Past and present sunspot observations

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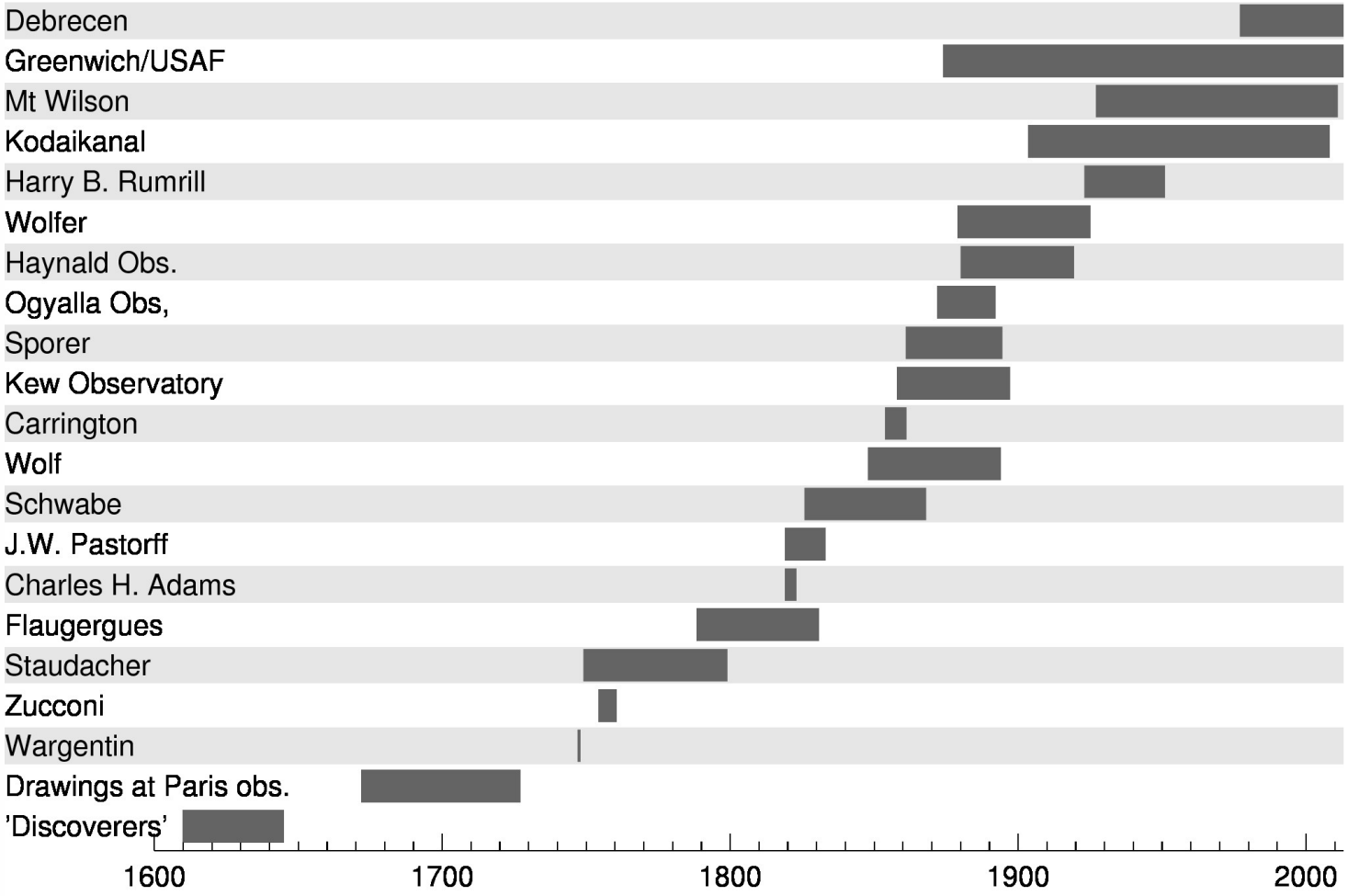
400 years of sunspot records

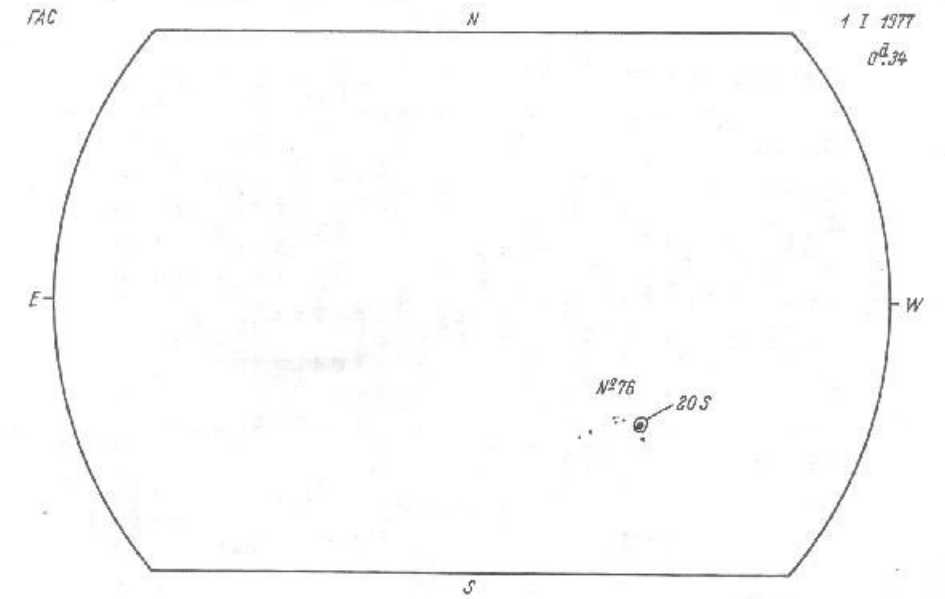


What we learn from sunspot data

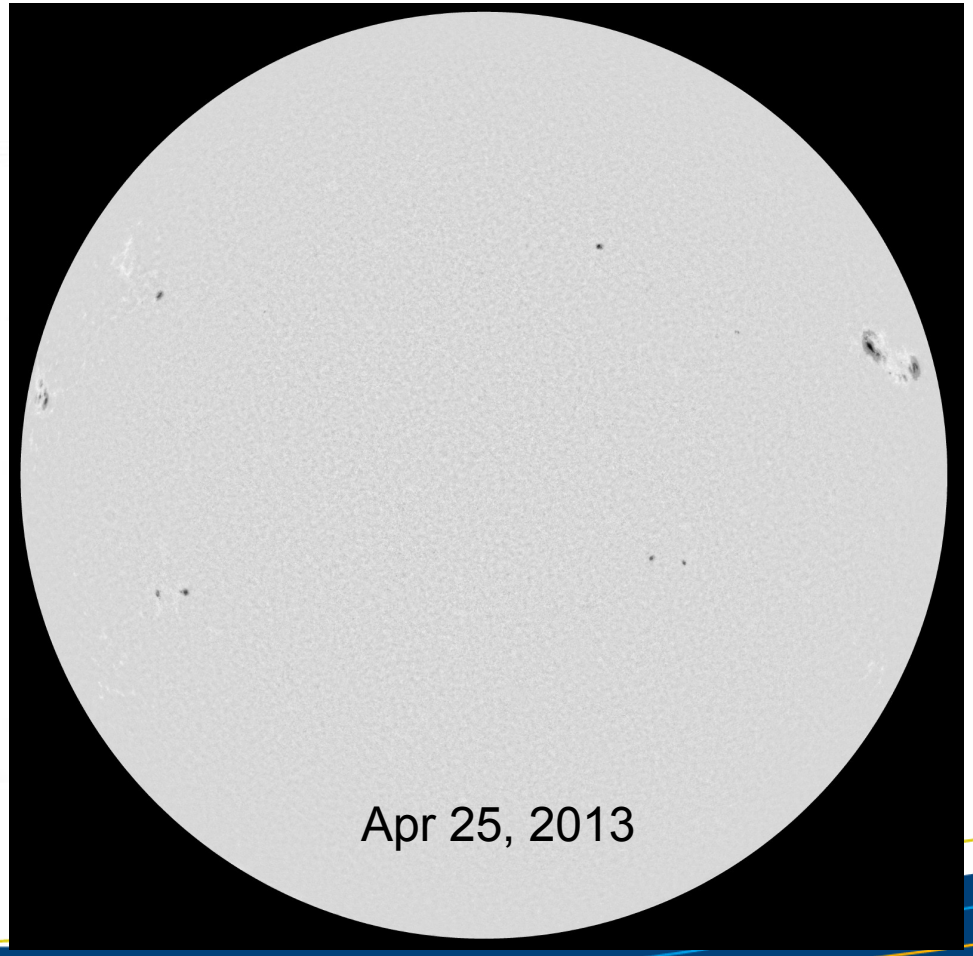
- Butterfly diagram
- Differential rotation
- Polarity tilt angles
  - Tilt angle change rate
- Polarity separations
  - Separation speed
- Proper motion of total groups
  - Typically far below 0.1 deg/day = <14 m/s

Debrecen, Hungary

- Good to-scale drawings
- Photographs



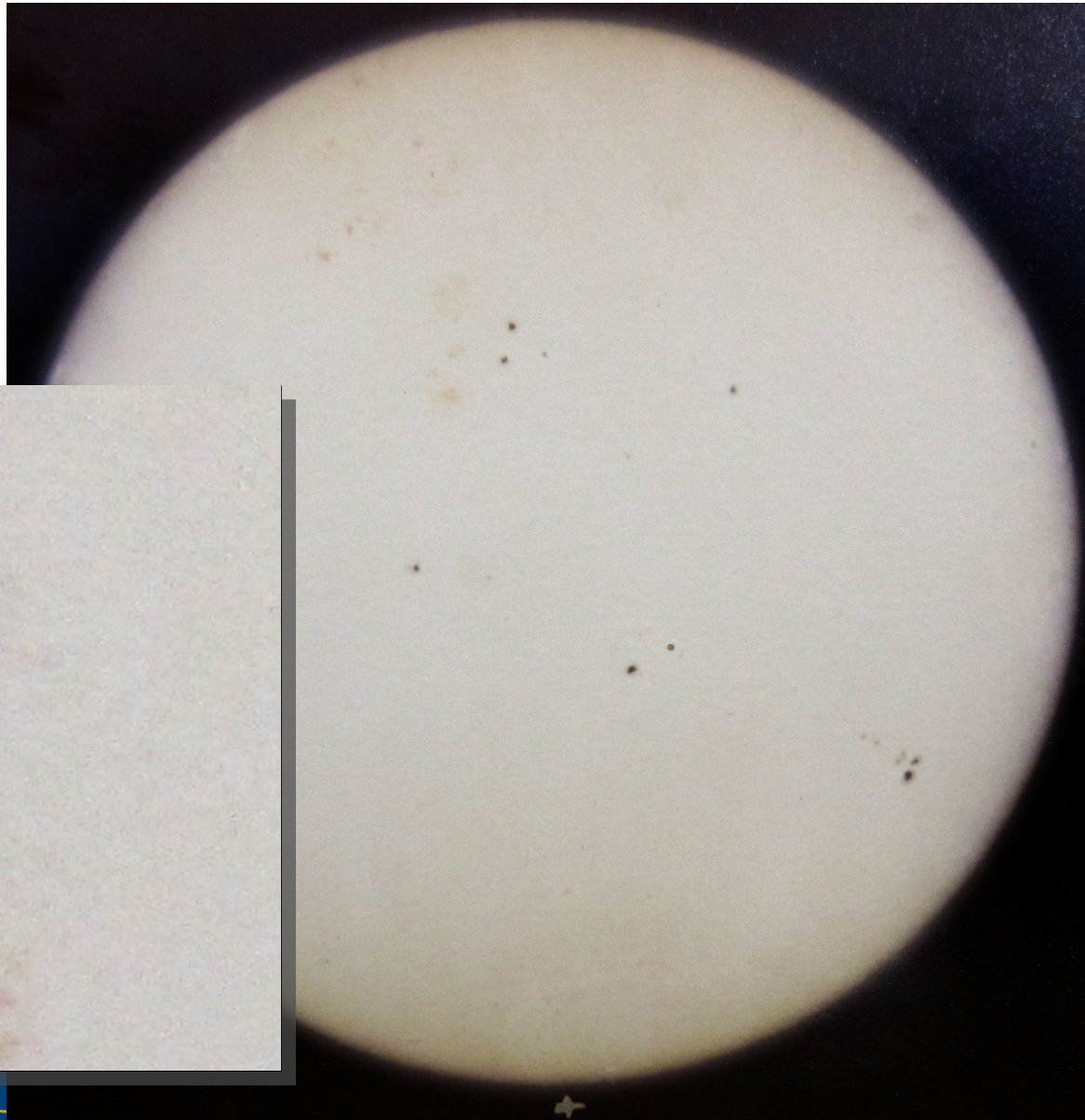
Jan 1, 1977



Apr 25, 2013

Greenwich photographs

- Visual observing drawing sunspots superior to photos



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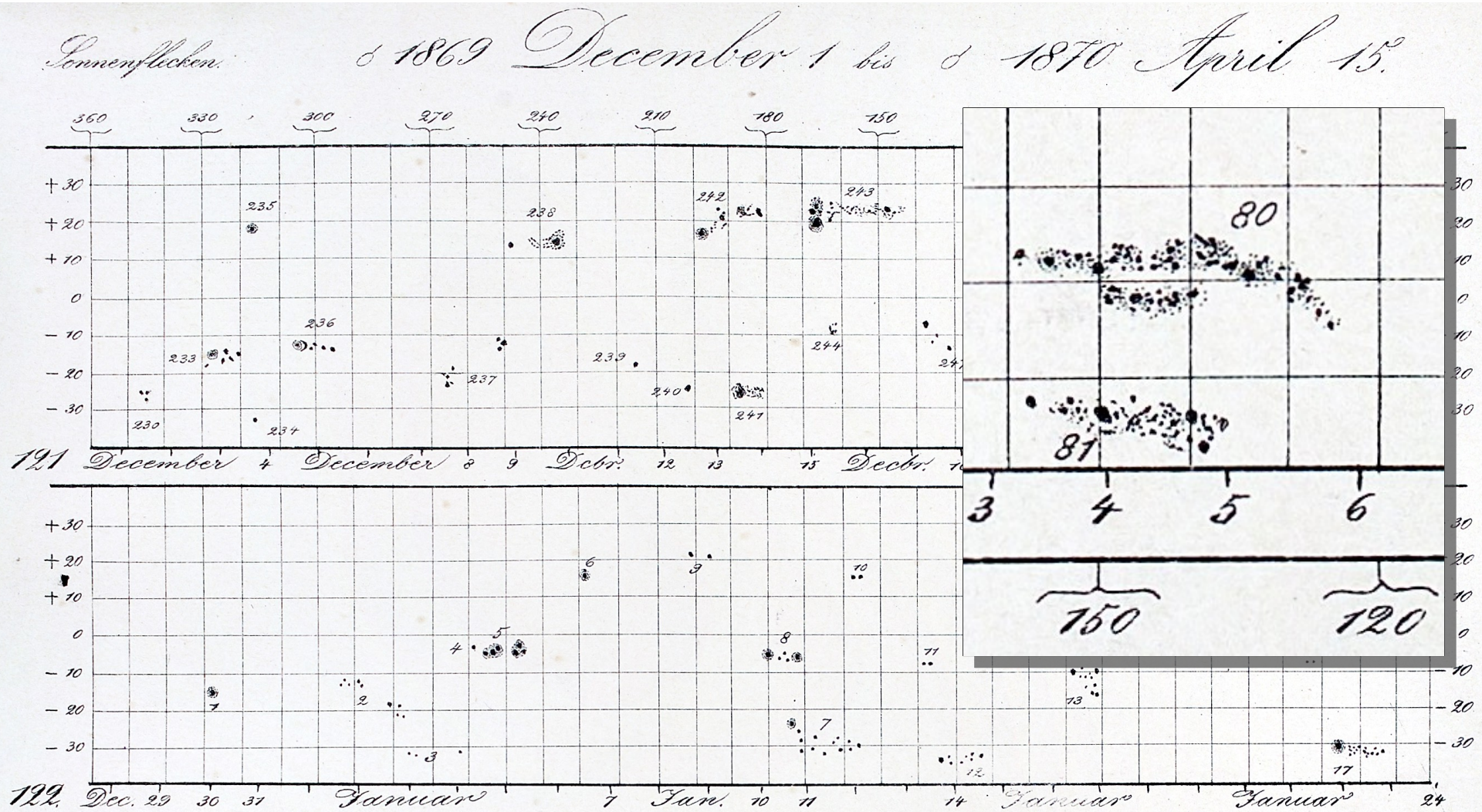
Spörer and Carrington

- Group drawings near passage of central meridian



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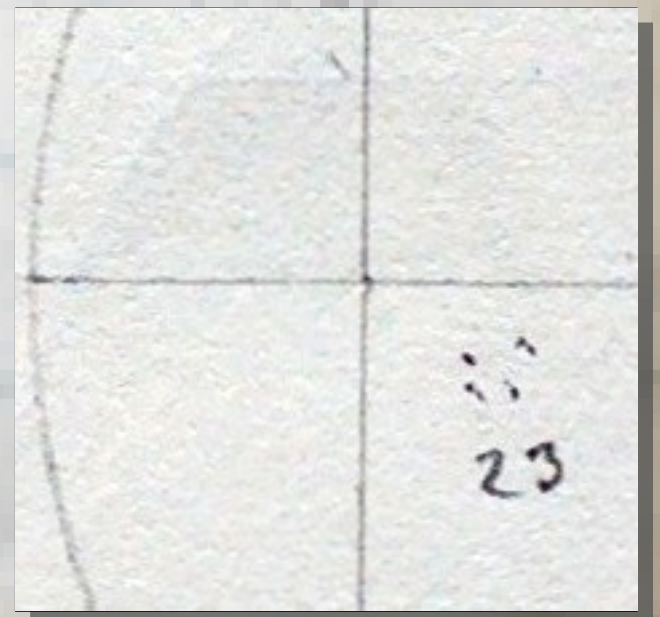
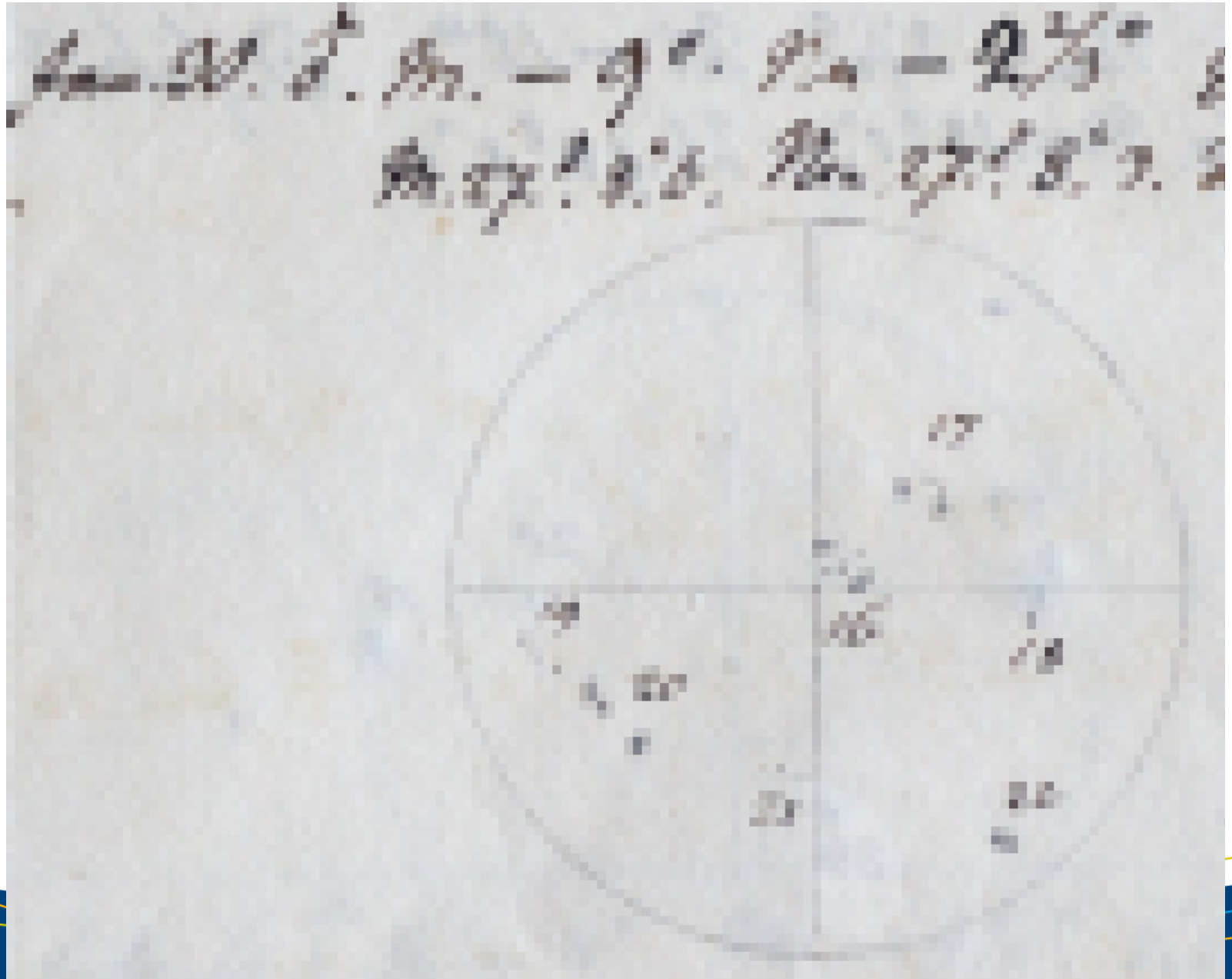
Samuel Heinrich Schwabe, 1825-1867

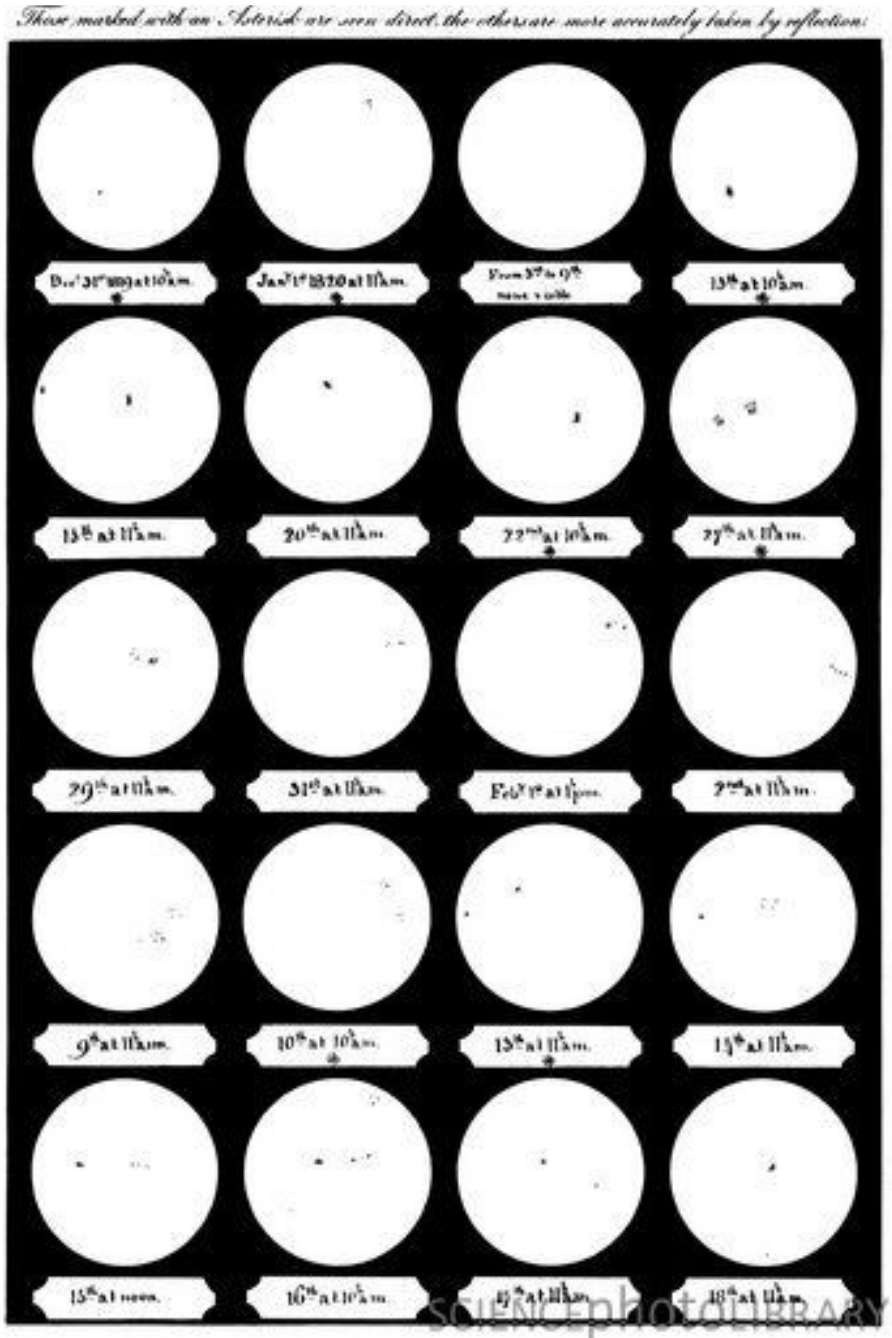


Schwabe



Adams

- Stored at Royal Astronomical Society library

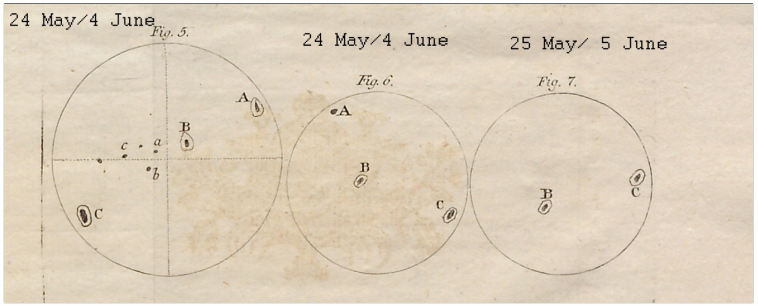


Honoré Flaugergues, ~1788-1830

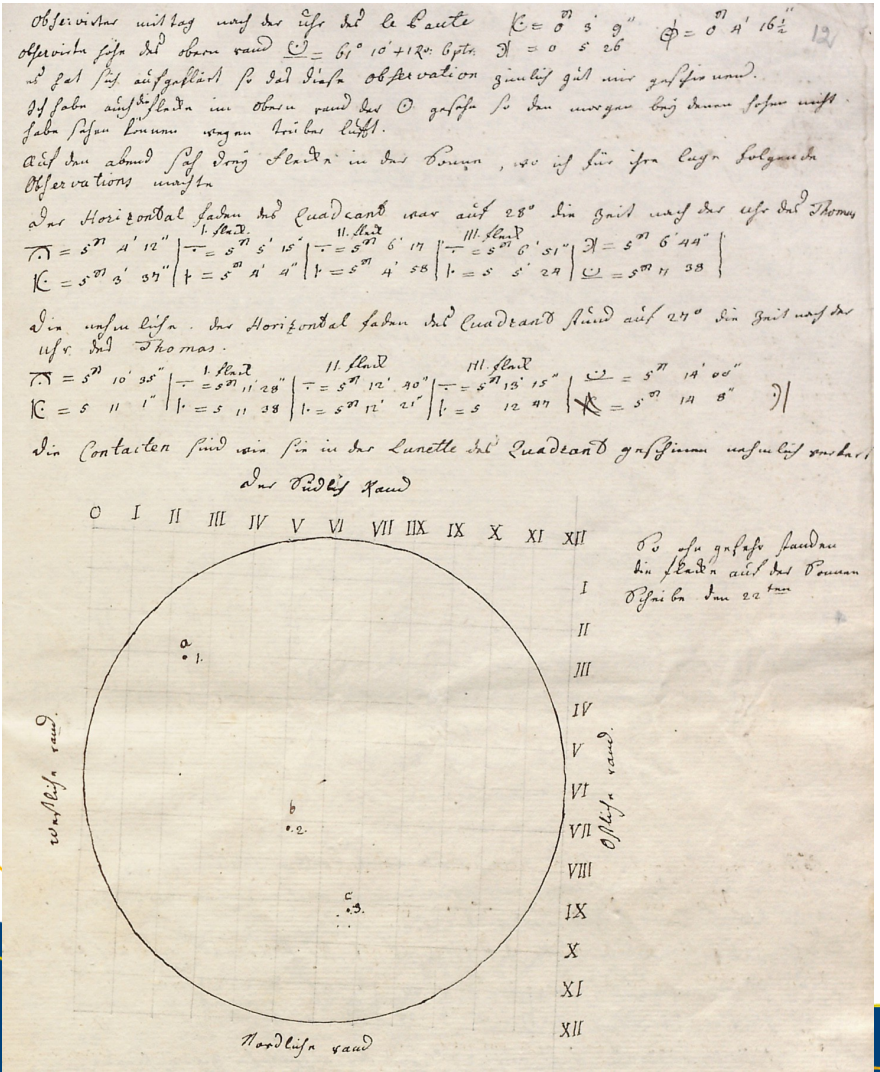
- Several hundred sunspot observations
- Wolf's interpretation of *sunspot numbers* correct
- Today in archives of the Paris Observatory library
- Mostly contact times:

"le bord du ⊙ al horaire	12 39 58
la grande tache a l'oblique	12 40 22.5
la petite tache a l'oblique	12 40 46
la grande tache al horiare	12 41 21
la petite tache al horaire	12 41 31
le bord du soleil al horaire	12 42 09
le letite tache al oblique	12 42 18
le grande tache al oblique	12 42 22"

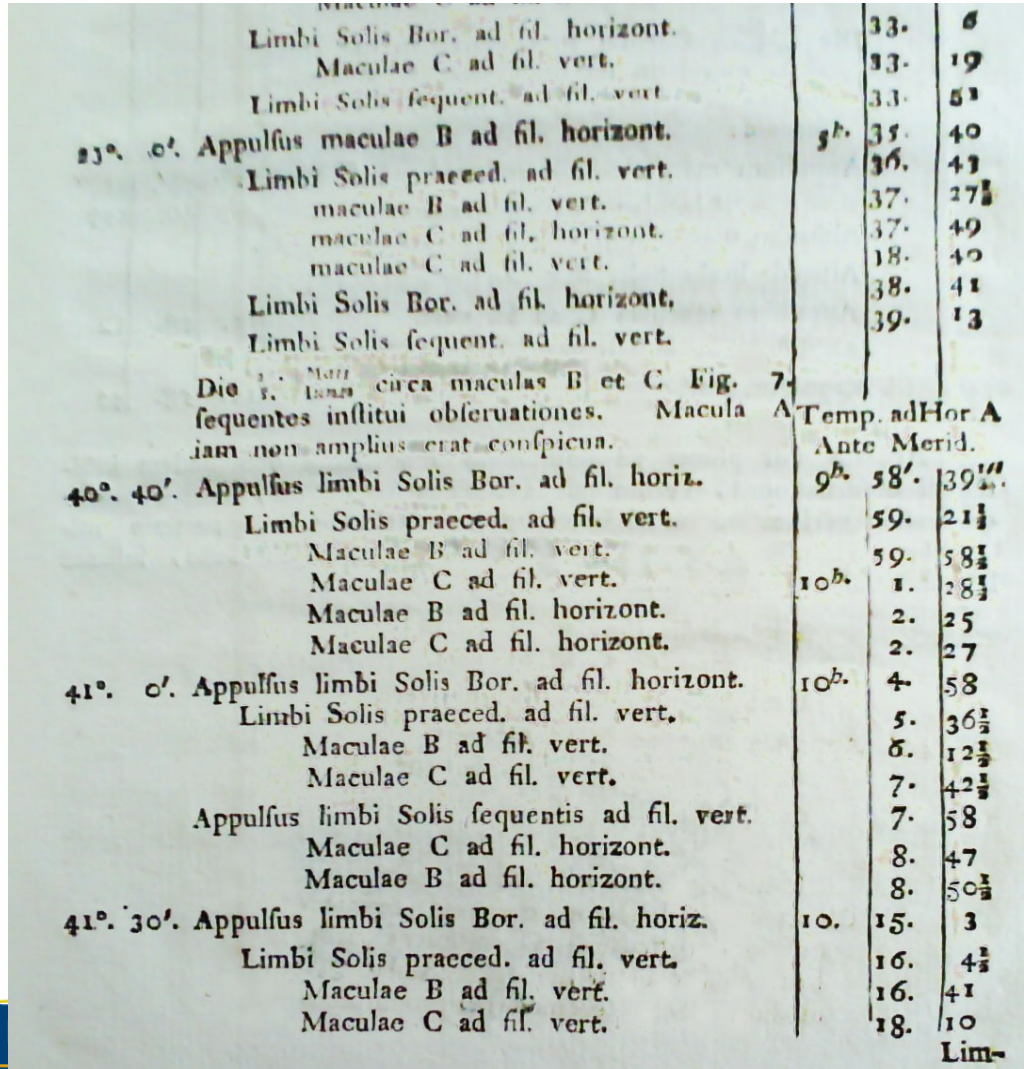
Venus transit 1769
Russian sources



Christophor Euler



S. Rumovskij



Limbi Solis Bor. ad fil. horizont. 33. 6
Maculae C ad fil. vert. 33. 19
Limbi Solis fequent. ad fil. vert. 33. 51
23°. 0'. Appulfus maculae B ad fil. horizont. 9h. 35. 40
Limbi Solis praeced. ad fil. vert. 36. 41
maculae B ad fil. vert. 37. 27½
maculae C ad fil. horizont. 37. 49
maculae C ad fil. vert. 38. 10
Limbi Solis Bor. ad fil. horizont. 38. 41
Limbi Solis fequent. ad fil. vert. 39. 13

Die 5. Maii circa maculas B et C Fig. 7. A
fequentes inftitui obferuationes. Macula Temp. ad Hor A
iam non amplius erat conſpicua. Ante Merid.

40°. 40'. Appulfus limbi Solis Bor. ad fil. horiz. 9h. 58'. 39''.
Limbi Solis praeced. ad fil. vert. 59. 21½
Maculae B ad fil. vert. 59. 58½
Maculae C ad fil. vert. 10h. 1. 28½
Maculae B ad fil. horizont. 2. 25
Maculae C ad fil. horizont. 2. 27
41°. 0'. Appulfus limbi Solis Bor. ad fil. horizont. 10h. 4. 58
Limbi Solis praeced. ad fil. vert. 5. 36½
Maculae B ad fil. vert. 6. 12½
Maculae C ad fil. vert. 7. 42½
Appulfus limbi Solis fequentis ad fil. vert. 7. 58
Maculae C ad fil. horizont. 8. 47
Maculae B ad fil. horizont. 8. 50½
41°. 30'. Appulfus limbi Solis Bor. ad fil. horiz. 10. 15. 3
Limbi Solis praeced. ad fil. vert. 16. 4½
Maculae B ad fil. vert. 16. 41
Maculae C ad fil. vert. 18. 10
Lim-

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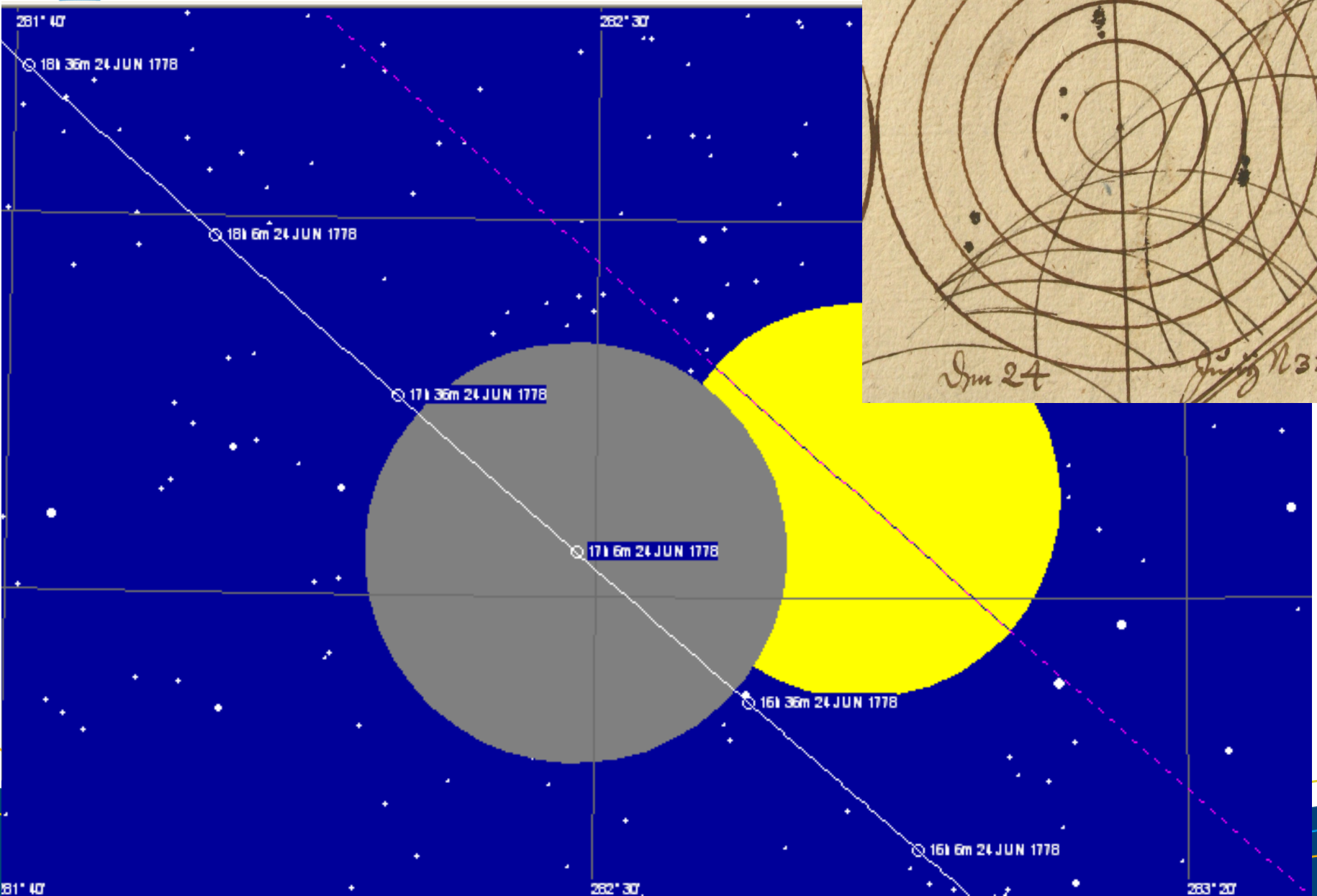
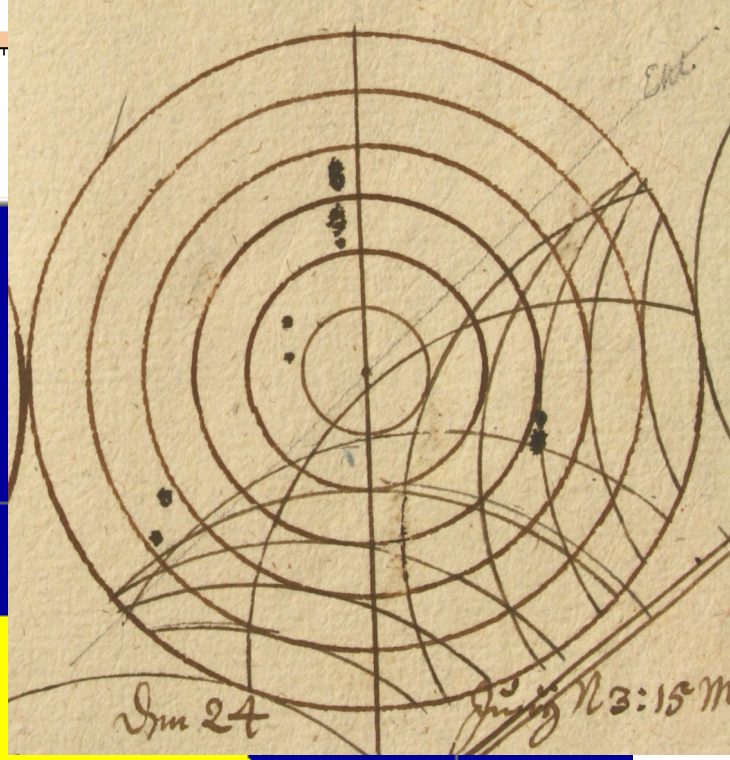
Johan Caspar Staudacher, 1749-1799

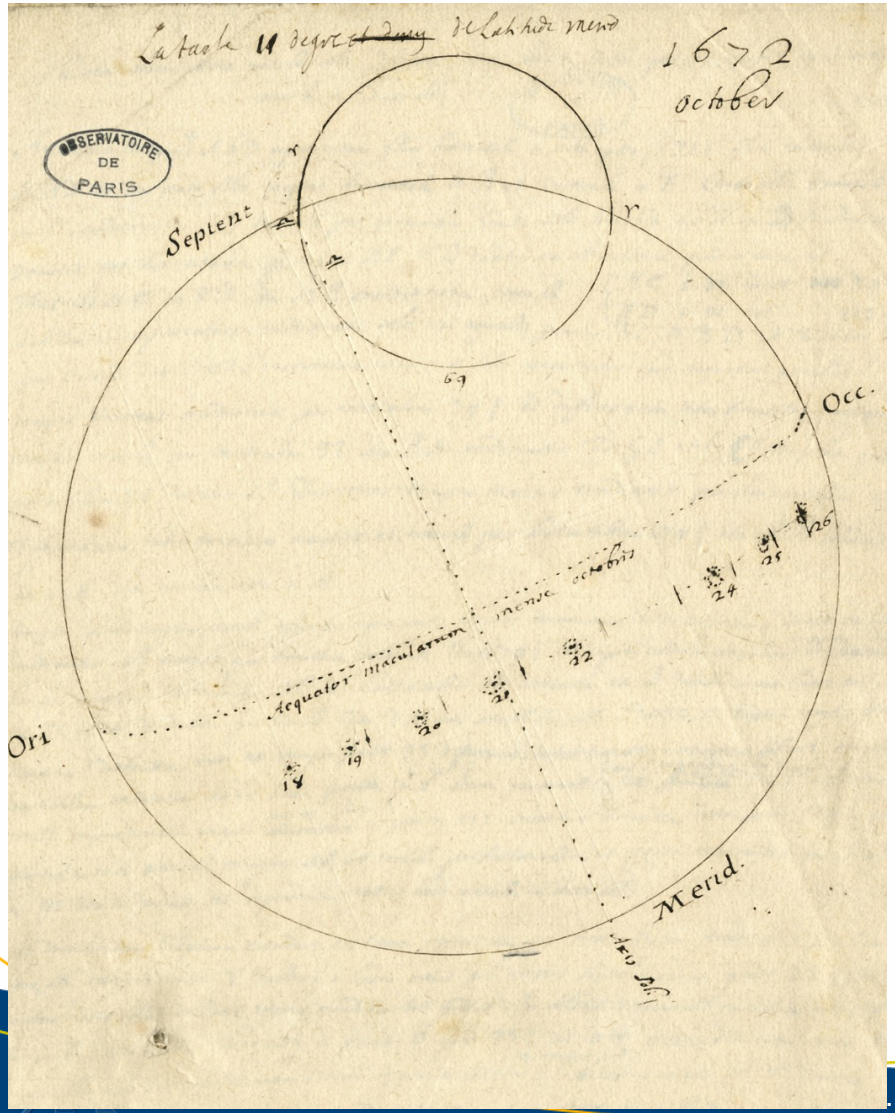
- About 1000 drawings
- Apparently the only continuous observer in second half of 18th century

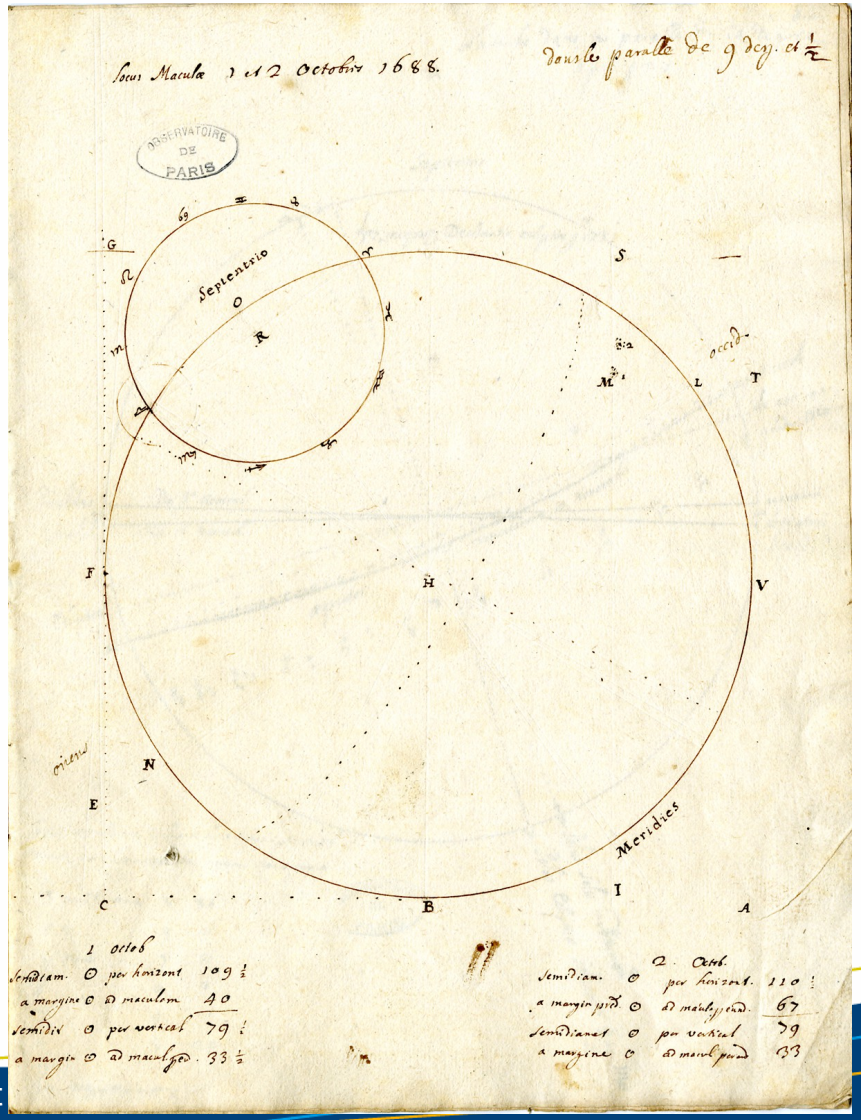
Staudacher: Jun 24, 1778



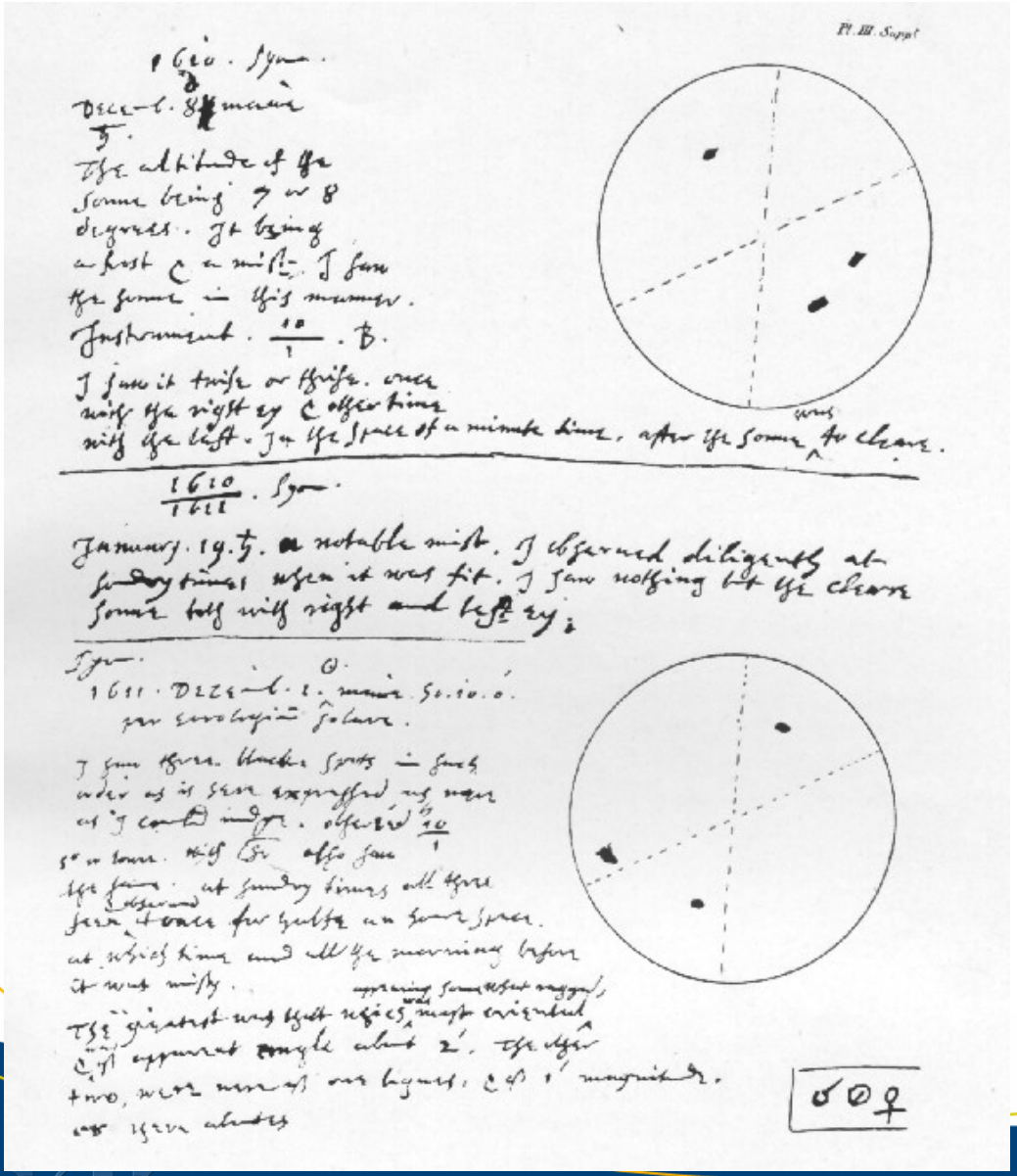


After Maunder minimum, ~1672-1727





The discoverers

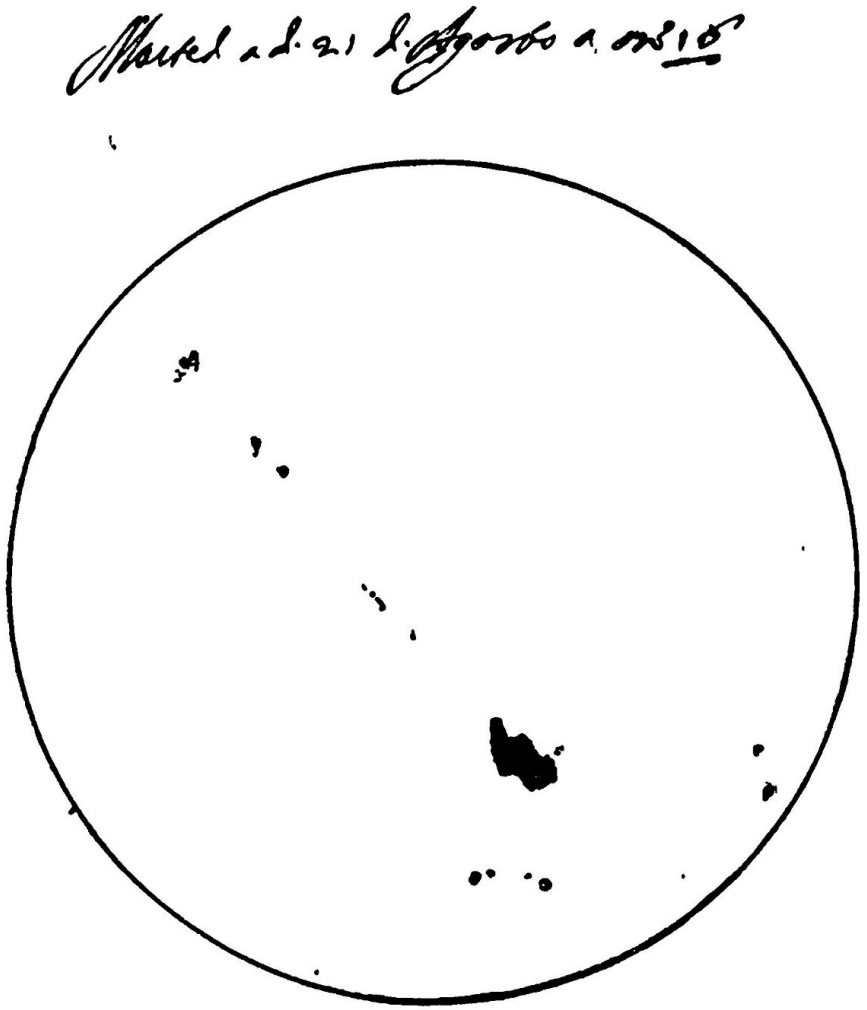


1610. Sym.
December 8th mane
5.
The altitude of the
Sonne being 7 or 8
degrees. It being
a frost & a mist. I saw
the Sonne in this manner.
Instrument. 10/1. B.
I saw it twise or thrise. once
with the right ey & after hime
with the left. In the Space of a minute time, after the Sonne was to clear.

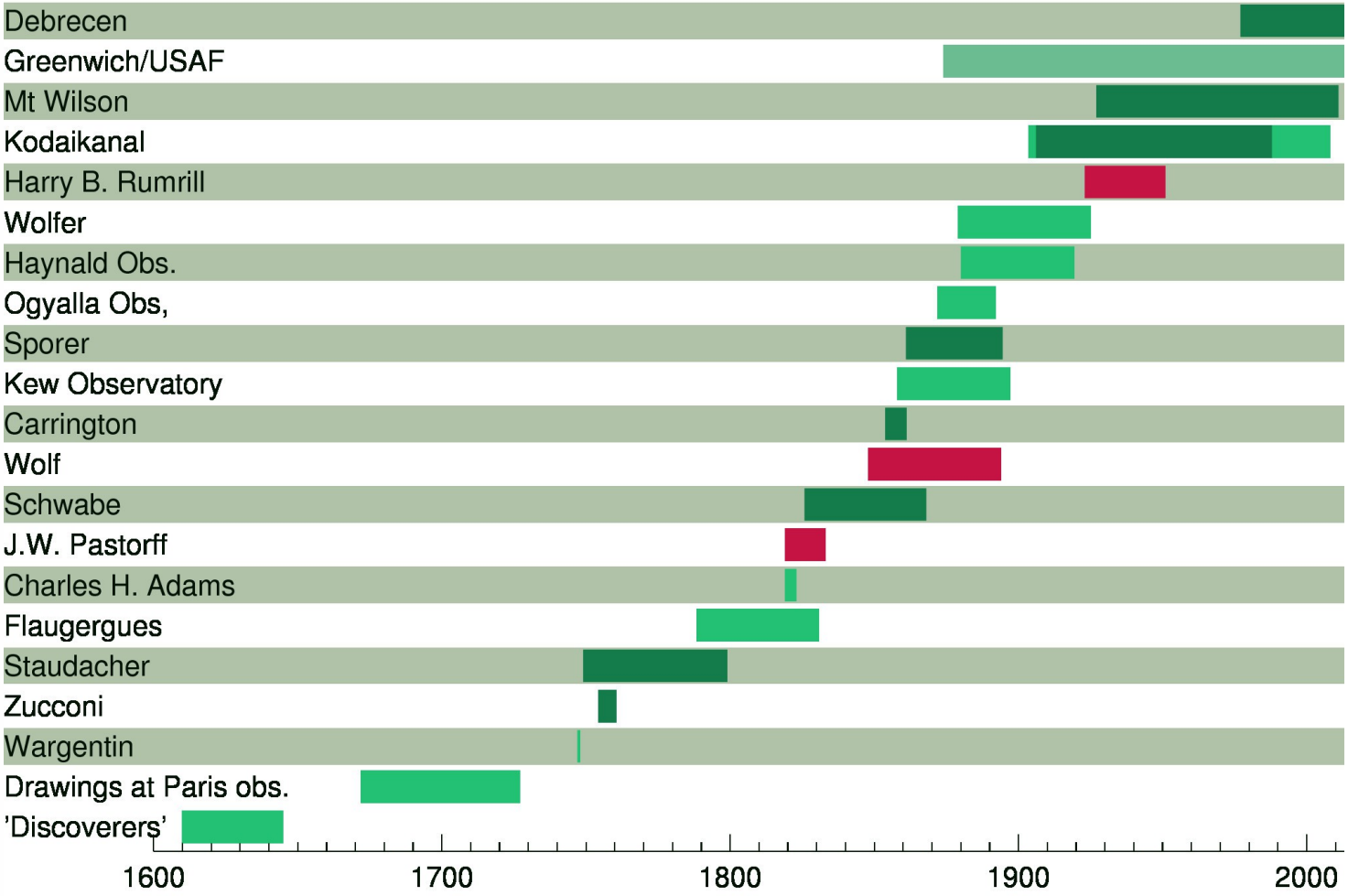
1610/1611. Sym.
January. 19.h. a notable mist. I observed diligently at
sundry times when it was fit. I saw nothing but the cleare
Sonne tolg with right and left ey:

Sym. ☉
1611. December. 1. mane 8.10.0.
per ecclypsin Solare.
I saw three blacke Spotts in such
order as is here expressed my mean
as I could judge. observed 10/1
8.0 a clock. with B. after saw
the same: at sundry times all three
observed seen 4 times for halfe an howre space.
at which time and all the morning before
it was misty. appearing somewhat ruggid,
The greatest was light ruffled, most eviedent
& of apparent angle about 2'. the other
two, were more of one bignes. & of 1' magnitude.
or there abouts

1609



Summary


Debrecen
Greenwich/USAF
Mt Wilson
Kodaikanal
Harry B. Rumrill
Wolfer
Haynald Obs.
Ogyalla Obs,
Sporer
Kew Observatory
Carrington
Wolf
Schwabe
J.W. Pastorff
Charles H. Adams
Flaugergues
Staudacher
Zucconi
Wargentin
Drawings at Paris obs.
'Discoverers'
1600
1700
1800
1900
2000