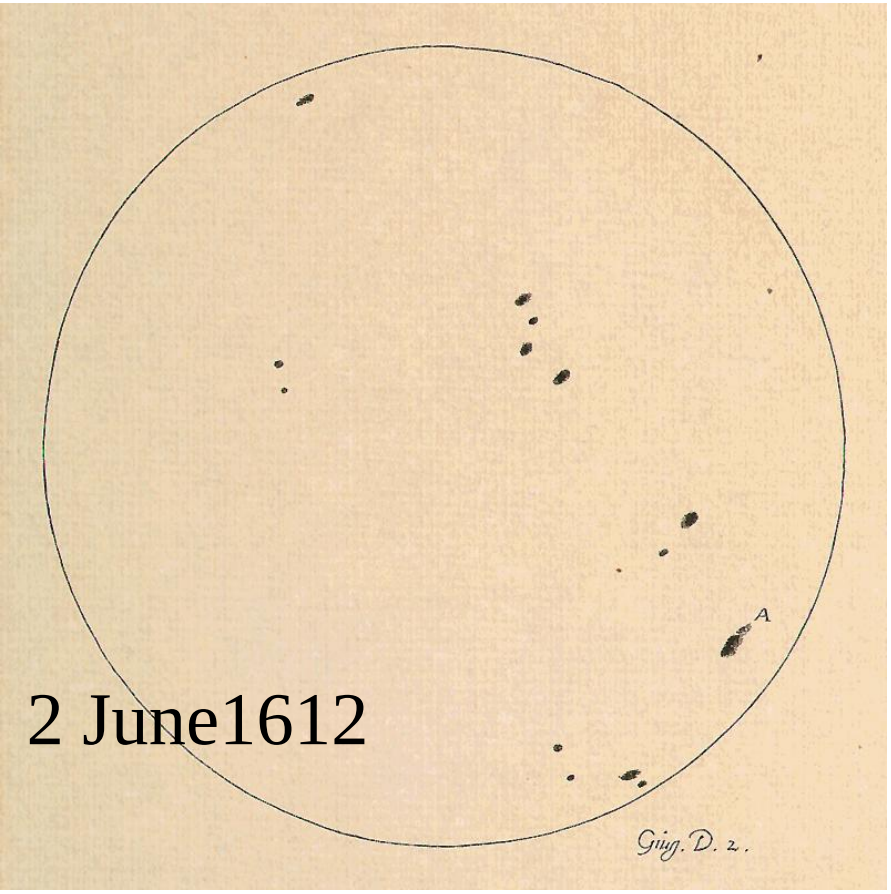
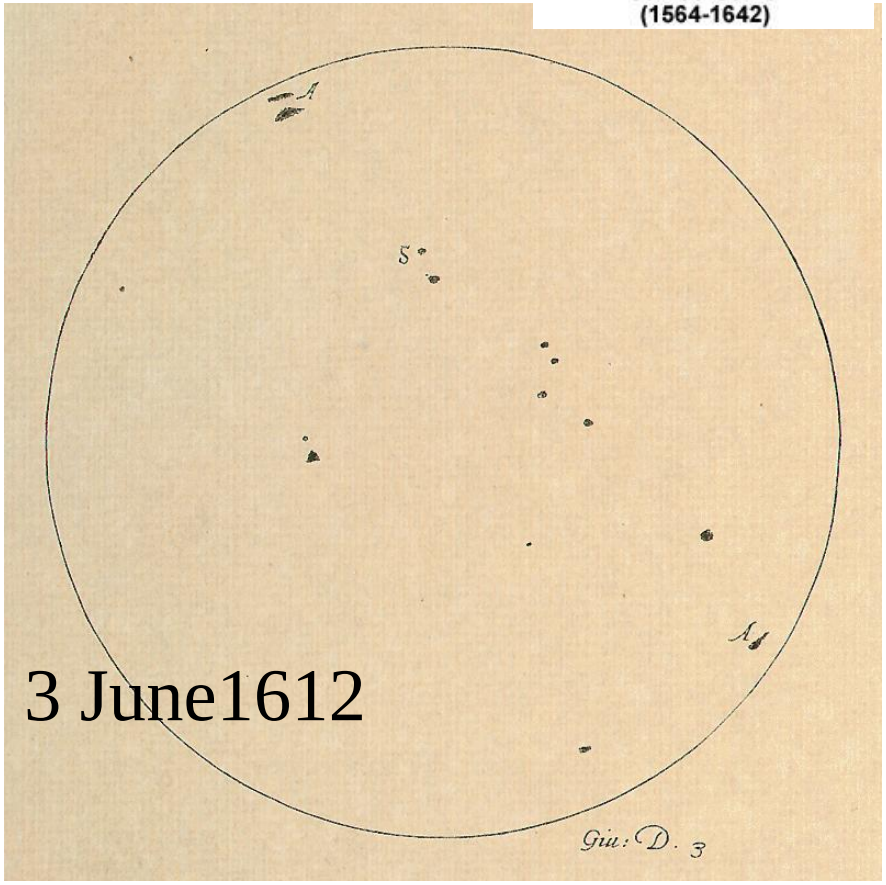


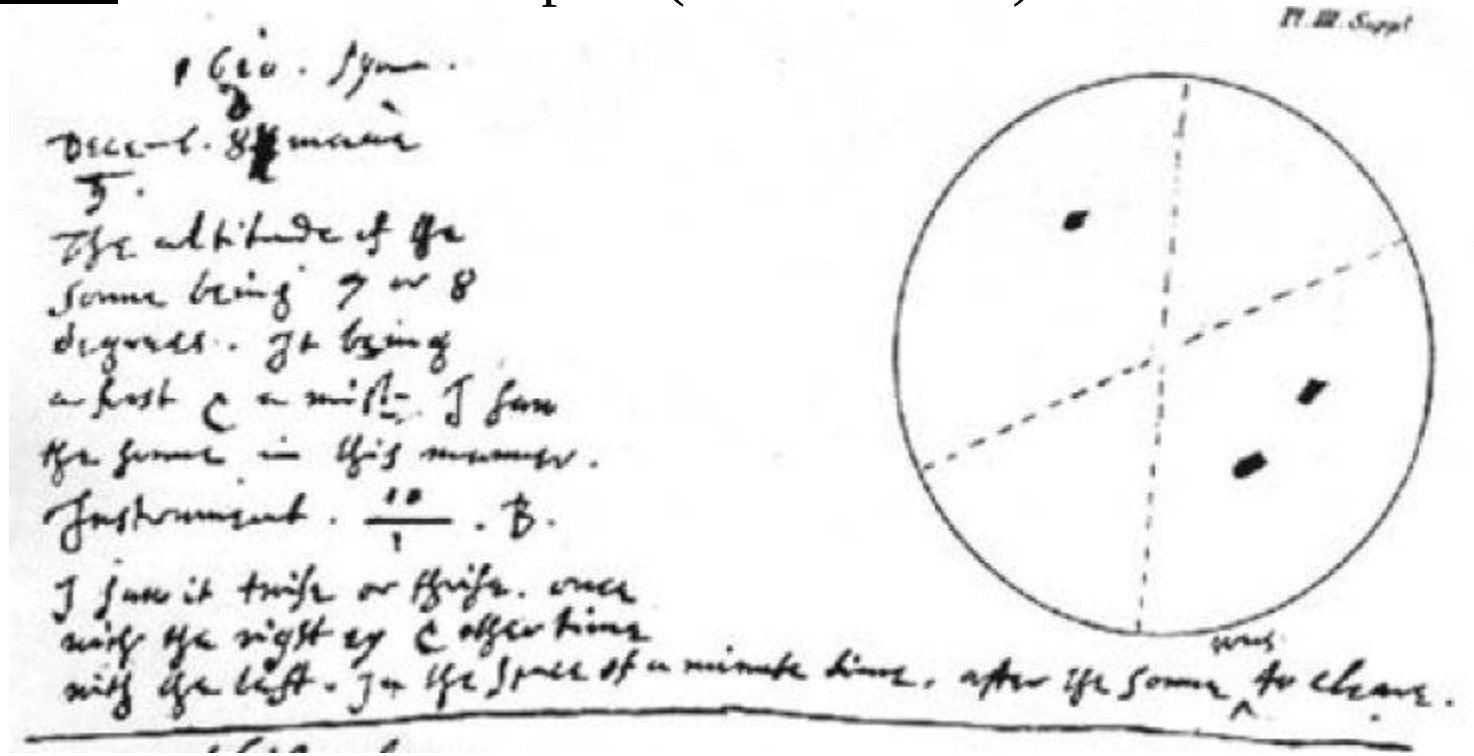
2 June1612



3 June1612

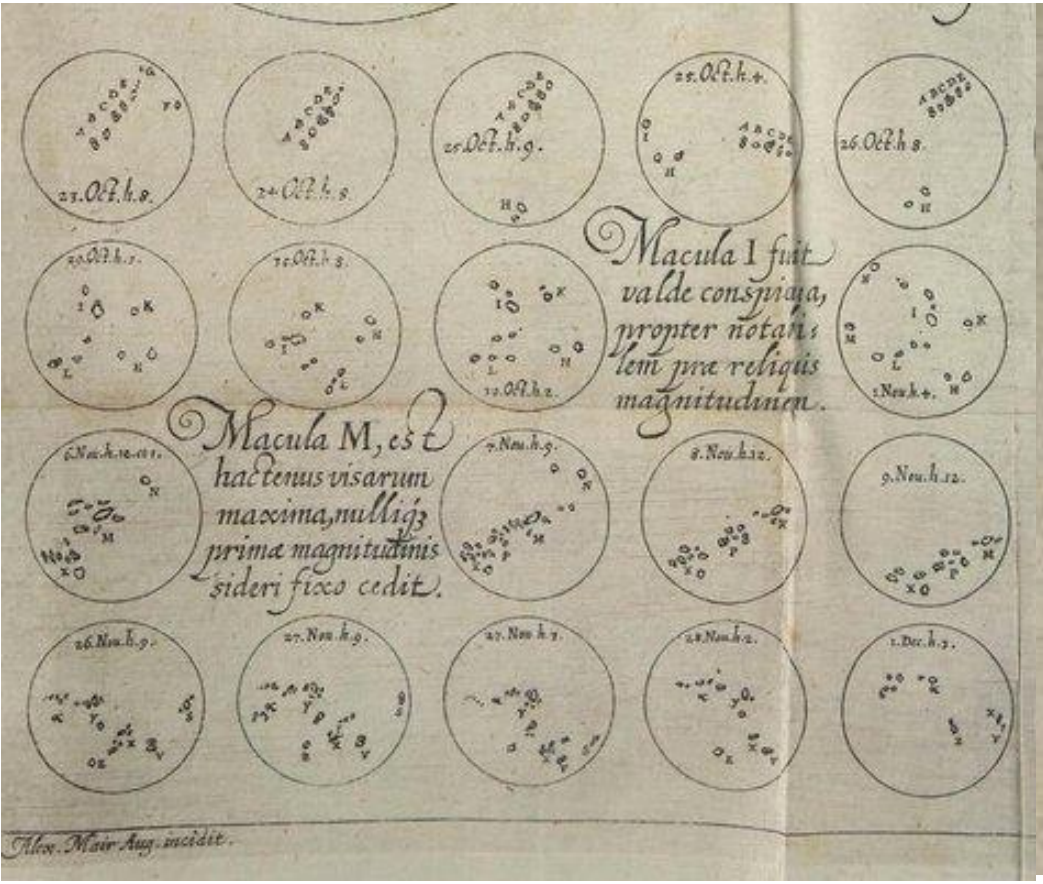
Galileo Galilei (1564-1642, Italy): Telescopic observations of spots (Dec 1610)

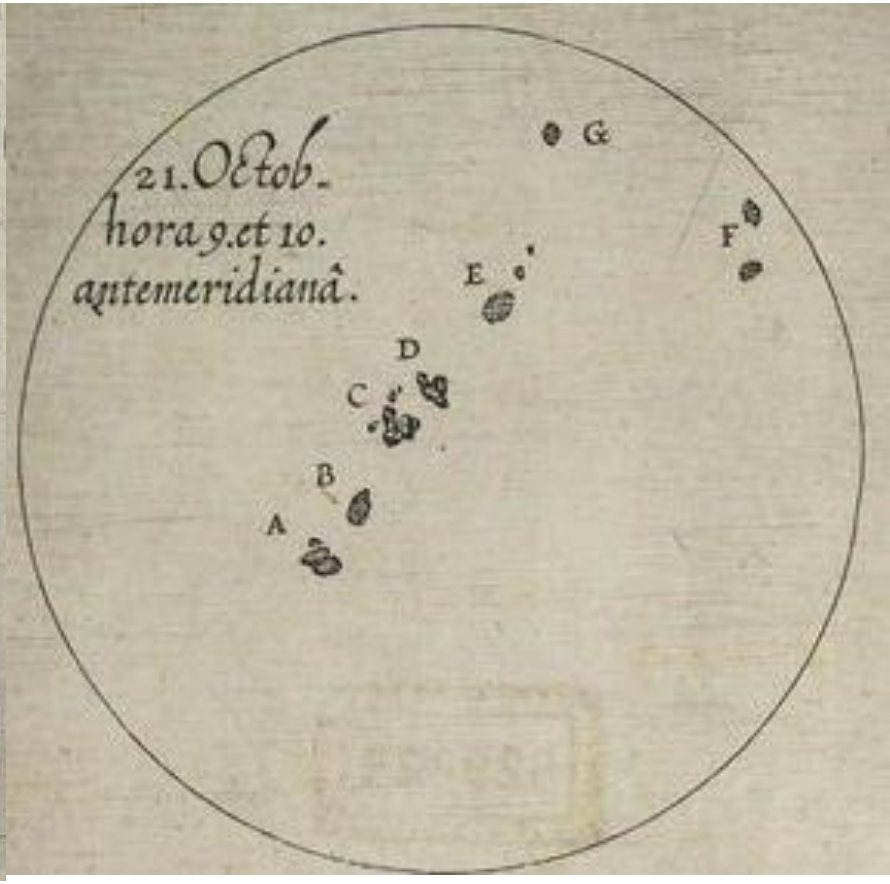
Thomas Harriot (1560-1621, England):
First datable observation of spots (18 Dec 1610)



„1610 Syon, Decemb. 8, mane [Saturday]. The altitude of the Sonne being 7 or 8 degrees. It being a frost & a mist. I saw the sonne in this manner. Instrument. 10/1. B.
I saw it twice or thrice, once with the right ey & other time with the left. In the space of a minute time, after the Sonne was to cleare.“

Galileo Galilei (1564-1642, Italy):
Telescopic observations of spots (Dec 1610)





Christoph Scheiner SJ (1574-1650, Ingolstadt, Rome):
First continuous monitoring over several weeks in 1611,
first publication of drawings (Jan 1612, Apelles)

Galileo Galilei (1564-1642, Italy):
Telescopic observations of spots (Dec 1610)

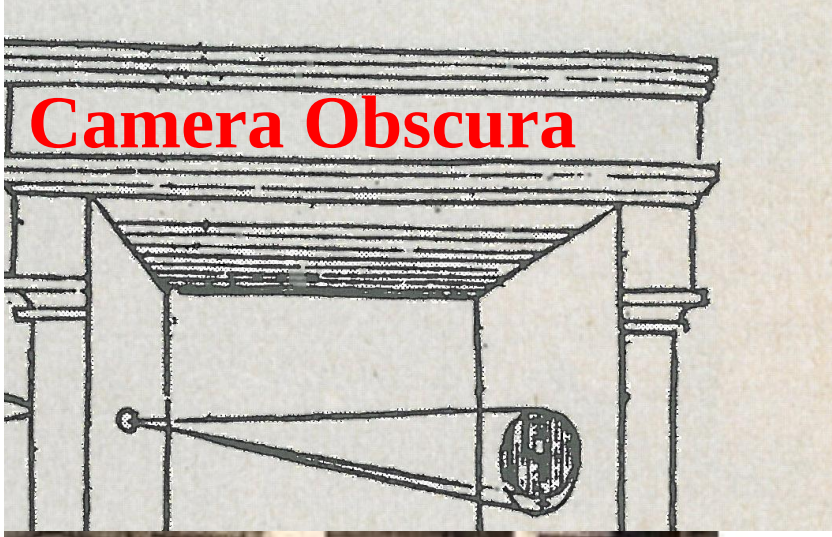
Thomas Harriot (1560-1621, England):
First datable observation of spots (18 Dec 1610)

David and Johann Fabricius (Frisia):
First publication on sunspots (J. Fabricius 1611)

Christoph Scheiner SJ (1574-1650, Ingolstadt, Rome):
First continuous monitoring over several weeks in 1611,
first publication of drawings (Jan 1612)

Simon Marius (1573 -1624, Ansbach, Bavaria):
Observations of sunspots 1611 to 1619

J. Hevelius observing the Sun by projection. Reprinted from his book
elestis.



g the Sun by the projection method.

- First telescopic observations of sun spots

- **Observations by Simon Marius 1611 – 1619**

- More observations by Saxonius, Tarde, Malapert:
  Constraining the first telescopic Schwabe cycle (1620)

Simon Marius (1573 -1624, Ansbach, Bavaria): Observations of sunspots 1611 to 1619

- born 10 Jan 1573 in Gunzenhausen
- 1586-1601 High school in Heilsbronn
- 1601 Visit toTycho Brahe in Prague (Fabricius, Kepler)
- 1602-1605 Studying at U Padua (observed SN 1604)
- since 1605:
  Court astronomer of Margrave of Brandenburg-Ansbach

- observations of Jupiter moons and sunspots
  „the German Galileo“, „an astronomer too good“ (Graney)

- deceased 16 Dec 1624

Simon Marius (1573 -1624, Ansbach, Bavaria): Observations of sunspots 1611 to 1619

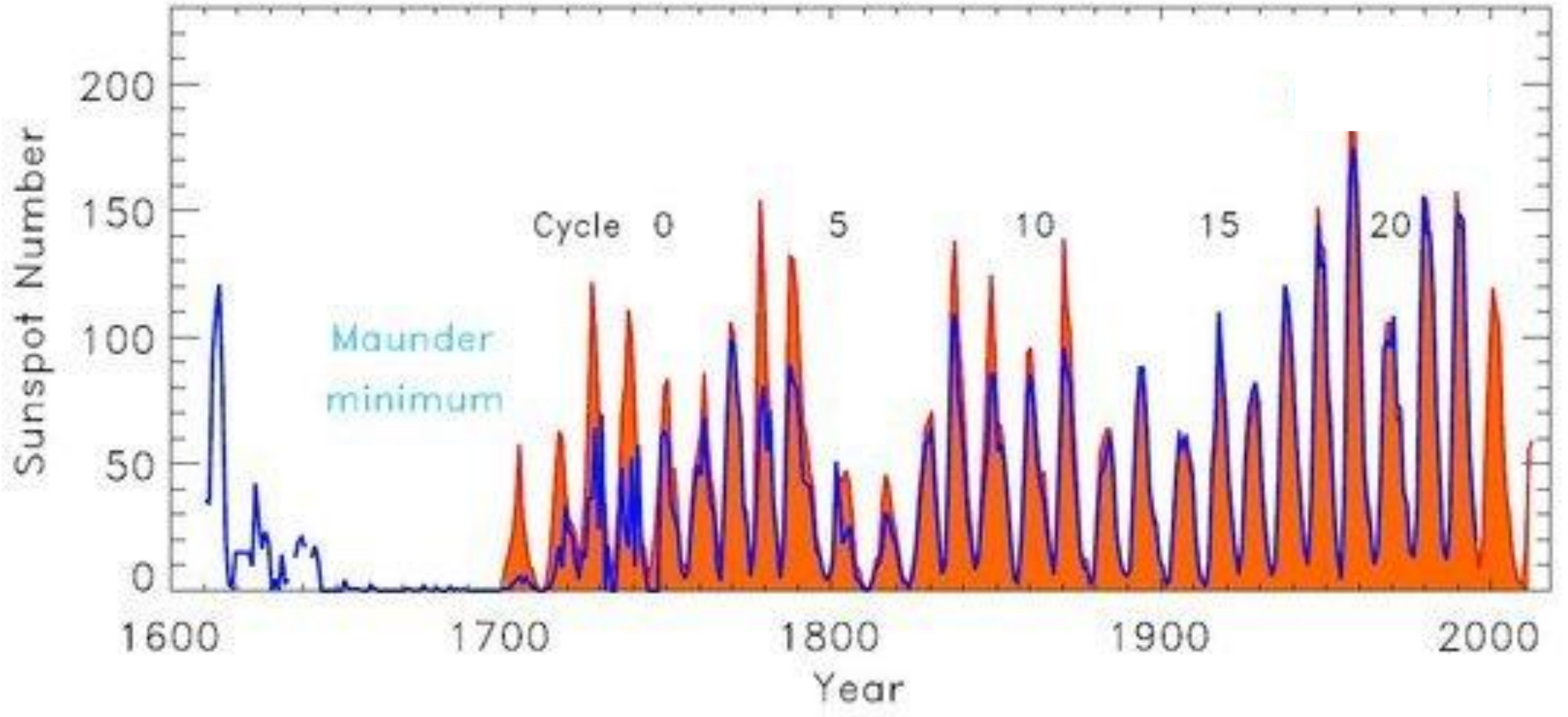
Brandenburg-Ansbach protestant:
Julian calendar until end of Feb 1700,
then Gregorian calendar.

Gregorian calendar reform:

previously:
Julian calendar wth leap years every 4 years (Julius Caesar 44 BC)

Pope Gregor XIII:
After 4 Oct 1582 jump to 15 Oct 1582,
leap years *almost* every 4 years
(e.g. AD 1600 a leap year, but AD 1700 not a leap year).

Simon Marius (1573 -1624, Ansbach, Bavaria): Observations of sunspots 1611 to 1619



Hoyt & Schatten (1998):
Catalogue of telescopic sunspot observations (1609 to 1995) with 463 observers on 111.358 days

Based on Wolf (1850ies)

Based on Wolf (1857)

1) Simon Marius, astronomische und astrologische Beschreibung des Kometen von 1618. Mürnberg 1619. 4.

Die Vorrede dieser Schrift ist « Anspach den 6. April 1619 » datirt. Marius erzählt, dass er « nun über die anderthalb Jahr nicht mehr so viel maculas in disco solis habe finden können, ja gar offt kein einig maculam antroffen, das doch vorige Jahr niemals geschehen. » Dieser Fleckenarmuth stellt Marius das

Simon Marius, astronomical and astrological description of the comet of 1618, Nuremberg April 1619:
Marius reports that he "now, for one and a half year, could not find as much spots on the solar disk, yet rather often not even a single spot, as was never the case in the years before." Marius compares this dearth of spots with the comet year 1618 and adds "I just recall it, but I do not conclude anything." (Wolf 1857)

Hoyt & Schatten (1998): Marius observed 7 June 1617 to 31 Dec 1618 but detected no spots at all

Most recent papers reject this generic statement by Marius, because it would not contain datable observations:
Clette et al. (2014), Svalsgard & Schatten (2015), Vaquero et al. (2015), Usoskin et al. (2015)

Hoyt & Schatten (1998): Marius observed 7 June 1617 to 31 Dec 1618 but detected no spots at all

1617

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1617
AS OBSERVED BY: MARIUS, S., NUREMBERG

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
2	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
3	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
4	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
5	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
6	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
7	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
8	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
9	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
10	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
11	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
12	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
13	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
14	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
15	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
16	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
17	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
18	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
19	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
20	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
21	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
22	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
23	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
24	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
25	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
26	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
27	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
28	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
29	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
30	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
31	-99	-99	-99	-99	-99	-99	0	0	-99	0	-99	0
eans:	-9.0	-9.0	-9.0	-9.0	-9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1618

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Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	-99	0	0	0	0	0
8	0	0	-99	0	0	0	-99	0	0	0	0	0
9	0	0	-99	0	0	0	-99	0	0	0	0	0
10	0	0	-99	0	0	0	-99	0	0	0	0	0
11	0	0	-99	0	0	0	-99	0	0	0	0	0
12	0	0	-99	0	0	0	-99	0	0	0	0	0
13	0	0	-99	0	0	0	-99	0	0	0	0	0
14	0	0	-99	0	0	0	-99	0	0	0	0	0
15	0	0	-99	0	0	0	-99	0	0	0	0	0
16	0	0	-99	0	0	0	-99	0	0	0	0	0
17	0	0	-99	0	0	0	-99	0	0	0	0	0
18	0	0	-99	0	0	0	-99	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	-99	0	0	0	0	0	0
22	0	0	0	0	0	-99	0	0	0	0	0	0
23	0	0	0	0	0	-99	0	0	0	0	0	0
24	0	0	0	0	0	-99	0	0	0	0	0	0
25	0	0	0	0	0	-99	0	0	0	0	0	0
26	0	0	0	0	0	-99	0	0	0	0	0	0
27	0	0	0	0	0	-99	0	0	0	0	0	0
28	0	0	0	0	0	-99	0	0	0	0	0	0
29	0	-99	0	0	0	-99	0	0	0	0	0	0
30	0	-99	0	0	0	0	0	0	0	0	0	0
31	0	-99	0	-99	0	-99	0	0	-99	0	-99	0
means:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Hoyt & Schatten (1998): Marius observed 7 June 1617 to 31 Dec 1618 but detected no spots at all

Marius 1617

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Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
2	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
3	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
4	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
5	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
6	-99	-99	-99	-99	-99	-99	0	0	0	0	0	0
7	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
8	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
9	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
10	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
11	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
12	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
13	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
14	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
15	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
16	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
17	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
18	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
19	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
20	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
21	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
22	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
23	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
24	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
25	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
26	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
27	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
28	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
29	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
30	-99	-99	-99	-99	-99	0	0	0	0	0	0	0
31	-99	-99	-99	-99	-99	-99	0	0	-99	0	-99	0
means:	-9.0	-9.0	-9.0	-9.0	-9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Tardé 1617

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1617
AS OBSERVED BY: TARDE, J., FARLAT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
2	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
3	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
4	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
5	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
6	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
7	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
8	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
9	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
10	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
11	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
12	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
13	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
14	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
15	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
18	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
19	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
20	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
21	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
22	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
23	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
24	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
25	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
26	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
27	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
28	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
29	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
30	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
31	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
means:	-9.0	-9.0	-9.0	-9.0	1.0	1.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0

Hoyt & Schatten (1998): **Marius observed 7 June 1617 to 31 Dec 1618 (except 3 gaps), but detected no spots at all**

Marius 1618

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1618
AS OBSERVED BY: MARIUS, S., NUREMBERG

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	-99	0	0	0	0	0
8	0	0	-99	0	0	0	-99	0	0	0	0	0
9	0	0	-99	0	0	0	-99	0	0	0	0	0
10	0	0	-99	0	0	0	-99	0	0	0	0	0
11	0	0	-99	0	0	0	-99	0	0	0	0	0
12	0	0	-99	0	0	0	-99	0	0	0	0	0
13	0	0	-99	0	0	0	-99	0	0	0	0	0
14	0	0	-99	0	0	0	-99	0	0	0	0	0
15	0	0	-99	0	0	0	-99	0	0	0	0	0
16	0	0	-99	0	0	0	-99	0	0	0	0	0
17	0	0	-99	0	0	0	-99	0	0	0	0	0
18	0	0	-99	0	0	0	-99	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	-99	0	0	0	0	0	0
22	0	0	0	0	0	-99	0	0	0	0	0	0
23	0	0	0	0	0	-99	0	0	0	0	0	0
24	0	0	0	0	0	-99	0	0	0	0	0	0
25	0	0	0	0	0	-99	0	0	0	0	0	0
26	0	0	0	0	0	-99	0	0	0	0	0	0
27	0	0	0	0	0	-99	0	0	0	0	0	0
28	0	0	0	0	0	-99	0	0	0	0	0	0
29	0	-99	0	0	0	-99	0	0	0	0	0	0
30	0	-99	0	0	0	0	0	0	0	0	0	0
31	0	-99	0	-99	0	-99	0	0	-99	0	-99	0
means:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Malapert 1618

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1618
AS OBSERVED BY: MALAPERT, C., BELGIUM

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
2	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
3	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
4	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
5	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
6	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
7	-99	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99
8	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
9	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
10	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
11	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
12	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
13	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
14	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
15	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
16	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
17	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
18	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
19	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
20	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
21	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
22	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
23	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
24	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
25	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
26	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
27	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
28	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
29	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
30	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
31	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
means:	-9.0	-9.0	1.0	-9.0	-9.0	1.0	1.0	-9.0	-9.0	-9.0	-9.0	-9.0

Naked-eye sunspots in the 17th century

Table 3 Comparison of naked-eye sunspots and telescopic sunspots from AD 1610 to 1743.

Date yy:mm:dd	Loc (+)	sun-spot	gro-ups	Text - Ref.	Comments	Telescopic spots date(s)	groups	observer(s)
1612:08:20	Ita		1	(drawing) - e	Aug 19-21	19-21 Aug	6-8	(5)
1613:03:30	Ch	1		black light - abc		no observations on Mar 30		
1616:10:10	Ch	1		black light - ab		no observations on Oct 10		
1617:01:11	Ch		1	several spots - abc	on one side	no observations on Jan 11		
1618:05:22	Ch		1	a black ladle - g		1-31 May	0 (*)	several (1)
1618:06:21	Ch		2	black vapors - c	on one side, 3 days	21-29 Jun	1	Malapert
1620:10	Ch		1	black vapor - bc	Oct 15-24	21-20 Oct	1	Malapert
1621:05:23	Ch		1	black vapor - abc		no observations in May		
1621:10/11	Ch		1	black snake - ac	Oct 15-Nov 12	1 Oct - 1 Nov	1	several
1622:6/7	Ch		2	moon,star in Sun - b	Jun 9-Jul 7	4-14 Jun	1	Scheiner
1624:03:18	Ch		8	≥ 100 spots - abc	Mar 17-20	no observations in March		
1624:04:16	Ch		2	black vapors - ac	on one side	no observations on Apr 16		
1624:05:26	Ch		1	black vapor - c		17-26 May	1	Scheiner
1625:5-8	Ch	2		black spots - abc	to one side, 10 days	1 May-31 Aug	1-10	Scheiner
1625:09:02	Ch	1		star seen on the Sun - g	on the side of the Sun	Sep 2	1	Scheiner
1626:06:29	Ch		1	a ladle - ab		29 Jun	1	(2)
1631:02:25	Ch	1		a black spot(s) - abc		no observations on Feb 25		
1635:02/03	Ch	1		a black light - abc	Feb 17-Mar 18	7-28 Feb	1	Gassendi
1637	Ch		1	several spots - abc		Jan-Oct	1-2	(3)
1638:03:16	Ch	1		Sun's light roiled - ac		16 Mar	4	Crabtree (11)
1638:09/10	Ch		1	black spots - ac	one side, Sep 8-Oct 6	1 Sep-13 Oct	0-9	Crabtree (11)
1638:12:09	Ch		1	black vapor - abc		9 Dec	7	Crabtree (11)
1639:02:05	Ch	1		Sun's light roiled - ac		5 May	5	Crabtree (11)
1639:03:16	Ch		2	black vapors - ac		16 Mar	2	Crabtree (11)
1639:10:26	Ch		1	a peck measure - abc		26 Oct	5	Crabtree (11)
1643:07:02	Ch		1	a black vapor - abc	also in Korea (f)	2 Jul	1	Hevelius
1647:05/06	Ch		1	like a knife - c	May 5-Jun 2	any	0 (*)	Hevelius
1647:07:28	Ch	1		a star in the Sun - ac		any	0 (*)	Hevelius
1648:01:16	Ko		1	black spots - a		any	0 (*)	Hevelius
1648:4-8	Ch	1		a star appeared - abc		any	0 (*)	Hevelius
1650:10:25	Ch		1	a peck measure - abc		any	0 (*)	Hevelius
1655:04:30	Ch	1		a black spot(s) - abc		1 Apr-31 Dec	0 (*)	Picard
1656:1-4	Ch	2		black spots - abc	Jan 26-Apr 23	9-21 Feb	1	Bose
1659:06:12	Ch	1		a black light - abc		any	0 (*)	Picard/Keill
1660:05:22	Ko		2	black vapors - ac	also in China	May	0 (4)	several
1661:07:05	Ch	1		a black spot - c	lower part of disc	1 Mar-30 Sep	0 (*)	Picard
1665:02:20	Ch	2		2 black spots - abc		any	0 (*)	Fogel,Picard
1665:08:27	Ch	1		a star in the Sun - ac		any	0 (*)	Fogel,Picard
1666:09:04	Ko		2	black vapors - ac	Sep 4-5	any	0 (*)	(6)
1684:03:17	Ch		1	dipper in Sun - abc	Mar 16-18	1-31 Mar	0 (*)	(7)
1709	Ch	1		a black spot - b		several	1-3	several
1720:06:01	Ko		1	a black vapor - b		1 Jun	3-27	several
1720:05:08	Ko		1	black gas - f		same	2-10	several
1726:10:21	Ko		1	a black vapor - b	Oct 20-22	20-22 Oct	5-6	(8)
1730:10:22	US		1	several spots - d		no observations in Oct		
1732:05:11	Ch		1	2 black spots - b	in SW, several days	no observations in May		
1739:04:19	US		1	very large spot - d	plus aurora	19-22 Apr	7	(9)
1743:10:20	Ko		1	a black vapor - b	Oct 19-21	no observations Oct 19-21, (10)		

Remarks: (+) Ita Italy, Ch China, Ko Korea. (*) Hoyt & Schatten (1998) report telescopic observations for those days, but no telescopic spot(s). (1) Both Riccioli in Bologna and Marius in Nuremberg supposedly observed the very same 334 days in 1618 including 22 May, when the naked-eye sunspot was observed, while neither Riccioli nor Marius detected any spot. (2) Willis et al. (2005) consider the Chinese naked-eye sunspot of Jun 29 as *spurious*, but Hoyt & Schatten (1998) specify that both Scheiner and Mogling detected one sunspot group each Jun 28, 29, and 30. (3) Observed by Marcgraf (Vaquero et al 2011). (4) A spot was seen from 7-19 May that year by several observers, which may be the same spot as the naked-eye spot; according to Wittmann & Xu (1987), Boyle (1671) also saw a spot on May 25, which is not listed in Hoyt & Schatten (1998). (5) Both Harroit & Galileo, the latter saw this spot both with a telescope and

1617 and 1618:

11 Jan 1617:

„ at about 9 a.m. there are several black spots [heizi] moving about at the side of the sun“

(no telescopic observations)

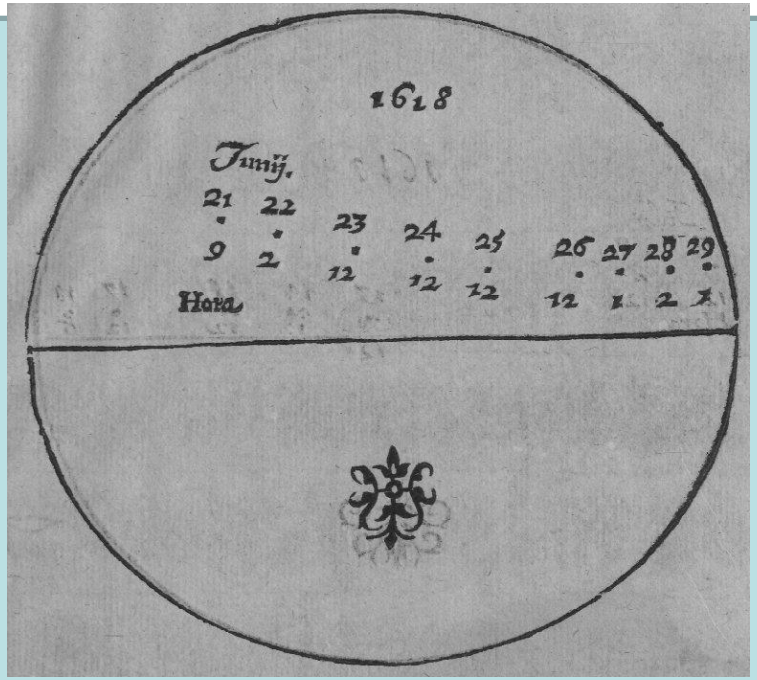
22 May 1618:

„ within the sun there was a black ladle“ or „… black spot [heizi]“

20-22 June 1618:

„ black vapour [heiqi] coming in and out of the sun, moving about “

Hoyt & Schatten (1998): Marius observed 7 June 1617 to 31 Dec 1618



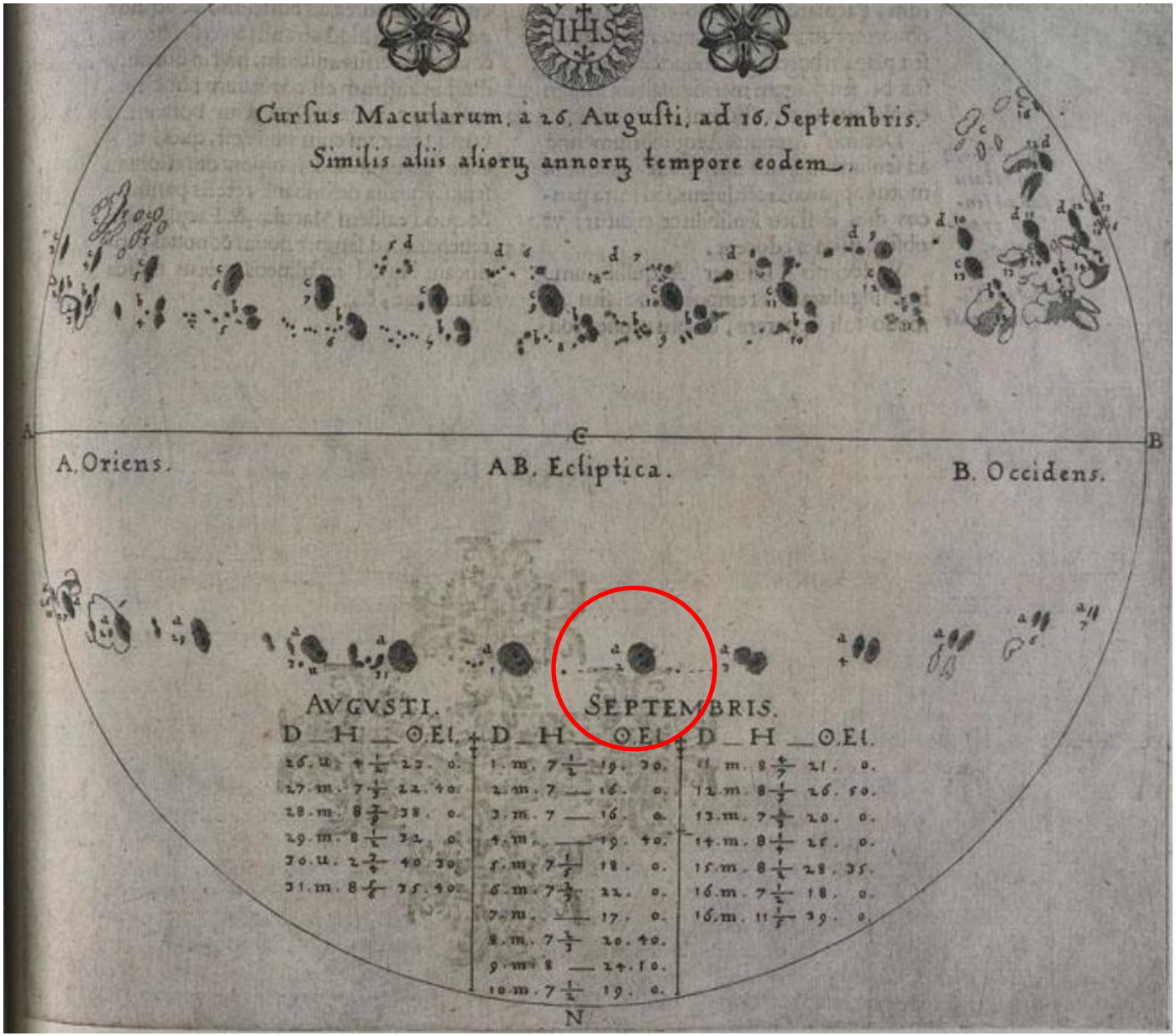
China, 20-22 June 1618:
„ black vapour [heiqi] coming in and out of the sun, moving about“

Consistent with Malapert:
21-29 June 1618
(spot 160 squ arc sec, drawn not to scale)

China, 22 May 1618:
„ within the sun there was a black ladle“ or „… black spot [heizi]“ with the naked eye …

Marius observed,
but saw no spots ?!

China: *A star at the side of the sun* (2 Sep 1625) - with naked eye !



C. Scheiner SJ
(in Rome)
Sep 1625
with telescope

(1600 square arc sec, i.e. visible to naked eye)

Hoyt & Schatten (1998): **Marius observed 7 June 1617 to 31 Dec 1618 (except 3 gaps), but detected no spots at all**

Marius 1618

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1618
AS OBSERVED BY: MARIUS, S., NUREMBERG

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	-99	0	0	0	0	0
8	0	0	-99	0	0	0	-99	0	0	0	0	0
9	0	0	-99	0	0	0	-99	0	0	0	0	0
10	0	0	-99	0	0	0	-99	0	0	0	0	0
11	0	0	-99	0	0	0	-99	0	0	0	0	0
12	0	0	-99	0	0	0	-99	0	0	0	0	0
13	0	0	-99	0	0	0	-99	0	0	0	0	0
14	0	0	-99	0	0	0	-99	0	0	0	0	0
15	0	0	-99	0	0	0	-99	0	0	0	0	0
16	0	0	-99	0	0	0	-99	0	0	0	0	0
17	0	0	-99	0	0	0	-99	0	0	0	0	0
18	0	0	-99	0	0	0	-99	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	-99	0	0	0	0	0	0
22	0	0	0	0	0	-99	0	0	0	0	0	0
23	0	0	0	0	0	-99	0	0	0	0	0	0
24	0	0	0	0	0	-99	0	0	0	0	0	0
25	0	0	0	0	0	-99	0	0	0	0	0	0
26	0	0	0	0	0	-99	0	0	0	0	0	0
27	0	0	0	0	0	-99	0	0	0	0	0	0
28	0	0	0	0	0	-99	0	0	0	0	0	0
29	0	-99	0	0	0	-99	0	0	0	0	0	0
30	0	-99	0	0	0	0	0	0	0	0	0	0
31	0	-99	0	-99	0	-99	0	0	-99	0	-99	0
means:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Malapert 1618

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1618
AS OBSERVED BY: MALAPERT, C., BELGIUM

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
2	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
3	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
4	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
5	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
6	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
7	-99	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99
8	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
9	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
10	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
11	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
12	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
13	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
14	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
15	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
16	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
17	-99	-99	1	-99	-99	-99	1	-99	-99	-99	-99	-99
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21	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
22	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
23	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
24	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
25	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
26	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
27	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
28	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
29	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
30	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
31	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
means:	-9.0	-9.0	1.0	-9.0	-9.0	1.0	1.0	-9.0	-9.0	-9.0	-9.0	-9.0

What did Marius write himself ?

„… dieweil ich nun **über die anderhalb Jahr** nicht mehr so viel maculas in disco Solis [Flecken auf der Sonnenscheibe] hab finden können, ja gar offt kein einig maculam antroffen, das doch **vorige Jahr** niemals geschehen.
dahero ich dann in meinen observationibus verzeichnet, Mirum mihi videtur, adeo raras vel saepius nullas maculas in disco solis deprehendi, quod ante hâc nunque est observatum [Es scheint mir sonderbar, dass vielmehr (nur) wenige oder häufiger (sogar) keine Flecken auf der Scheibe der Sonne entdeckt werden können, was vor diesem niemals beobachtet worden ist.].
Marius April 1619

"..., while I now, **for one and a half year**, could not find as much spots [maculas] on the solar disk, yet rather often not even a single spot [maculam],
as was never the case in the years before.
I have therefore written this in my observational log books, this appears strange to me, that rather few or more often no spots could be detected on the disk of the sun, which was never observed before."

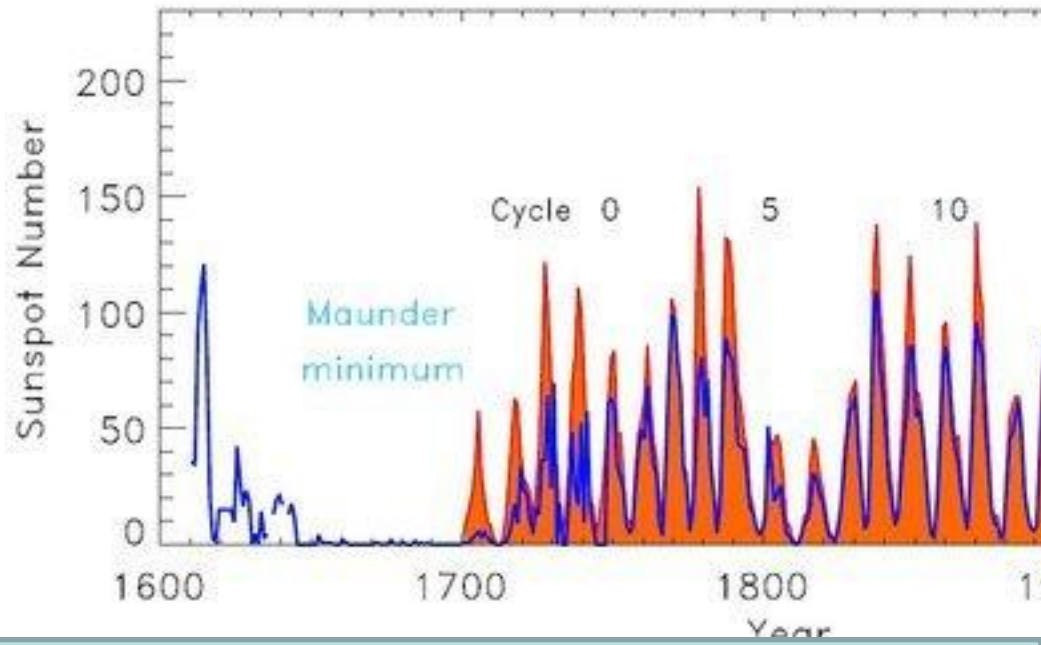
„vorige Jahr": singular or plural ? year or years ?
Can be plural, without article more likely plural
(Grimm & Grimm 1854, Bartz et al. 2004, examples by Lessing and Goethe)

Neuh & Neuh 2016

What did Marius write himself ?

„that rather few or more often [saepius] no spots could be detected on the disk of the sun, which was never observed before.”

Marius April 1619



Marius (April 1619): „ rather few or more often no spots “ (comparative)
➔ active day fraction < 0.5 but not zero (fall 1617 to spring 1619),
Transition from a Schwabe cycle maximum to a minimum !

Marius (April 1619): „no spots … which was never observed before“
➔ active day fraction = 1.0 from Aug 1611 to fall 1617 (when he observed)

Active day fraction f = (active days) / (active + inactive days)

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What did Marius write himself ?

Letter from Marius to Maestlin dated 29 Dec 1611 (julian):

"Habeo plurimum te quibus ad T. Ex. scriberem, utpote de illuminatione veneris et mercurij a Sole in modum lunae, et de Maculis in Sole, quas ab Augusto huiusque plurimas semperque diversas observavi."

"I praise You most for those things about which I write to you, His Excellency, namely the irradiation of Venus and Mercury from the Sun in the same way as the moon, and about the spots on the sun, which I have observed in very large numbers and always in different form since August."

Marius (29 Dec 1611) ➔ spot observations since Aug 1611 !

Neuh & Neuh 2016

What did Marius write himself ?

Prognosticon for 1613, finished and dated 1612 June 30 (julian):

"Die maculas in sole belangt, welche von Johann Fabricio und seinem Vattern Herrn Davide Fabricio erstlich observirt worden, die hab ich voriges Jahr 1611. im Augusto zum erstenmal gesehen, monstrante Ahasvero Schmidnero Regiomontano Borusso, der damals mich visitiert hat.“

"Regarding the spots in the sun, which were first observed by Johannn Fabricius and his father, David Fabricius, which I have seen for the first time last year 1611 in August, as they were shown to me by Ahasverus Schmidnerus from the Preussian Königsberg, who had visited me at that time.”

Marius (29 Dec 1611) ➔ spot observations since Aug 1611

(first with Ahasver Schmidtner, 1580-1634)

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What did Marius write himself ?

Mundus Iovialis (8 Feb 1614):

"Acturus nunc eram de maculis in Sole, uti ante hac proposueram, quidquid etiam in eis a 3. Augusti Anno 1611. usque huc observavi manifestare.
Verum non saltem ob causas ab initio indicatas in praesenti nil de eis certo determinare volo nec possum, sed quia etiam Doctissimos de iis dissentire, et egometipse mihi satisfacere nequeam. Quare relictis iis, Quatuor alia nunc subjungam, de quibus in dedicationibus meis annuorum prognosticorum hactenus nullam feci mentionem."

" It had been my intention, according to my former proposal, to deal now with the spots on the Sun, setting out all my observations upon them from August 3, 1611,
to the present time. However, I do not wish - and, indeed, am unable - to make any definite statement about them at present, not only from the causes originally pointed out, but for the further reason that I find the greatest authorities in disagreement, and am unable to satisfy myself. I therefore pass these matters by, and will take up here four other points not yet mentioned by me in the dedications of my yearly forecasts."

Marius (8 Feb 1614) ➔ spot observations since 3 Aug 1611 ! (julian)

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What did Marius write himself ?

Letter from Marius to Maestlin dated 29 Dec1611 (julian):
"… spots on the sun, which I have observed in very large numbers and always in different form since August."

Mundus Iovialis (8 Feb 1614):
"… spots on the Sun, setting out all my observations upon them from August 3, 1611" (julian)

Prognosticon for 1613, finished and dated 1612 June 30 (julian):
"… spots in the sun …, which I have seen for the first time last year 1611 in August, … shown to me by Ahasverus Schmidnerus …"

Marius observed sunspot(s) on 3 / 13 Aug 1611 with Schmidtner (and then many spots until end of the year 1611)

David Fabricius in letter to Maestlin on 1611 Dec 11: "Indeed, this summer [1611] I often observed ten or eleven spots scattered on the Sun's disk at one time."

27 Aug 1611: 12 large fiery rays were seen on the sky, for four full hours (Romania)
(quasi-)simultaneous aurora

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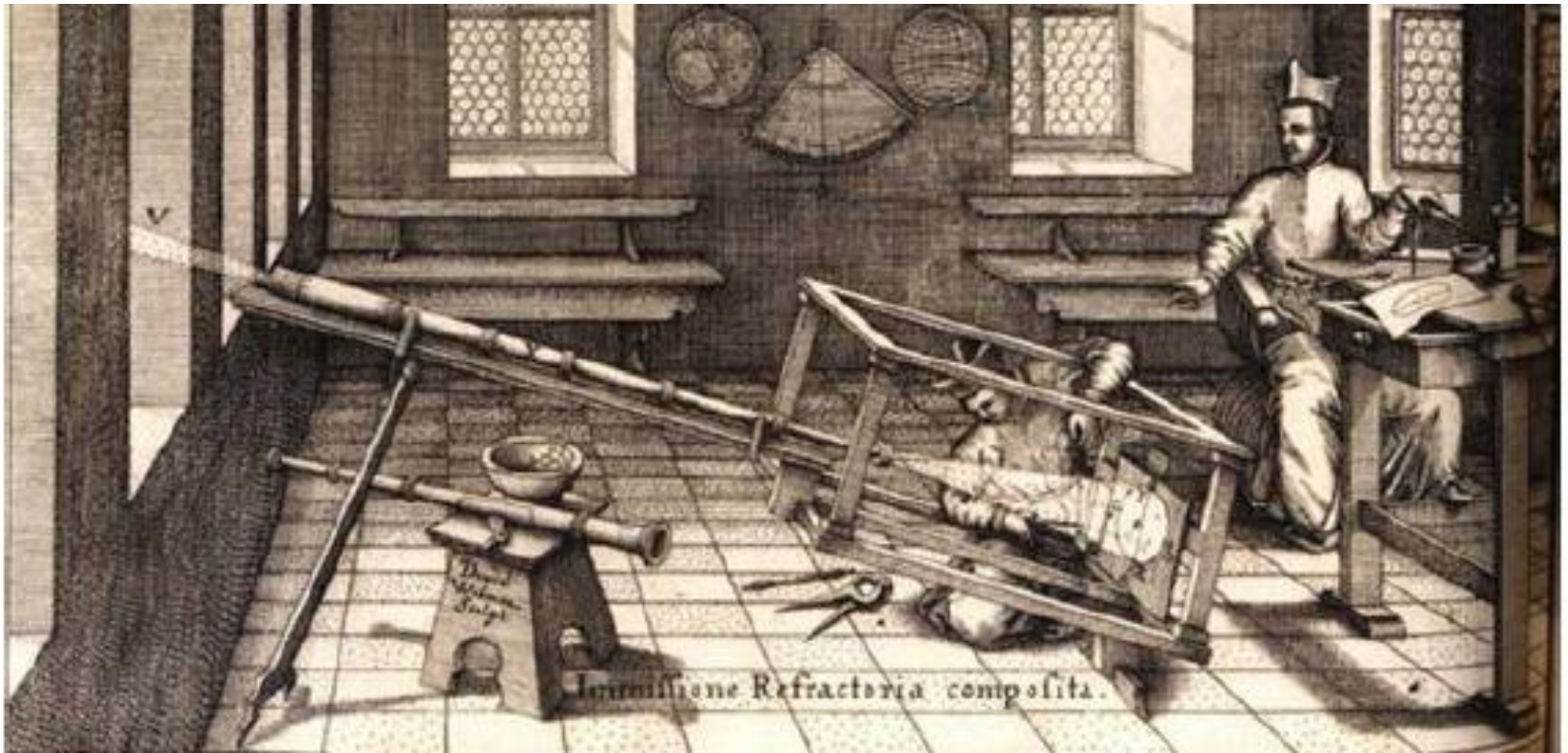
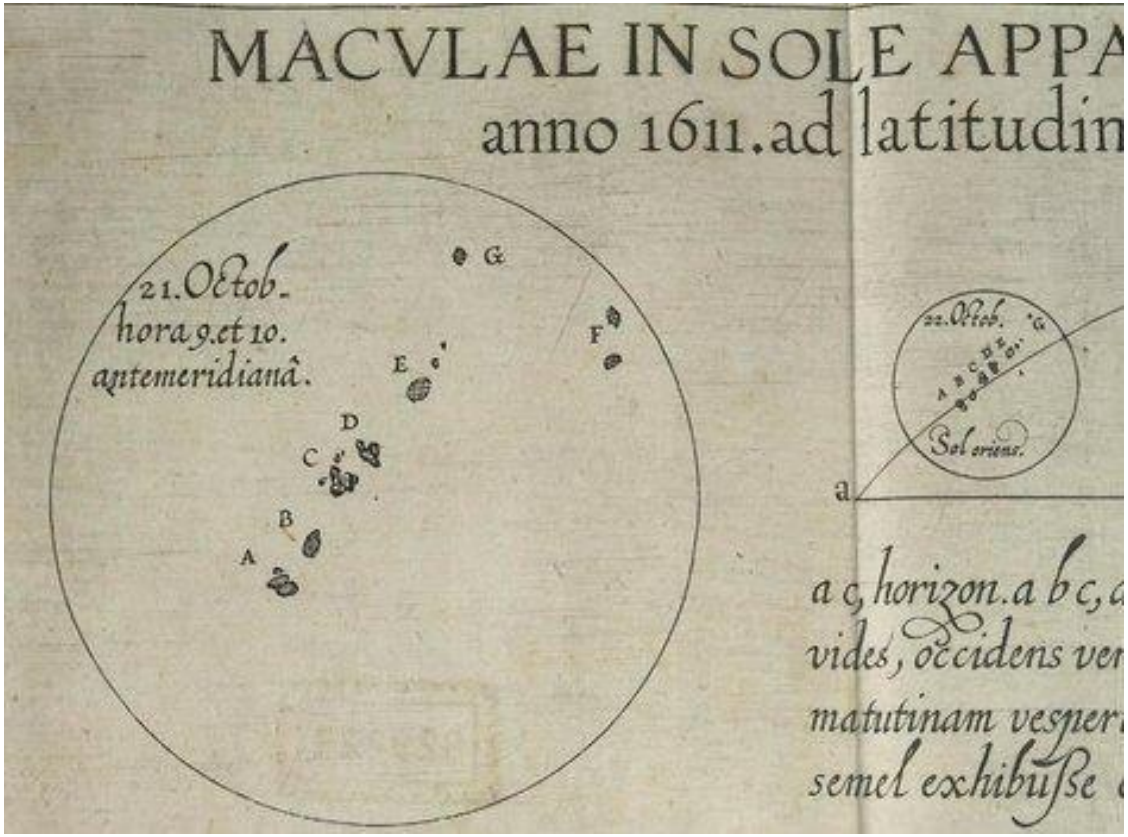
What did Marius write himself ?

Prognosticon for 1613, finished and dated 1612 June 30 (julian):

"When that [original] way of observing them [spots] was not sufficient any more for me, namely through the light ray in a dark room [Camera Helioscopica] by using the Belgian instrument, I have thought and implemented on Oct 11 [1611] a different way, so that I could see the sun and its spots clearly through the mentioned instrument during the bright day without harm for the face, including their daily motion. But later more about this."



What did Marius write himself ?



Scheiner SJ (Ingolstadt)

in the letter „Apelles“

drawing for 1611 Oct 21 (gregorian)

Marius observed spots on 1611 Oct 3 / 13 and / or Oct 11 / 21

(spots form an angle with [the ecliptic] ➔ solar equator is inclined to the ecliptic.)

Also an aurora in Europe in Oct 1611 (Link)

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What did Marius write himself ?

Mundus Iovialis (in 1615 appendix):

" Namely on [1615] July 4/14 there was a highly educated man here,
Mr. Petrus Saxo from Holstein, student of mathematics, who undertook a travel from Ingolstadt from Scheiner directly to me.

..., and that I have shown a figure,
which I had drawn on the 17th/27th day of November of the year 1611,
to the previously mentioned Holsteinian, who looked at it with admiration and added that this would have been shared with him in secret by Scheiner."

Marius observed on 1615 Jul 4/14 with Petrus Saxonius (Holstein)

and has produced a drawing of sunspots on 17 / 27 Nov 1611

(probably also on many other days, but lost)

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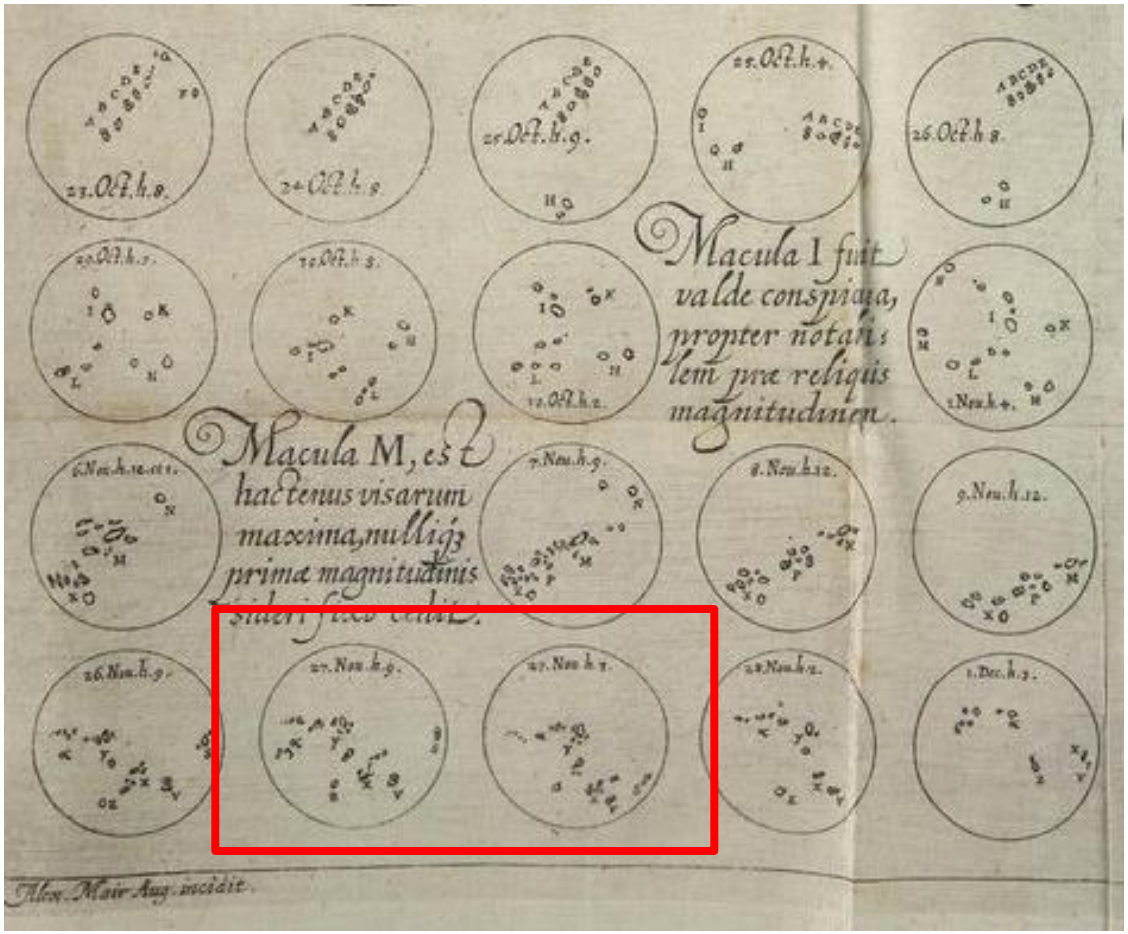
What did Marius write himself ?



Scheiner SJ (Ingolstadt)

in the letter „Apelles“

2 drawings
for 1611 Nov 27
(gregorian)

Marius observed on 1615 Jul 4/14 with Petrus Saxonius (Holstein)

and has produced a drawing of sunspots on 1611 Nov 17 / 27

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What did Marius write himself ?

Prognosticon for 1613, finished and dated 1612 June 30 (julian):

“Den 30. May diss Jahrs, hab ich 14. solcher auff einmal gesehen. Es seyn aber nicht in ipso corpore solari, sondern seyn corpora, quae circa Solem feruntur.”

“On May 30 [Julian] of this year [1612], I have seen 14 such [spots] at once. They were [would be], however, not on the solar body themself, but they were [would be] bodies orbiting the sun.”

Marius (20 June 1612) ➔ 14 spots on 1611 May 30 (julian)
= 1611 June 9 (gregorian)

(14 spots as upper limit for Marius until 20 June 1612)

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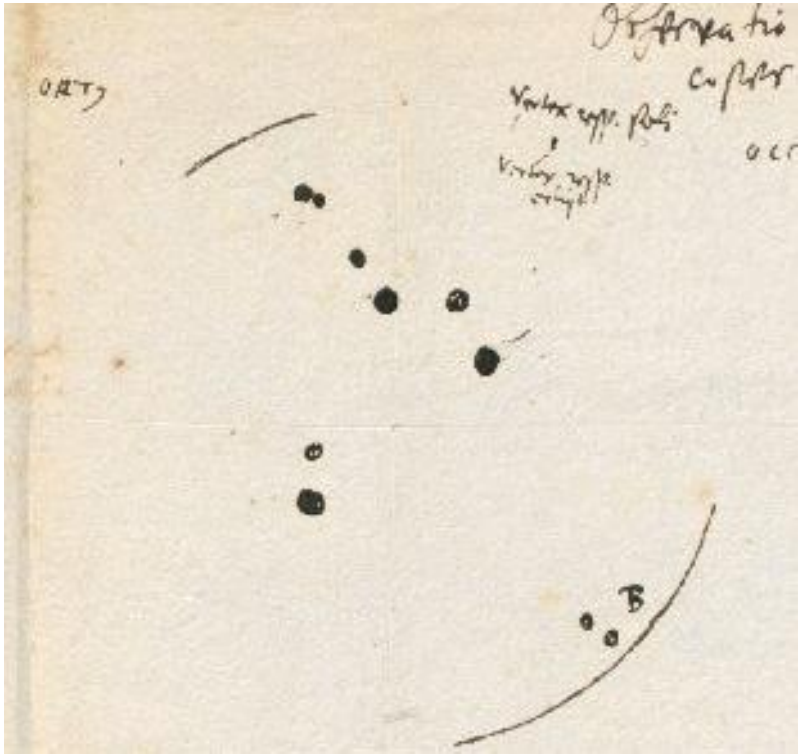
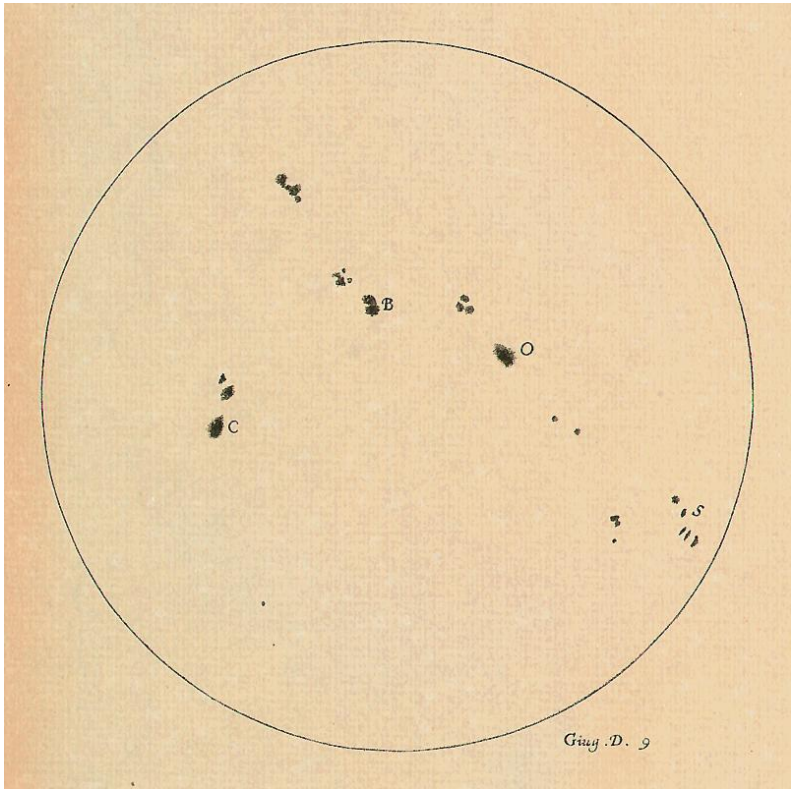
What did Marius write himself ?

Joachim Jungius (1587-1657, Giessen, Hambg)
30 May (julian): 10 spots in 5 groups



Galileo Galilei (Italy) 9 June (greg.):
25-30 spots in 7 - 9 groups



Thomas Harriot (England): 5 groups on 1611 June 8 and 10 (greg.)

Marius (20 June 1612) ➔ 14 spots on 1611 May 30 (julian)
= 1611 June 9 (gregorian)

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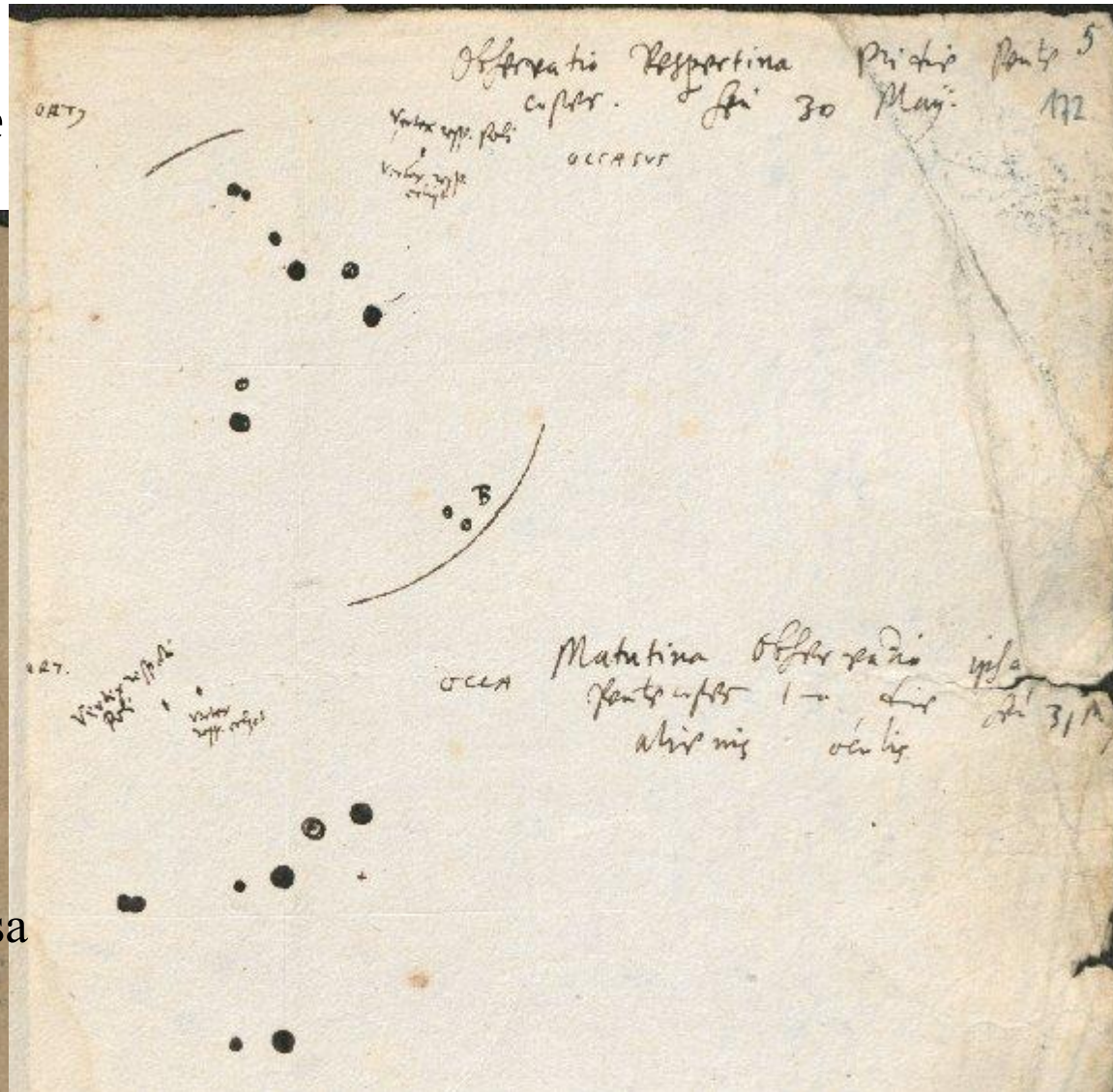
Joachim Jungius on 1611 May 30 (jul.) = 1611 June 9 (greg.)

Jungius:
"Observatio Vespertina pridie Pente costen ... 30. Maii"
(„evening observation day before pentecost ... 30 May", jul.)

"Vertex resp. Poli"
(to „celestial pole")
"Vertex resp. eclipsis"
(to „ecliptic pole")
"ortus" (east)
"occasus“ (west)

… 31. Maii Matutina observatio ipsa
Alienis oculis

Jungius (Giessen)
MS at U Hamburg



Correction of an error in Hoyt & Schatten regarding Harriot June 1612

Table 3 Correction of values from Harriot for 1612 June 8–13. For the days 1612 June 8-13 (Gregorian), we list the number of groups for Harriot as given in HS98 (*alldata*) and the corrected (just shifted) numbers according to the drawings by Harriot himself (see http://digilib.mpiwg-berlin.mpg.de); "n/o" for "not observed" (on that day). We did not change the number of groups, i.e. did not question the listing by HS98, but we just correct the dating. There is a simple shift error in the table *alldata* in HS98. The monthly number does not change, because the correction is just a permutation. Days before Jun 8 and after Jun 13 are not affected by the mistake. We list daily means from HS98 and our calculation (both without the correction), and then in the last column the daily means after the correction – where the two other observers Galilei and Jungius were of course also taken into account. For none of the possible combination for Galilei (see Note '[a]' below), we can reproduce the exact HS98 values, possibly at least partly due to their rounding (the same problem happens for both the *alldata* table from HS98 as listed below and the *filldata* table from HS98, where they interpolated for days without observations – similar problems with HS98 were noticed for other years in Neuhäuser et al. 2015 and Svalgaard & Schatten 2015). In the Col. 2, we list Wolf's numbers (Wolf 1858), which compare well with our corrected estimate from Harriot's drawings

Day/Date in June 1612	Wolf (1858) gr/sp (e)	Number Groups HS98 Value	Number Groups Harriot Drawing	HS98 Mean	Daily Mean Group Sunspot Number Our Mean (a) w/ Gal/HS	w/ Gal/Sak	w/ 2 × Gal	Our Corrected Mean (b)
8	5g12s	n/o	5	117 ± 17	122.5 ± 23.7	134.6 ± 6.4	125.0 ± 17.3	123.8 ± 14.3
9[c]	n/o	5	n/o	123 ± 5	126.7 ± 10.8 (d)	129.8 ± 9.5	127.6 ± 9	130.0 ± 9.2 (c)
10	6g14s	n/o	6	108 ± 4	108.6 ± 4.0	101.3 ± 14.4	102.7 ± 10.5	113.1 ± 22.4
11	n/o	6	n/o	116 ± 4	125.5 ± 16.9 (d)	124.2 ± 17.5	123.4 ± 14.4	116.4 ± 4.7
12	5g14s	n/o	5	109 ± 8	122.5 ± 23.7	121.6 ± 24.8	116.3 ± 19.8	117.3 ± 16.3
13	n/o	5	n/o	112 ± 11	116.7 ± 24.5	121.6 ± 24.8	113.5 ± 21	111.3 ± 25.1

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Datable sunspot observations by Marius 1611 - 1619

Table 1 **Datable sunspot observations by Marius.** We summarize here the dates with sunspot observations as reported by Marius. Dates are given in Julian ([J.]) or both calendars. We also cite some other important information from his reports here.

Date	Spots	Text (Julian dates)	Sect.	Remarks
1611 Aug 3/13	≥ 1	*my observations ... from Aug 3, 1611*	4.1	no observers in HS98 (a)
before 1611 Dec 29 [J.]		*spots ... observed in very large numbers*	4.1	many spots
before 1611 Dec 29 [J.]		*always in different form since August [1611]*	4.1	not only round
1611 Oct 11/21	≥ 1	*implemented on Oct 11 [1611] a different way* (b)	4.2	Scheiner for Oct 11/21 (Fig. 3)
1611 Oct 3/13	≥ 1	*on Oct 3/13 [1611] ... invented a method* (b)	4.2	observed Oct 3/13
1611 Nov 17/27	≥ 1	*figure ... I had drawn on 17 Nov 1611*	4.4	Scheiner (Fig. 3)
1612 May 30 / June 9	14	*May 30 this year [1612], I have seen 14 spots*	4.6	Jungius, Galilei (Figs. 4-6)
before 1612 June 30 [J.]		*see spots clearly ... including their daily motion*	4.6	observed often
1614 Feb 18/28		*my observations ... Aug 3, 1611, to present time*	4.1	observed since Aug 1611
before 1614 Feb 18/28		*sunspots do not traverse the disk of the sun on the*		general remark
		ecliptic, but build an angle with it	4.4	observed often
before 1615 Jul 4/14	?	*I have shown a figure (from 1611) to (Saxonius)*	4.7	see Sect. 4.8
before 1618 fall comet		*tail-like longish spots on the disk of the sun*	3.3	spot groups
before 1619 Apr		*for one and a half year, could not find as much spots*	3.3	decreasing activity
before 1619 Apr		*often not even a single spot, as was never ... before*	3.3	active day frac. =1 before (c)
before 1619 Apr		*rather few, or more often, no spot*	3.3	active day fraction < 0.5
		... which was never observed before ... since 1611	3.3	active day frac. =1 before (c)

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Simon Marius (1573 -1624):

„State-of-the-art“ (Hoyt & Schatten 1998):
Marius observed mid 1617 to end of 1618, but no spots.

Marius:
Observed and detected spots on 3 / 13 Aug 1611.
Spots in large numbers, in different form, etc.

Detected spot(s) on 3 / 13 and/or 11 / 21 Oct 1611

Spot drawing on 17 / 27 Nov 1611

Daily motion, inclination to ecliptic

14 spots on 30 May / 9 Jun 1612 (similar: Galileo, Jungius and Harriot)

Fall 1617 to spring 1619:
Rather few or more often no spots ➔ active day fraction < 0.5 (not 0)

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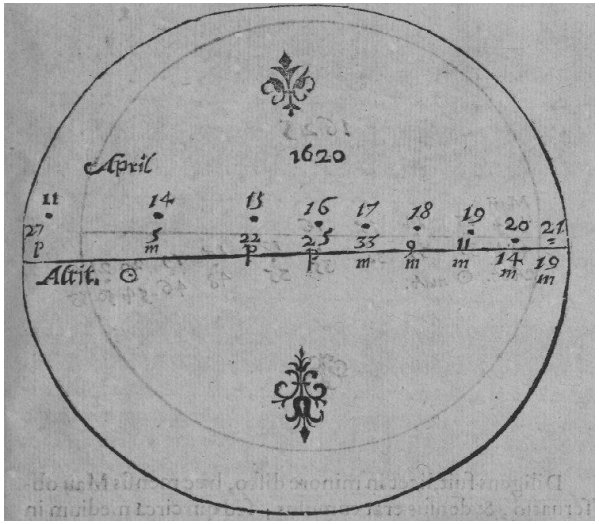
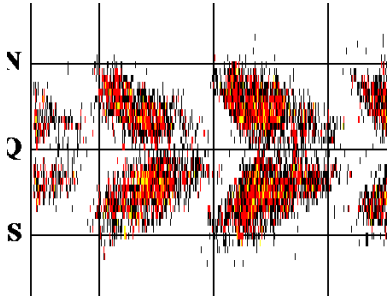
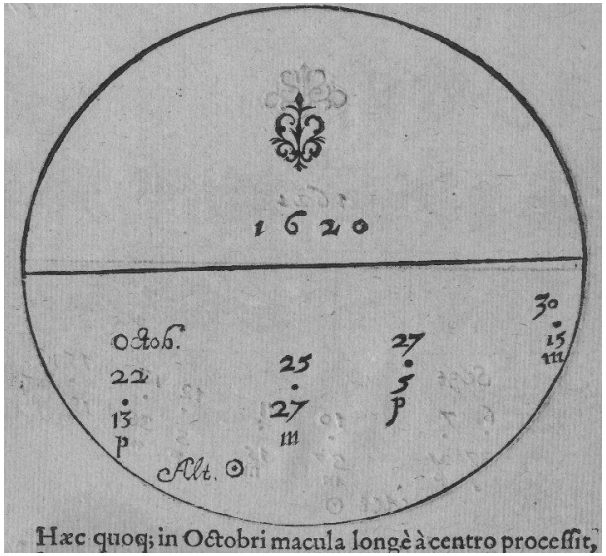




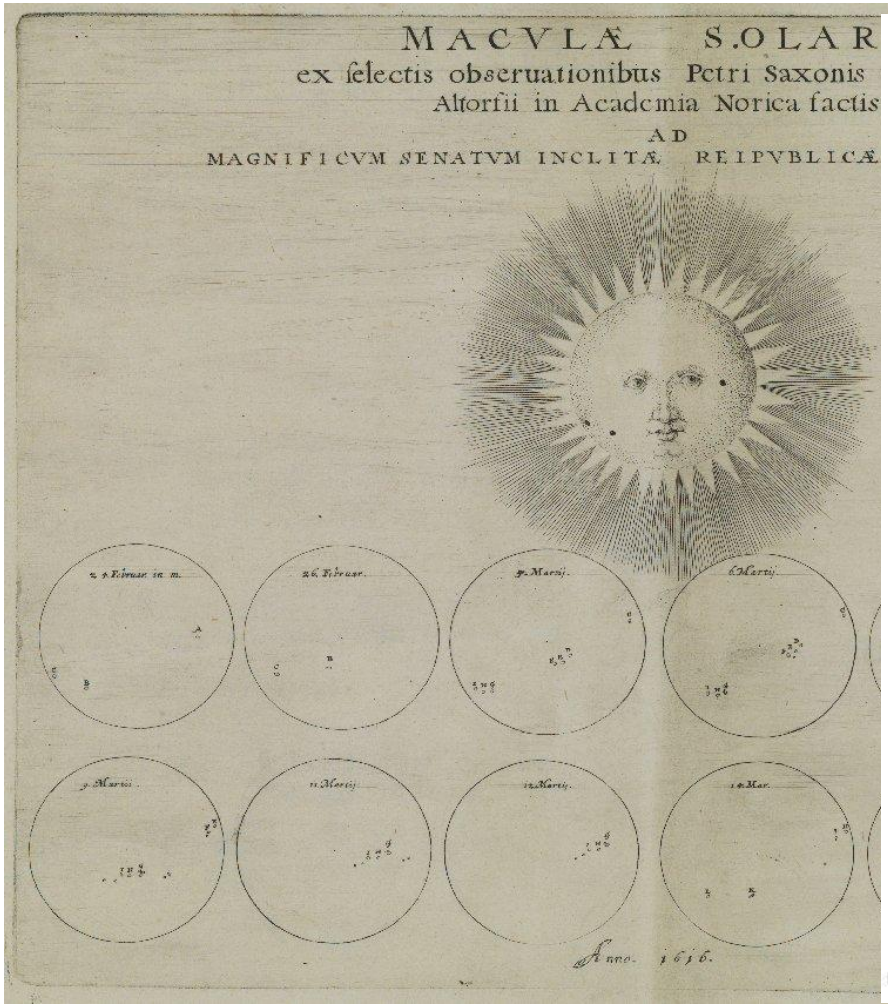


- First telescopic observations of sun spots

- Observations by Simon Marius 1611 – 1619

- **More observations by Saxonius, Tardé, Malapert: Constraining the first telescopic Schwabe cycle (~1610 to ~1620)**

Mundus Iovialis (in 1615 appendix):
" Namely on [1615] July 4/14 there was a highly educated man here,
Mr. Petrus Saxo(nius) from Holstein, student of mathematics …
(1591-1625)



NUMBER OF SUNSPOT GROUPS
AS OBSERVED BY: SAXONIUS

Day	Jan	Feb	Mar	Apr	May
1	-99	-99	-99	-99	-99
2	-99	-99	-99	-99	-99
3	-99	-99	-99	-99	-99
4	-99	-99	7	-99	-99
5	-99	-99	-99	-99	-99
6	-99	-99	7	-99	-99
7	-99	-99	6	-99	-99
8	-99	-99	7	-99	-99
9	-99	-99	8	-99	-99
10	-99	-99	-99	-99	-99
11	-99	-99	3	-99	-99
12	-99	-99	2	-99	-99
13	-99	-99	-99	-99	-99
14	-99	-99	4	-99	-99
15	-99	-99	-99	-99	-99
16	-99	-99	4	-99	-99
17	-99	-99	3	-99	-99
18	-99	-99	-99	-99	-99
19	-99	-99	-99	-99	-99
20	-99	-99	-99	-99	-99
21	-99	-99	-99	-99	-99
22	-99	-99	-99	-99	-99
23	-99	-99	-99	-99	-99
24	-99	3	-99	-99	-99
25	-99	-99	-99	-99	-99
26	-99	2	-99	-99	-99
27	-99	-99	-99	-99	-99
28	-99	-99	-99	-99	-99
29	-99	-99	-99	-99	-99
30	-99	-99	-99	-99	-99
31	-99	-99	-99	-99	-99
means:	-9.0	2.5	5.1	-9.0	-9.0

Saxonius:
1616 Feb 24 to Mar 17

Dates given here all Julian,
Saxo protestant
from northern Germany
working at protestant
U Altdorf (Nürnbg.-Erlg.).

But given as Gregorian by Hoyt & Schatten (1998), i.e. wrong by 10 days

Correct: 1616 Mar 5 – 27 (greg.)

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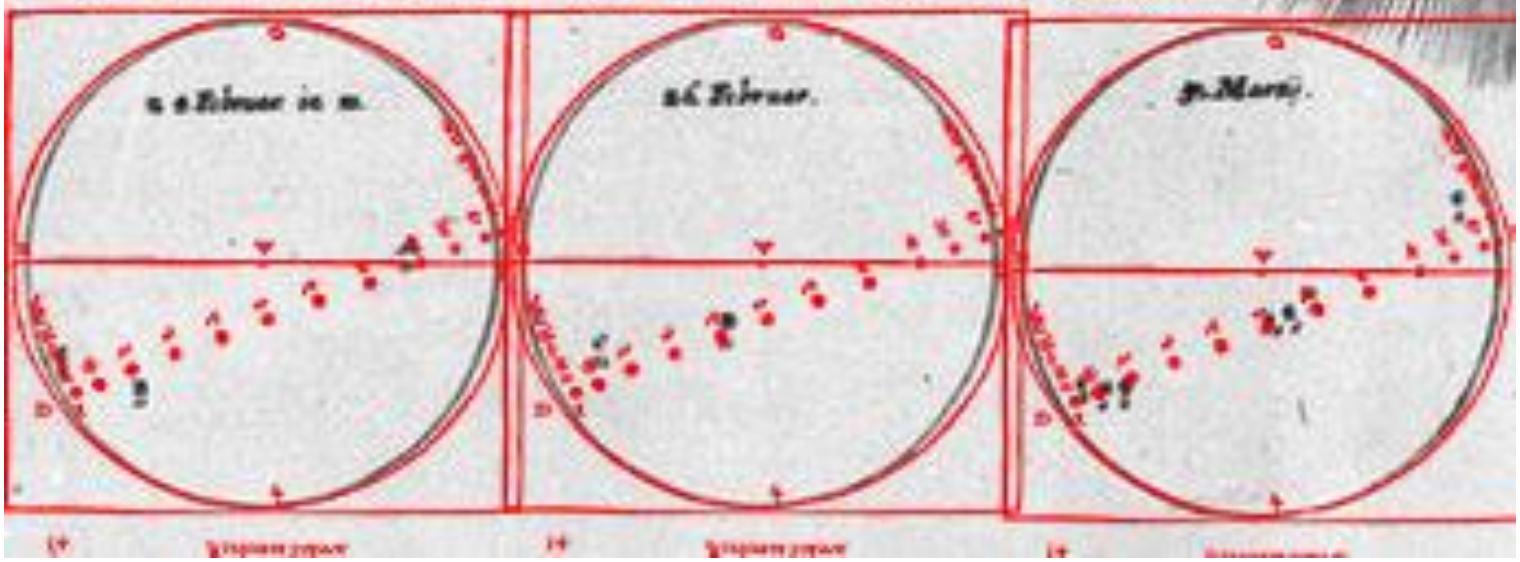
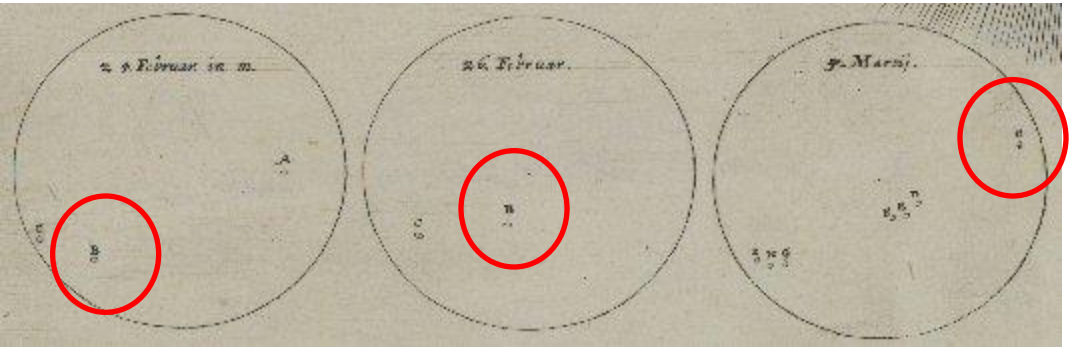


Petrus Saxo(nius) (UAltdorf):

1616 Mar 5 – 27 (greg.)

Feb 24 26 Mar 4 (jul.)
Mar 5 7 14 (greg.)



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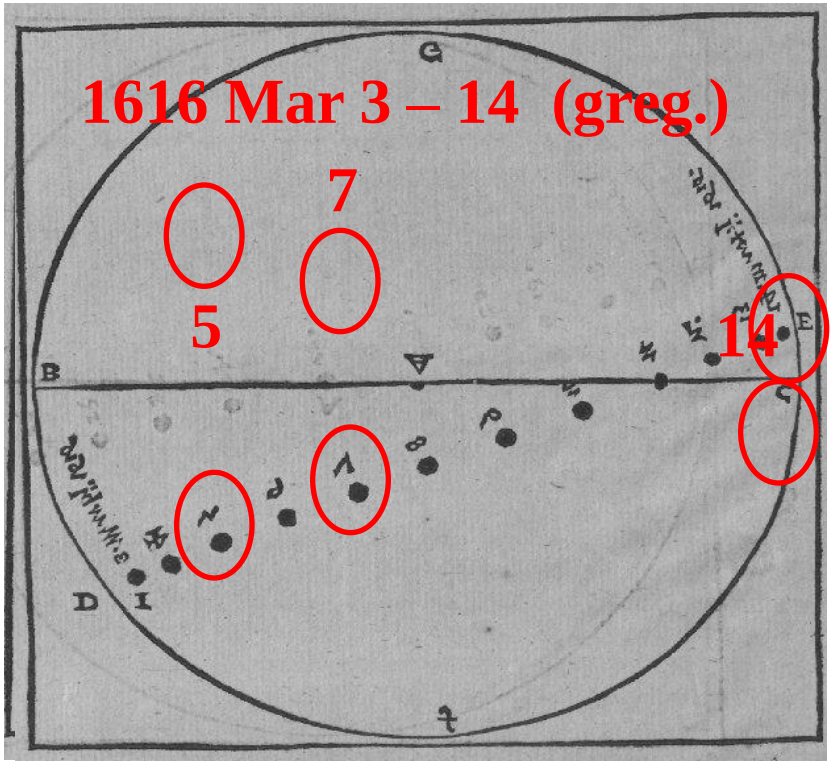
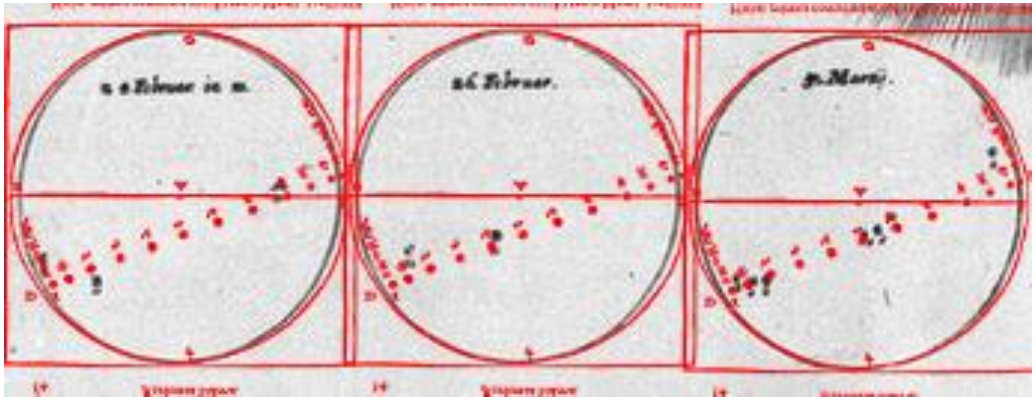
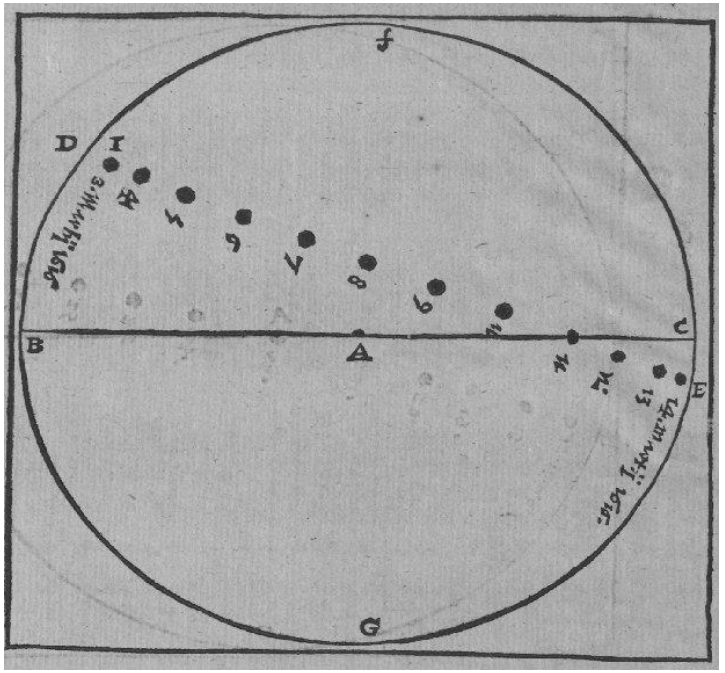
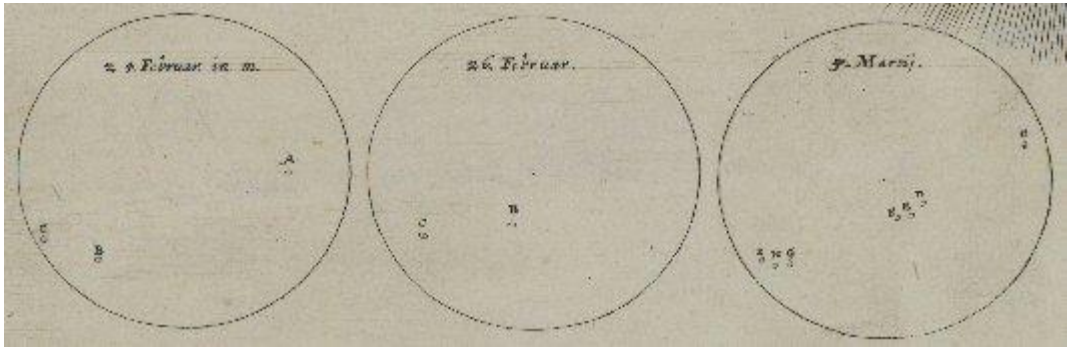
Tardé (1561-1636 France):







➔Tardé shows typically one spot at a time (and how it traverses the solar disk)



➔Saxonius shows all spots, but used Julian dates

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Correct calendar conversion for Saxonius and Tarde 1616

1616		number of groups	
Julian	Gregorian	Saxonius	Tardé
Feb 22	Mar 3	n/o	≥ 1
Feb 23	Mar 4	n/o	≥ 1
Feb 24	Mar 5	3	≥ 1
Feb 25	Mar 6	n/o	≥ 1
Feb 26	Mar 7	2	≥ 1
Feb 27	Mar 8	n/o	≥ 1
Feb 28	Mar 9	n/o	≥ 1
Feb 29	Mar 10	n/o	≥ 1
Mar 1	Mar 11	n/o	≥ 1
Mar 2	Mar 12	n/o	≥ 1
Mar 3	Mar 13	n/o	≥ 1
Mar 4	Mar 14	7	≥ 1
Mar 5	Mar 15	n/o	n/o
Mar 6	Mar 16	7	n/o
Mar 7	Mar 17	6	n/o
Mar 8	Mar 18	7	n/o
Mar 9	Mar 19	8	n/o
Mar 10	Mar 20	n/o	n/o
Mar 11	Mar 21	3	n/o
Mar 12	Mar 22	2	n/o
Mar 13	Mar 23	n/o	n/o
Mar 14	Mar 24	4	n/o
Mar 15	Mar 25	n/o	n/o
Mar 16	Mar 26	4	n/o
Mar 17	Mar 27	3	n/o

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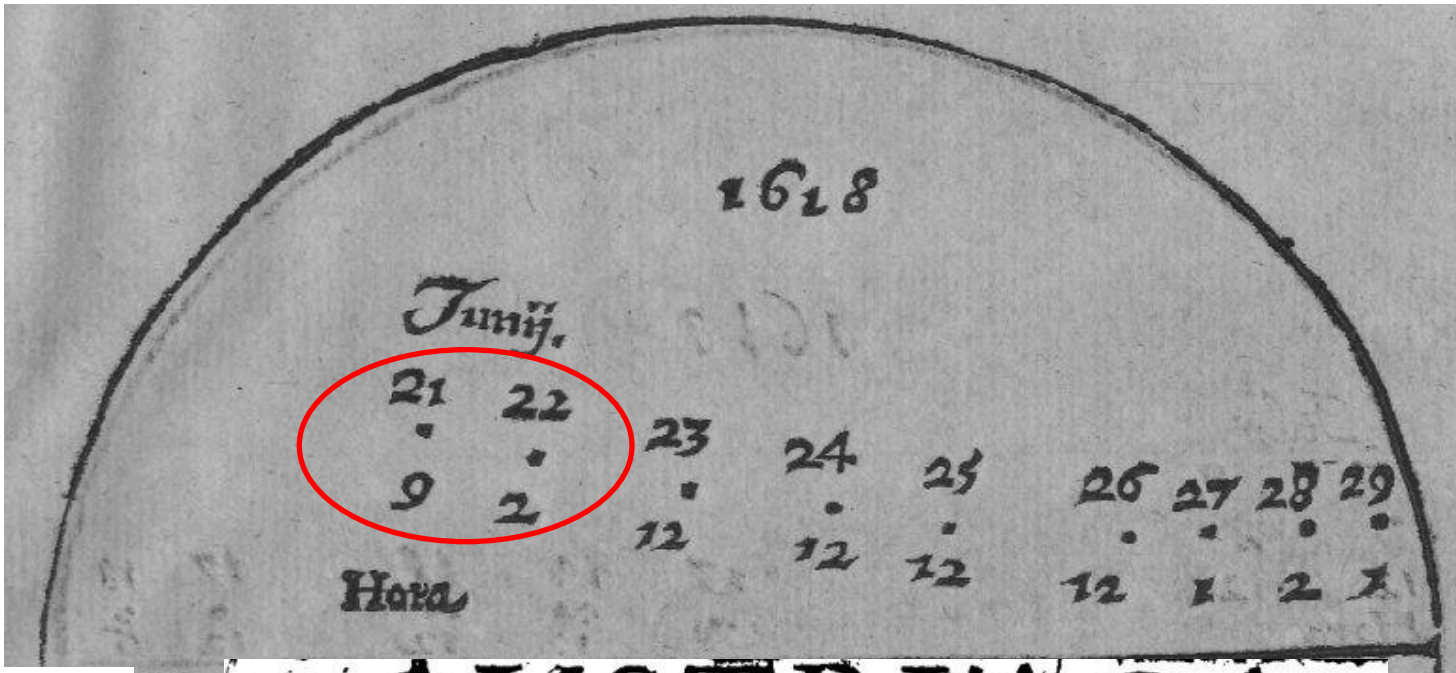
China: „black vapour [heiqi] coming in and out of the sun, moving about“ (20 - 22 June 1618)

C. Malapert SJ

in Kalisz, Pl

with telescope

B = 1.3 deg
P = -7.3 deg
(June 21-29)



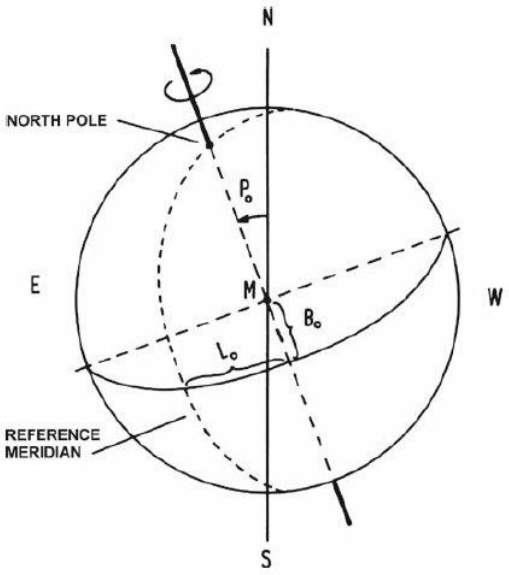
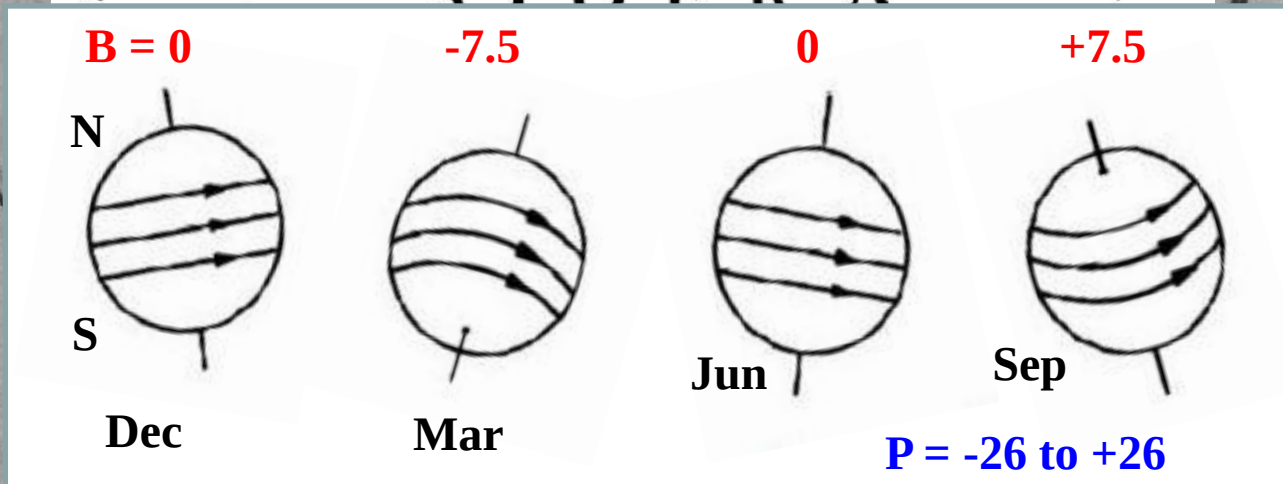
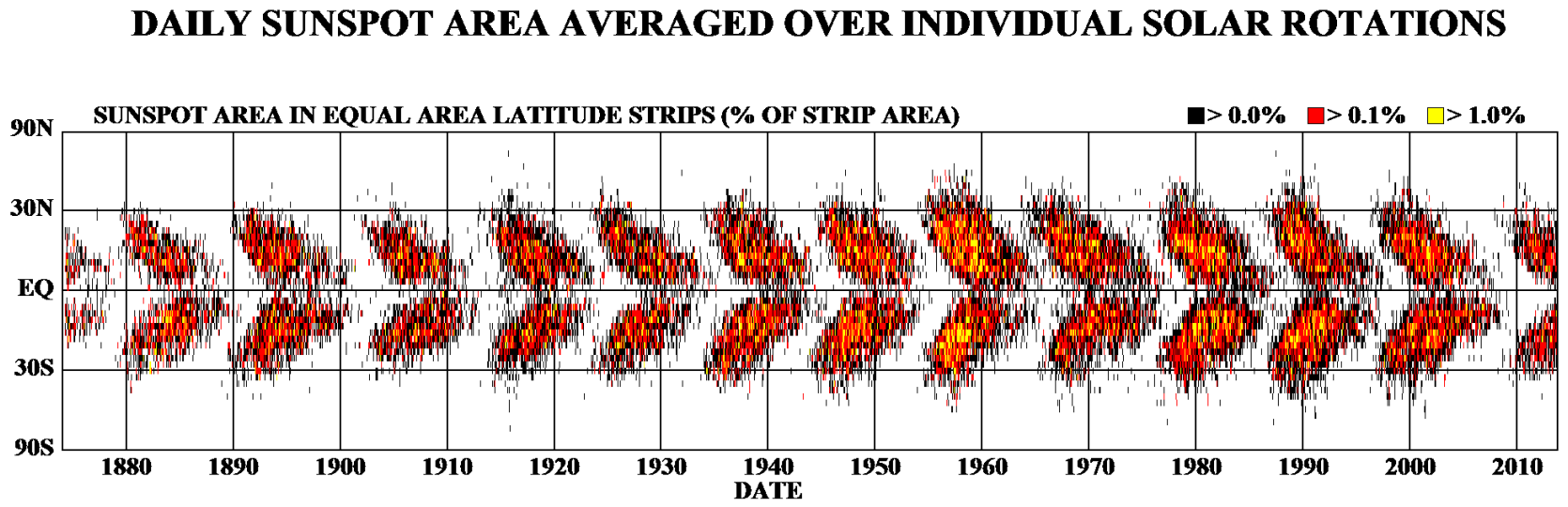
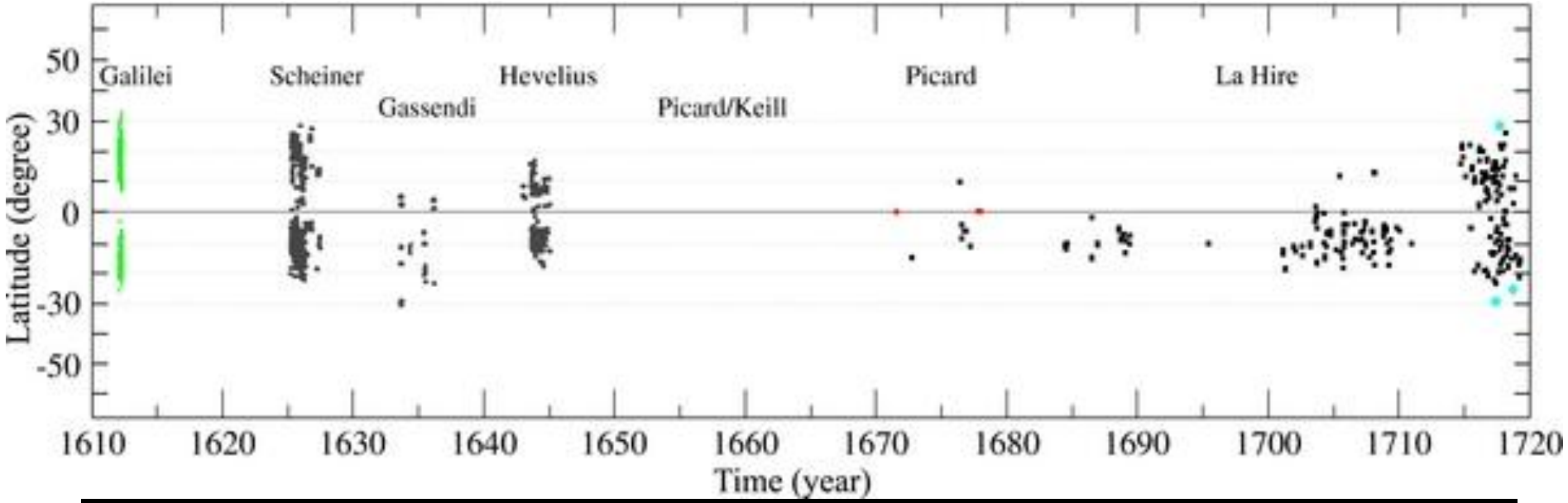


Fig. 3.42. Heliographic coordinates.

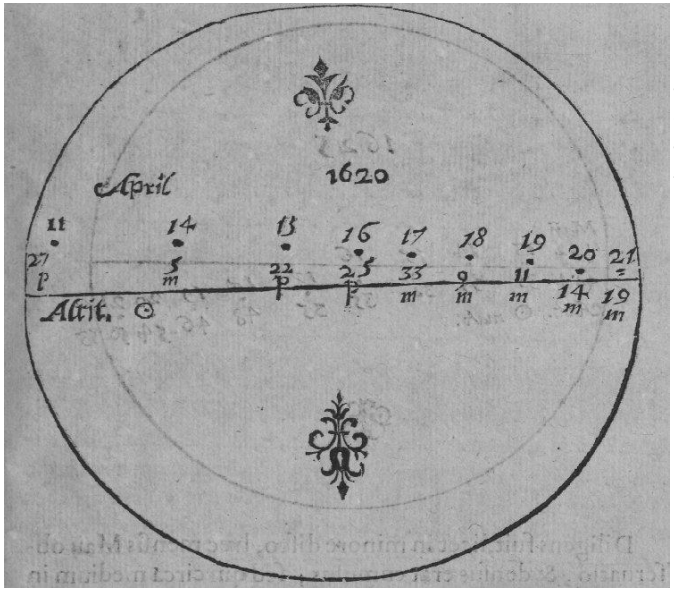


Schwabe cycle since 1750: 10.4 +/- 1.2 yr

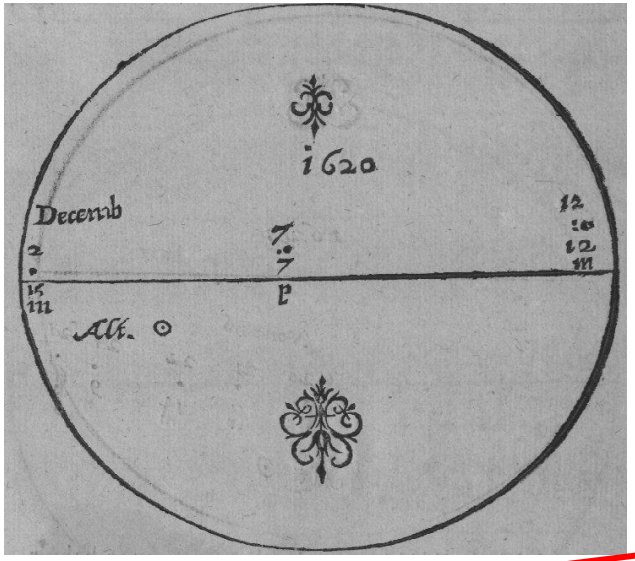




C. Malapert observed the first telescopic Schwabe cycle minimum

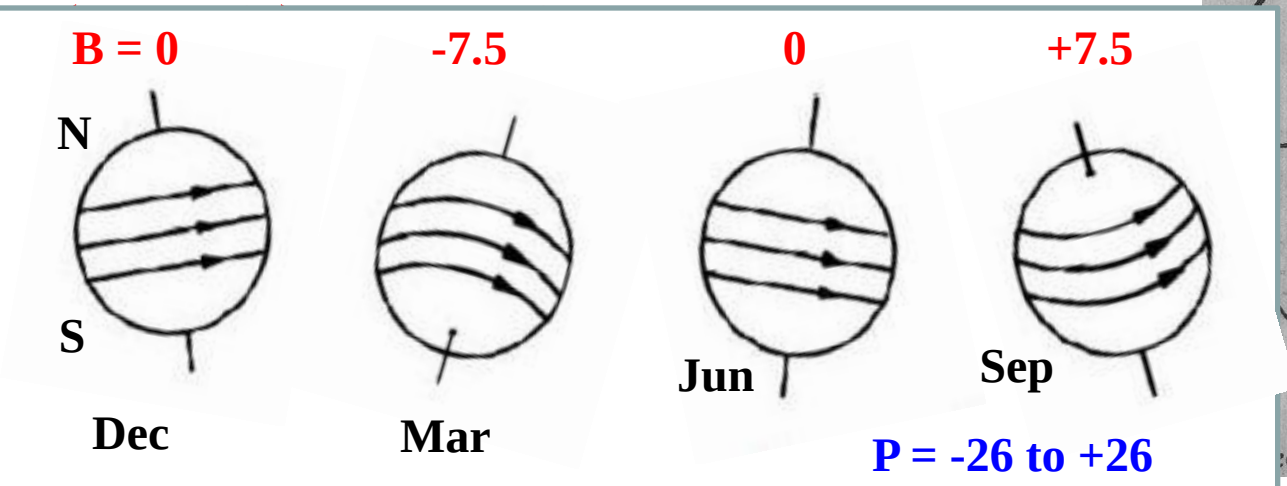


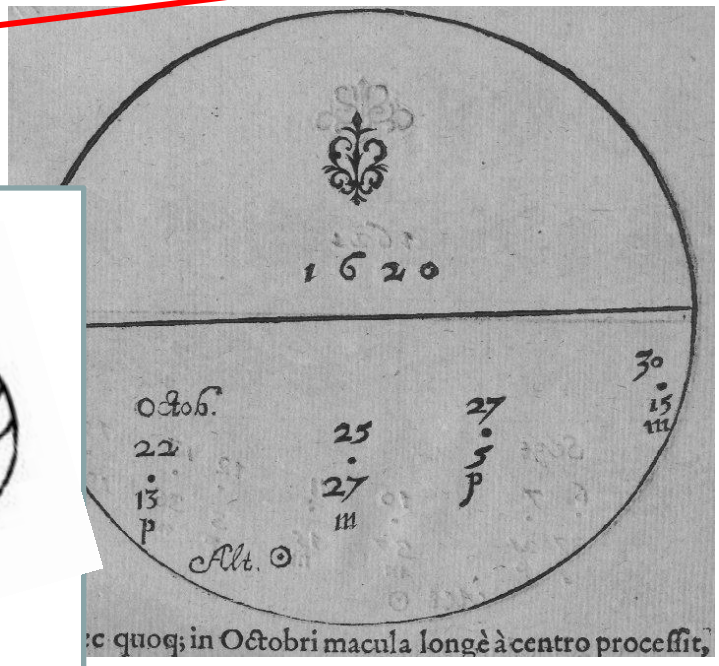
11-21Apr:
P = -26 deg
B = -6 deg



2-12 Dec:
P = 14 deg
B = 0 deg

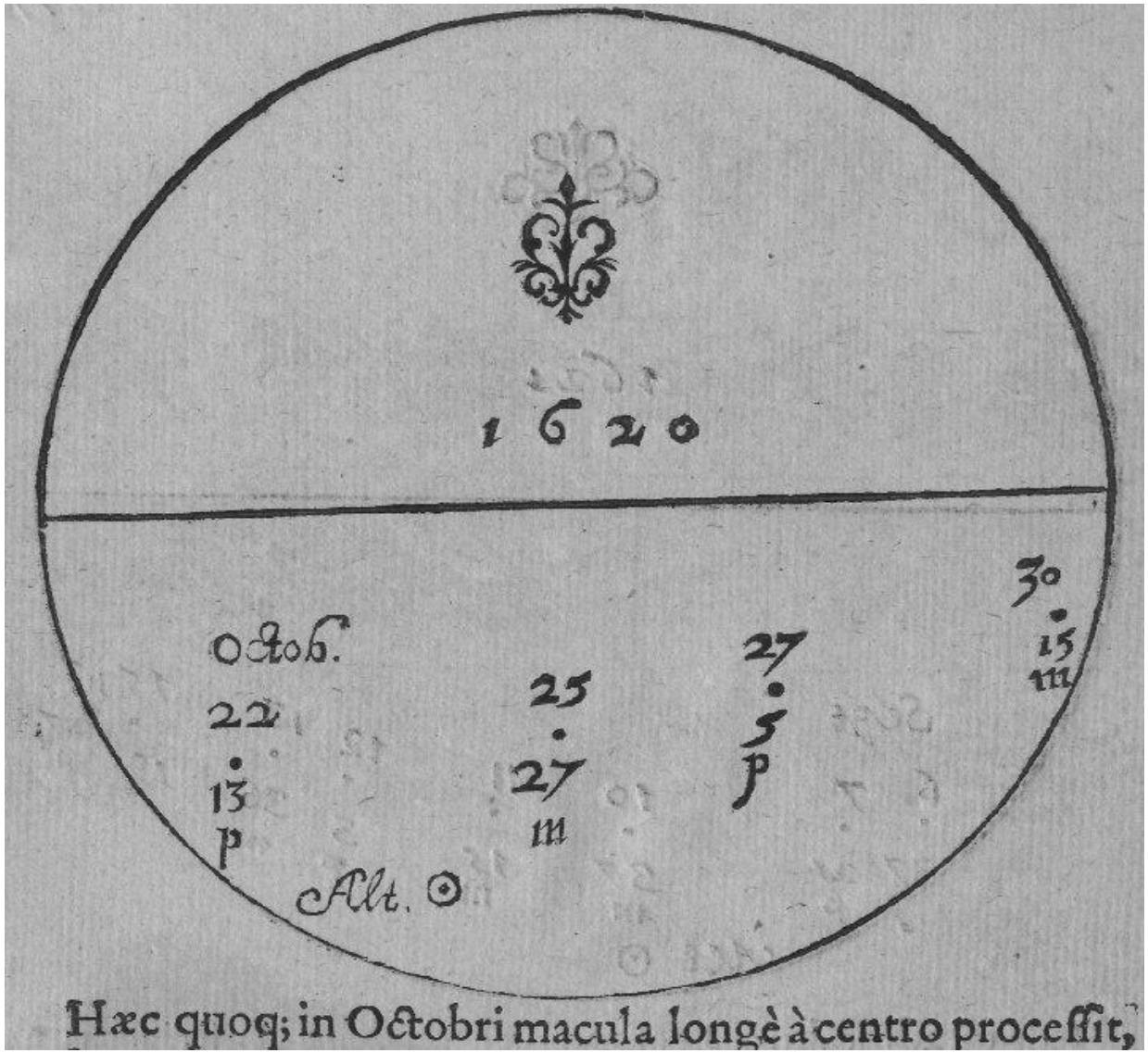
Apr & Dec 1620:
Last spots at low latitude





C. Malapert observed the first telescopic Schwabe cycle minimum

22-30 Oct:
P = 25 deg
B = 5 deg



China:
„back vapour“
during the
10 day-period
1620 Oct 15-24

Neuh & Neuh 2016

Date (Gregorian)	sunspots	aurorae criteria	observer or location	Remarks, Ref. or Section	quasi-simultan
before 1617 fall	many spots		Marius	Sect. 3.3	
1617 Jan 11	several naked-eye spots		China	Sect. 3.2	
1617 May 27-June 6	1 spot group		Tardé	Sect. 4.8	
1617 fall-1619 spring	few or no spots		Marius	Sect. 3.3	
1618 Mar 8-18	spots and groups		Malapert et al.	Sect. 7.2	
1618 May 17		2 (e)	China	Yau et al. & Xu et al.	sim
1618 May 22	1 naked-eye spot group		China	Sect. 3.2	sim
1618 Jun 20-22	1 naked-eye spot group		China	Sect. 3.2	sim
1618 Jun 21-29	1 spot group		Malapert	Fig. 2	sim
1618 Jul 7-19	1 spot group		Malapert et al.	Sect. 7.2	sim
1618 Jul 19		2 (f)	China	Yau et al.	sim
1618 Nov 17		2	Korea	Yau et al.	cor. hole? (m)
1618 Dec 14		1	Korea	Yau et al.	cor. hole? (m)
1618 Aug-Dec (k)	no spots		Argoli	Sect. 3.4	
1617 fall-1619 spring	few or no spots		Marius	Sect. 3.3	
1619 Jan 4-7		4	Korea	Yau et al. & Xu et al.	
1619 Jan 13-20	1 spot group		Malapert	low latitude, Sect. 7.2	
1619 Aug 16-28	1 spot group		Malapert	low latitude	
1620 Feb 3		2	China	Xu et al.	
1620 Feb 17-28	1 spot group	(a)	Malapert	low latitude, Sect. 7.2	(a)
1620 Apr 11-21	1-2 spots		Malapert	low latitude, Fig. 11	
1620 Jun 6 & 7	1 spot		Malapert	30° *south*, Sect. 7.2	
1620 Aug 19		1	China	Xu et al.	
1620 Oct 19		1 (g)	China	Yau et al.	sim
1620 Oct 15-24	naked-eye spot		China	Yau & Stephenson 1988	sim (i)
1620 Oct 22-31 (b)	1 spot group		Malapert et al.	high latitude, Fig. 12	sim (d,i)
1620 Dec 2-13 (c)	1-3 spots		Malapert et al.	low latitude, Fig. 13	(d)
1621 Jan 9-11	1 group		Schickard	Ref. HS98	
1621 May 2		3	China	Xu et al.	
1621 May 23	naked-eye spot(s)		China	Wittmann & Xu 1987	
1621 Sep 6-16	1 spot group		Malapert	high latitude	sim
1621 Sep 12		(h)	Europe/Syria	Fritz 1873	sim
1621 Sep 26-30	1 spot group		Scheiner	Ref. HS98	
1621 Oct 1-15	1 spot group		Scheiner & Smoguleczz	Ref. HS98	
1621 Oct 5-Nov 1	1 spot group		Smogulez	Ref. HS98	sim
1621 Oct 25-31	1 spot group		Scheiner	Ref. HS98	sim
1621 Oct 15-Nov 12	naked-eye spots		China	Wittmann & Xu 1987	sim (l)
1621 Nov 20-25	1 spot group		Malapert	high latitude	
1621 Nov 16-25	1 spot group		Scheiner	Ref. HS98	

Timing of the Schwabe cycle minimum

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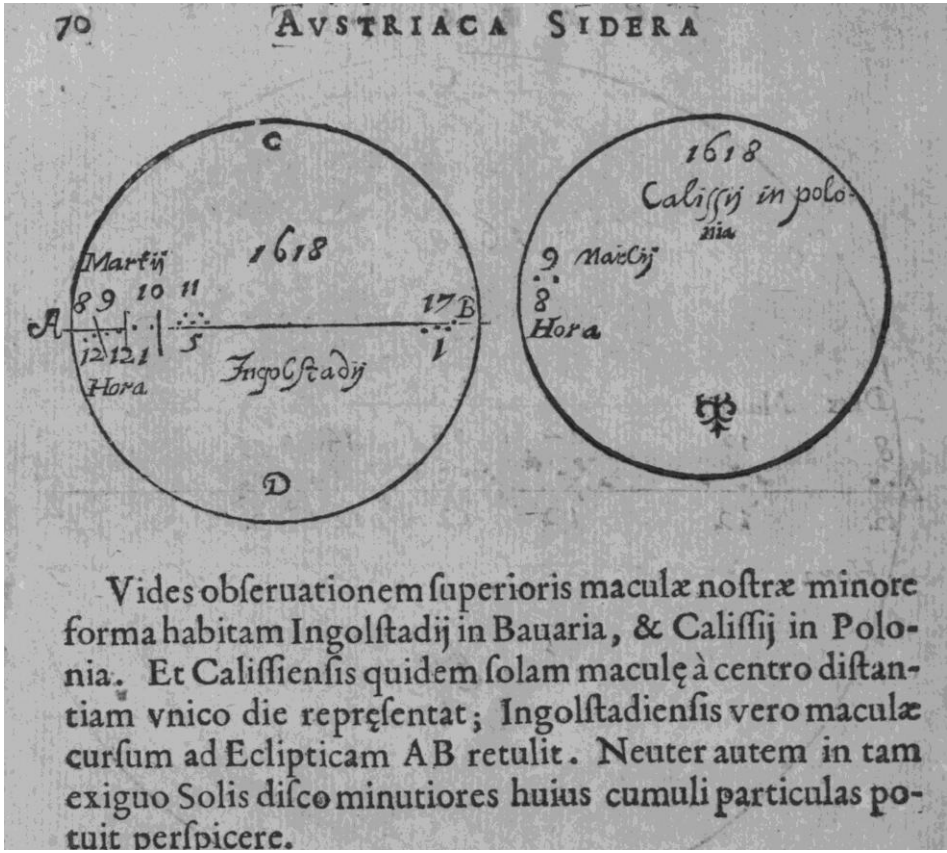
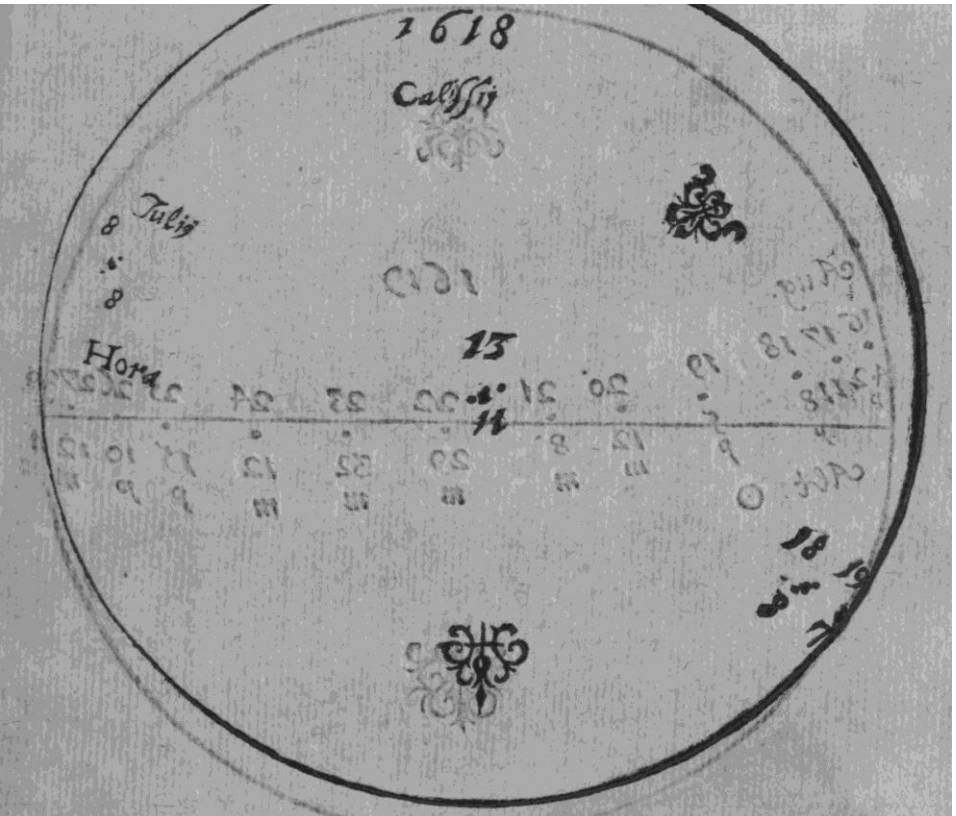
C. Malapert SJ (1581-1630) also presented observations by others:

Johann Cysat SJ (1586-1657) from Ingolstadt, Germany …… >



Vides obſeruationem ſuperioris maculæ noſtræ minore forma habitam Ingolſtadij in Bauaria, & Caliſſij in Polonia. Et Caliſſienſis quidem ſolam maculę à centro diſtantiam vnico die repręſentat; Ingolſtadienſis vero maculæ curſum ad Eclipticam AB retulit. Neuter autem in tam exiguo Solis diſco minutiores huius cumuli particulas potuit perſpicere.



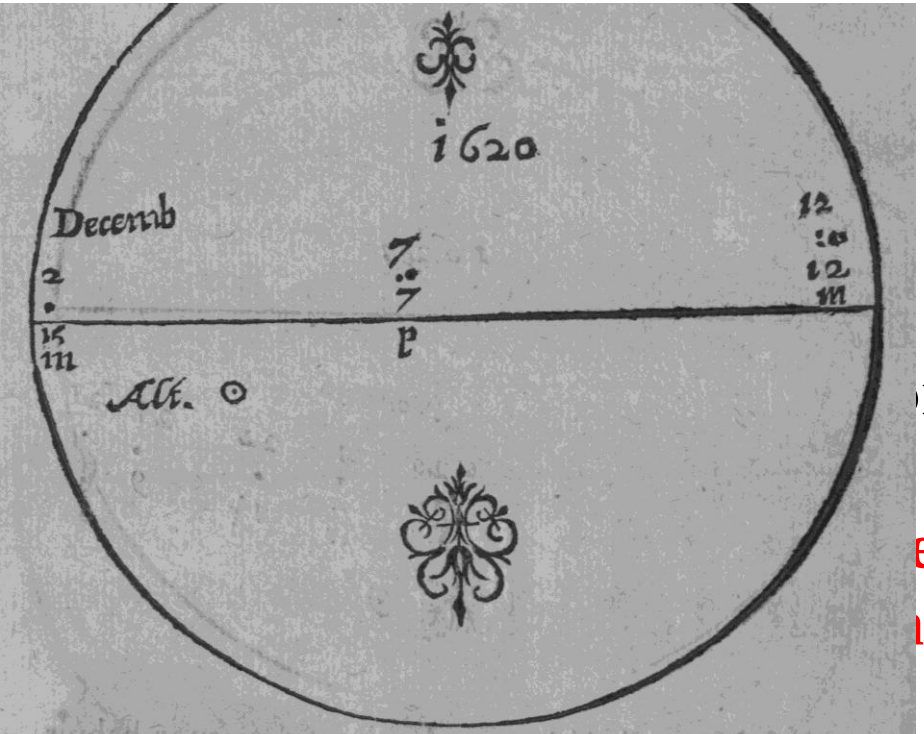
Hęc eadem eſt Menſis Iulij macula, quam ex meis obſeruationibus iam propoſui. Habita eſt Calliſſij in Polonia obſeruatio à Simone Perouio noſtræ Societatis ibidem Mathematico. Non eſt redacta ad Eclipticam; videre tamen eſt quàm conſentiant diſtantiæ à centro, præcipuè verò die 13, quando eadem fere hora, locis adeo diſtantibus,

Simon Perovius SJ (~1583-1656) from Kalisz, Poland

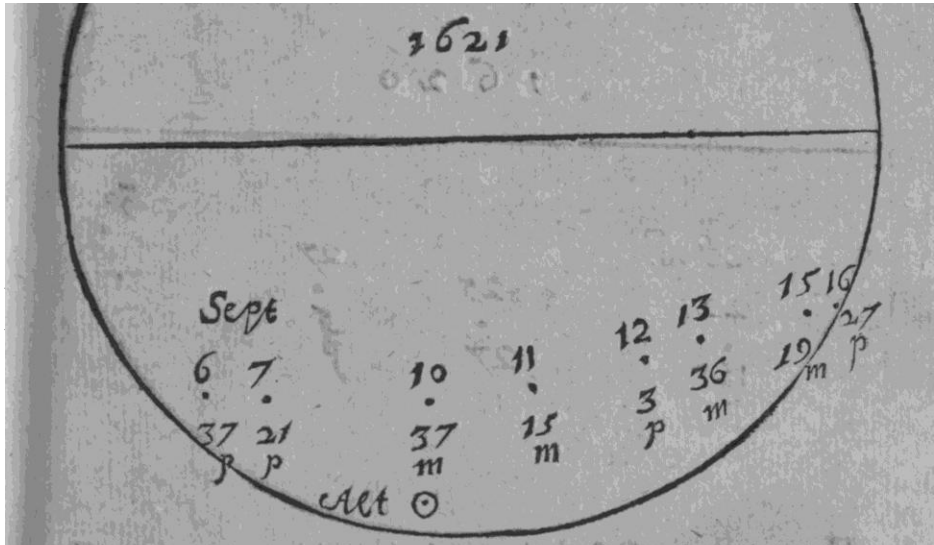
Neuh & Neuh 2016

C. Malapert SJ (1581-1630) also presented observations by others:

Guilielmus Wely SJ (born ca. 1600) from Coimbra, Portugal



Vnica erat die 2 Decembris hæc macula ; die autem 7 cohærentem habuit alteram exiguam, duas demum in exitu, vt figura repræsentat . Conimbricæ hęc macula die 2 aberat ab ingressu parte 1, die 3 partibus 4, die 4 partibus 10, die 5 partibus 16, die 7 partibus 30, die 11 aberat ab egressu partibus 10, die 12 partibus 5, die 13 parte 1; vbi vides ingressum & egressum aptè nobiscum congruere ; die tamen 7 satis latum est à nobis discrimen , nisi in



Longè admodum à centro hæc Synodus Austriacorum processit, habuitq; à tergo sequentem die 6 rectam seriem aliquot minutularum; die autem 11 & aliquot sequentibus, longo interuallo primarium cumulum duæ aliæ maculæ sequebantur . Hanc eandē maculā Conimbricę in Lusitania obseruauit Guilielmus Wely Societatis nostræ ibidem Matheseos Professor, annotauitque eam die 13 abfuisse ab egressu partibus 13 qualium semidiameter circuli est 40; die autem 14 abfuisse partibus 10, die 15 partibus 4, die 16 parte 1; quę omnia (vt tute experiri potes) cum nostris eorundē dierū obseruationibus congruunt. Hęc

Additional observations by Malapert and colleagues

Date	HS 98	Mal-apert	Pero-vius	Wely	Cy-sat	Note
1618 Mar 8	1	✓	-	-	✓	b,c
9	-	-	✓	-	✓	c
10	1	✓	-	-	✓	b,c
11	-	-	-	-	✓	c
12-15	1	✓	-	-	-	f
16	-	-	-	-	-	f
17	-	-	-	-	✓	c
18	1	✓	-	-	-	f
1618 Jun 21-29	1	✓	-	-	-	f
1618 Jul 7	1	✓	-	-	-	f
8	-	-	✓	-	-	c
9	1	✓	-	-	-	f
10-12	-	-	-	-	-	f
13	1	✓	✓	-	-	c
14 & 15	1	✓	-	-	-	f
16	-	-	-	-	-	f
17	1	✓	-	-	-	f
18	1	✓	✓	-	-	c
19	-	-	✓	-	-	c
1620 Feb 17-20	1	✓	-	-	-	f
21	-	-	-	-	-	f
22	1	✓	-	-	-	f
23	-	-	-	-	-	f
24-28	1	✓	-	-	-	f

Date	HS 98	Mal-apert	Pero-vius	Wely	Cy-sat	Note
1620 Apr 11	1	✓	-	-	-	f
12 & 13	-	-	-	-	-	f
14-21	1	✓	-	-	-	f
1620 Jun 6 & 7	-	✓	-	-	-	g
1620 Oct 21	1	-	-	✓	-	d
22	1	✓	-	✓	-	d
23	-	-	-	-	-	f
24	1	-	-	✓	-	d
25	1	✓	-	-	-	f
26	1	-	-	✓	-	d
27	1	✓	-	✓	-	d
28 & 29	1	-	-	✓	-	d
30	1	✓	-	✓	-	d
31	-	-	-	✓	-	d
1620 Dec 2	1	✓	-	-	-	f
3-5	1	-	-	✓	-	d
6	-	-	-	-	-	f
7	1	✓	-	✓	-	d
8-10	-	-	-	-	-	f
11	-	-	-	✓	-	d
12	1	✓	-	✓	-	d
13	1	-	-	✓	-	d

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Hoyt & Schatten (1998) for Riccioli for 1618 also incorrect

Marius: Anyway wrong

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1618
AS OBSERVED BY: MARIUS, S., NUREMBERG

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	-99	0	0	0	0	0
8	0	0	-99	0	0	0	-99	0	0	0	0	0
9	0	0	-99	0	0	0	-99	0	0	0	0	0
10	0	0	-99	0	0	0	-99	0	0	0	0	0
11	0	0	-99	0	0	0	-99	0	0	0	0	0
12	0	0	-99	0	0	0	-99	0	0	0	0	0
13	0	0	-99	0	0	0	-99	0	0	0	0	0
14	0	0	-99	0	0	0	-99	0	0	0	0	0
15	0	0	-99	0	0	0	-99	0	0	0	0	0
16	0	0	-99	0	0	0	-99	0	0	0	0	0
17	0	0	-99	0	0	0	-99	0	0	0	0	0
18	0	0	-99	0	0	0	-99	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	-99	0	0	0	0	0	0
22	0	0	0	0	0	-99	0	0	0	0	0	0
23	0	0	0	0	0	-99	0	0	0	0	0	0
24	0	0	0	0	0	-99	0	0	0	0	0	0
25	0	0	0	0	0	-99	0	0	0	0	0	0
26	0	0	0	0	0	-99	0	0	0	0	0	0
27	0	0	0	0	0	-99	0	0	0	0	0	0
28	0	0	0	0	0	-99	0	0	0	0	0	0
29	0	-99	0	0	0	-99	0	0	0	0	0	0
30	0	-99	0	0	0	0	0	0	0	0	0	0
31	0	-99	0	-99	0	-99	0	0	-99	0	-99	0
means:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

~~Riccioli SJ (1598-1671):~~ Argoli

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1618
AS OBSERVED BY: RICCIOLI, J.B., BONONIA

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	-99	0	0	0	0	0
8	0	0	-99	0	0	0	-99	0	0	0	0	0
9	0	0	-99	0	0	0	-99	0	0	0	0	0
10	0	0	-99	0	0	0	-99	0	0	0	0	0
11	0	0	-99	0	0	0	-99	0	0	0	0	0
12	0	0	-99	0	0	0	-99	0	0	0	0	0
13	0	0	-99	0	0	0	-99	0	0	0	0	0
14	0	0	-99	0	0	0	-99	0	0	0	0	0
15	0	0	-99	0	0	0	-99	0	0	0	0	0
16	0	0	-99	0	0	0	-99	0	0	0	0	0
17	0	0	-99	0	0	0	-99	0	0	0	0	0
18	0	0	-99	0	0	0	-99	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	-99	0	0	0	0	0	0
22	0	0	0	0	0	-99	0	0	0	0	0	0
23	0	0	0	0	0	-99	0	0	0	0	0	0
24	0	0	0	0	0	-99	0	0	0	0	0	0
25	0	0	0	0	0	-99	0	0	0	0	0	0
26	0	0	0	0	0	-99	0	0	0	0	0	0
27	0	0	0	0	0	-99	0	0	0	0	0	0
28	0	0	0	0	0	-99	0	0	0	0	0	0
29	0	-99	0	0	0	-99	0	0	0	0	0	0
30	0	-99	0	0	0	0	0	0	0	0	0	0
31	0	-99	0	-99	0	-99	0	0	-99	0	-99	0
means:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Riccioli cited Argoli for that there were no spots in 1618
during the comet observations:
1618 Aug 25 - Sep 25, Nov 11 - 29, and since Nov 23 or 25
Andrea Argoli (1570-1657), U Sapienza, Rome
(Argoli not listed in Hoyt & Schatten (1998) for 1618)

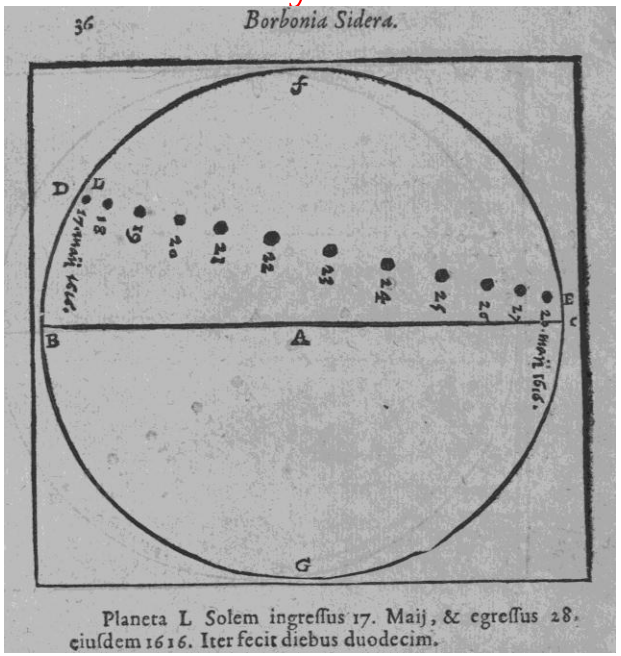
Neuh & Neuh 2016

Hoyt & Schatten (1998) for Tardé for1616

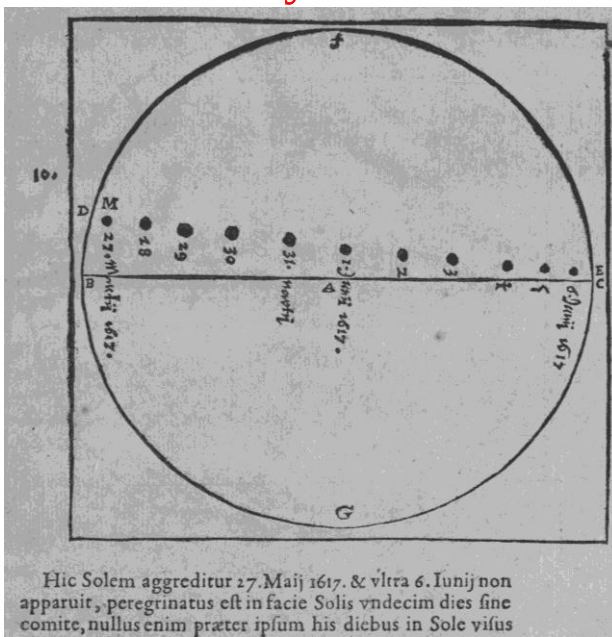
NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1616
AS OBSERVED BY: TARDE, J., FARLAT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
2	-99	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99
3	-99	-99	1	-99	-99	1	-99	-99	-99	-99	-99	-99
4	-99	-99	1	-99	-99	1	-99	-99	-99	-99	-99	-99
5	-99	-99	1	-99	-99	1	-99	-99	-99	-99	-99	-99
6	-99	-99	1	-99	-99	1	-99	-99	-99	-99	-99	-99
7	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
8	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
9	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
10	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
11	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
12	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
13	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
14	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
15	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99	-99
17	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
18	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
19	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
20	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
21	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
22	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
23	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
24	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
25	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
26	-99	-99	-99	1	1	-99	-99	-99	-99	-99	-99	-99
27	-99	-99	-99	1	2	-99	-99	-99	-99	-99	-99	-99
28	-99	-99	-99	-99	2	-99	-99	-99	-99	-99	-99	-99
29	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
30	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
31	-99	-99	-99	-99	1	-99	-99	-99	-99	-99	-99	-99
means:	-9.0	-9.0	1.0	1.0	1.1	1.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0

Tardé for May1616:



Tardé for May / June 1617:



What did Marius write on the nature of spots ?

"I have thought about it a lot since the year 1611, what those spots could be, and how they would form, but have not come to a conclusion yet, which I could rest on. But this I say: that I several times have clearly seen tail-like longish spots on the disk of the sun, indeed somewhat similar to a comet, so that I was often surprised. Like, if those spots would bring some kind of coolness to the extreme heat of the sun, and later would become a comet by merging or rather combining, I do not conclude anything, I cannot do it, but just indicate my thoughts."
(Marius April 1619)

e.g. no / few spots in (2nd half of?) 1618, but three comets !

Theories for nature of „spots":

- Spots (clouds) on the surface of the sun (e.g. Galilei, Johann Fabricius)

- Small solar system bodies transiting the sun (Scheiner, Tarde, Malapert, D. Fabricius)

- Spots form comets by merging (and comets come from the sun)
  (Marius 1619, later also Argoli and Riccioli)

China: *black vapour in front of the sun*

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What did Marius write himself ?

„… dieweil ich nun **über die anderhalb Jahr** nicht mehr so viel maculas in disco Solis [Flecken auf der Sonnenscheibe] hab finden können, ja gar offt kein einig maculam antroffen, das doch **vorige Jahr** niemals geschehen.
dahero ich dann in meinen observationibus verzeichnet, Mirum mihi videtur, adeo raras vel saepius nullas maculas in disco solis deprehendi, quod ante hâc nunque est observatum [Es scheint mir sonderbar, dass vielmehr (nur) wenige oder häufiger (sogar) keine Flecken auf der Scheibe der Sonne entdeckt werden können, was vor diesem niemals beobachtet worden ist.].
Marius April 1619

"..., while I now, **for one and a half year**, could not find as much spots [maculas] on the solar disk, yet rather often not even a single spot [maculam],
as was never the case in the years before.
I have therefore written this in my observational log books, this appears strange to me, that rather few or more often no spots could be detected on the disk of the sun, which was never observed before."

Marius saw turn from maximum to minimum around 1618/1619 ➔ minimum

Marius always saw spots since August 1611 ➔ previous minimum before 1611

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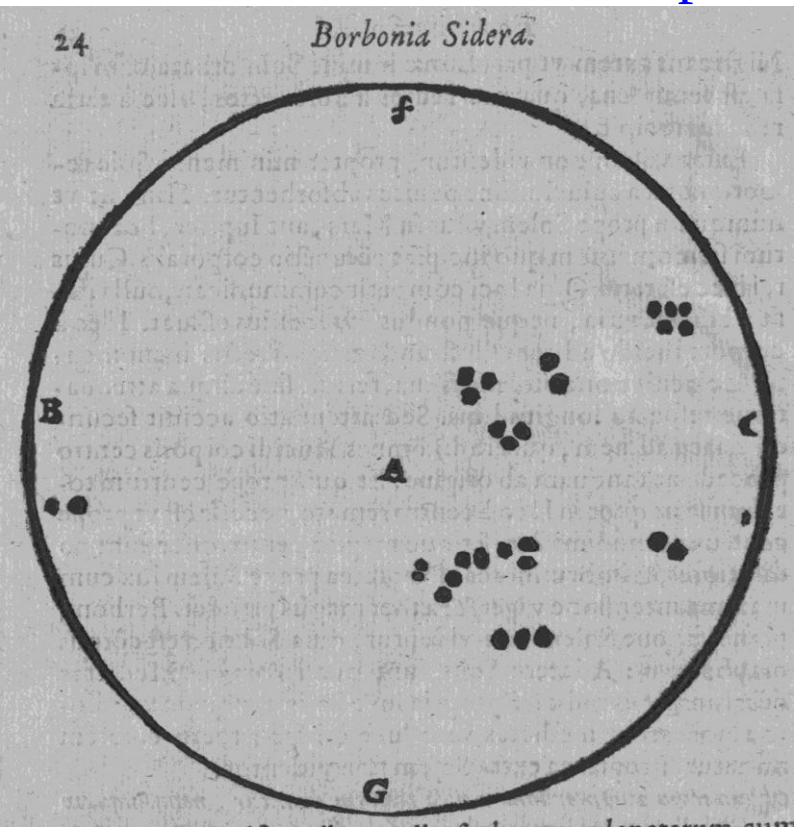
Schwabe cycle maximum about 1612 to 1615 (?)

Marius: 14 spots on 1612 May 30 / Jun 9
(valid for the time until June 1613)

these days also the 1612 maxima for Harriot and Galilei

Tardé: ~ 30 spots on 1615 Aug 25



Hoyt & Schatten:
10 groups on 1615 Mar 25
and
5 groups on 1615 Aug 15
but
correct 30 spots on Aug 25

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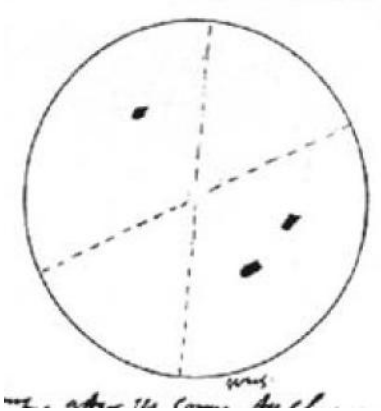
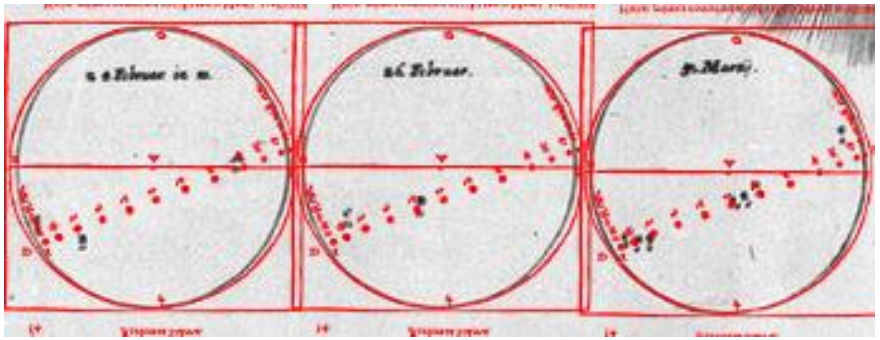


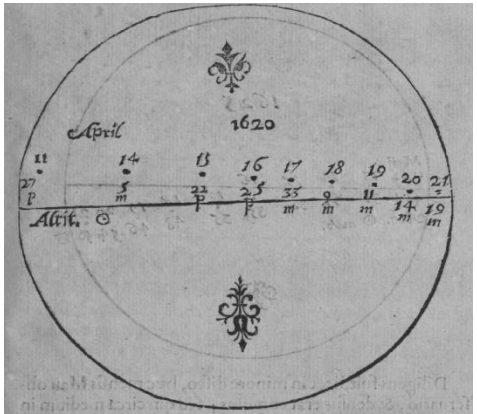


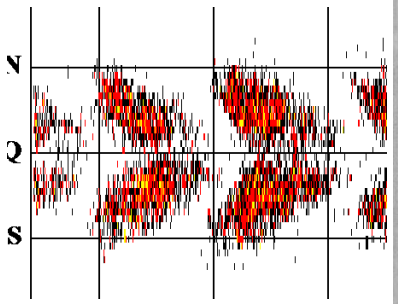
- First telescopic observations of sunspots

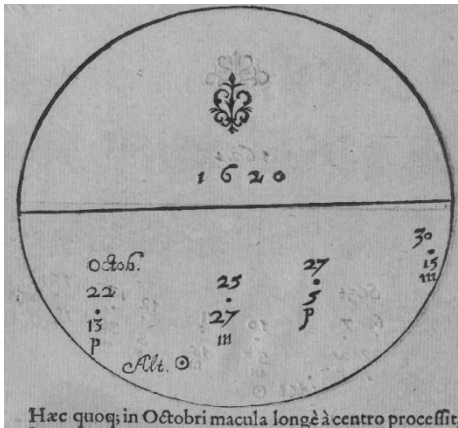
- Observations by Simon Marius 1611 – 1619

- More observations by Saxonius, Tardé, Malapert: the first telescopic Schwabe cycle minimum (1620)

Marius:
Fall 1617 to spring1619:
„rather few or more often no spots“ ➔
active day fraction < 0.5







Summary

Simon Marius observed and detected spots on 3 / 13 Aug. 1611,
Spots in large numbers, in different form, etc.,
detected spot(s) on 3 / 13 and/or 11 / 21 Oct 1611,
spot drawing on 17 / 27 Nov 1611,
14 spots on 30 May / 9 Jun 1612 (similar: Galileo, Jungius and Harriot)

Marius: Fall 1617 to spring1619:
„rather few or more often no spots“ ➔ active day fraction < 0.5 (but not zero)

„*as never observed before*“ ➔ active day fraction was 1.0 from Aug 1611 to fall 1617

➔ Schwabe minima before Aug 1611 and in or after ~ 1619
(maximum spot and group numbers from 1612 to 1616)

Hoyt & Schatten missed early observers: D. & J. Fabricius, Schmidtnerus, Marius, Tanner, Argoli, Perovius, and Wely - generic „zeros“ for Marius & Riccioli wrong

Generic statements can be very important !!!

Lets go (back) to the original sources !!!

Neuh & Neuh 2016