

ON SOLAR ACTIVITY CYCLES IN THE 16th CENTURY

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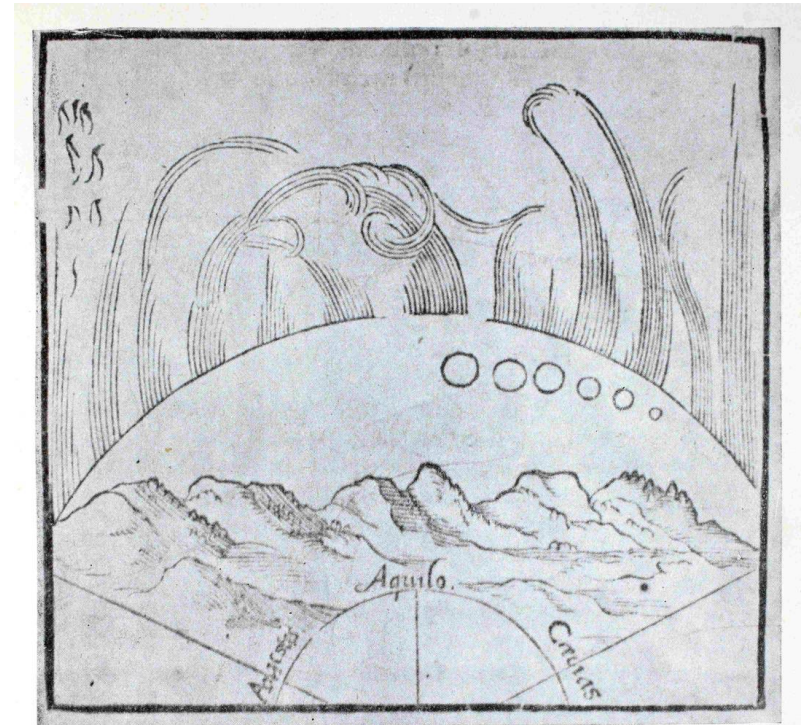
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1. 10 Sep 1580: the first SWE described by scientists
2. Pinning down cycle phases in the 16th century

THE FIRST SWE DESCRIBED BY SCIENTISTS

1581: a press in Cracow prints a booklet, *De coeli sive aeris ardore*, containing the full version of the first scientific description of an aurora.

The booklet had previously been printed in Cibinium (Sibiu, Szeben, Herrmannstadt) in Transylvania, but the two extant copies of this first edition are fragmentary and do not contain the drawing.



Hung. Nat. Széchenyi Library

microfiche #385.FM2/2962 (1997)

Author: Marcello Squarcialupi — an Italian medical doctor and polyhistor in the Transylvanian court in Alba Iulia (MLAT 49°).

For an English translation of the description of the event see Kázmér & Timár (2016, Geosci. Lett. 3, 15).

Excerpts:

...the white light and the brownish red cloud extended from north to southwest ...

The light became so strong, that objects cast shadow..

Colours radiating from the light field were similar to sun rays radiating through openings in a cloud cover. These rays were projected on the sky in pyramidal form...

Finally, in the north, appeared an intense arc, purple in full, looking like a mountain in the sky, wide at the bottom, peaked at the top...

Observed also in Switzerland and Germany, and described by Maestlin in Heidelberg (but published later only).

Clearly, a major SWE —and not the only one in 1580–83: these must have been solar maximum years.

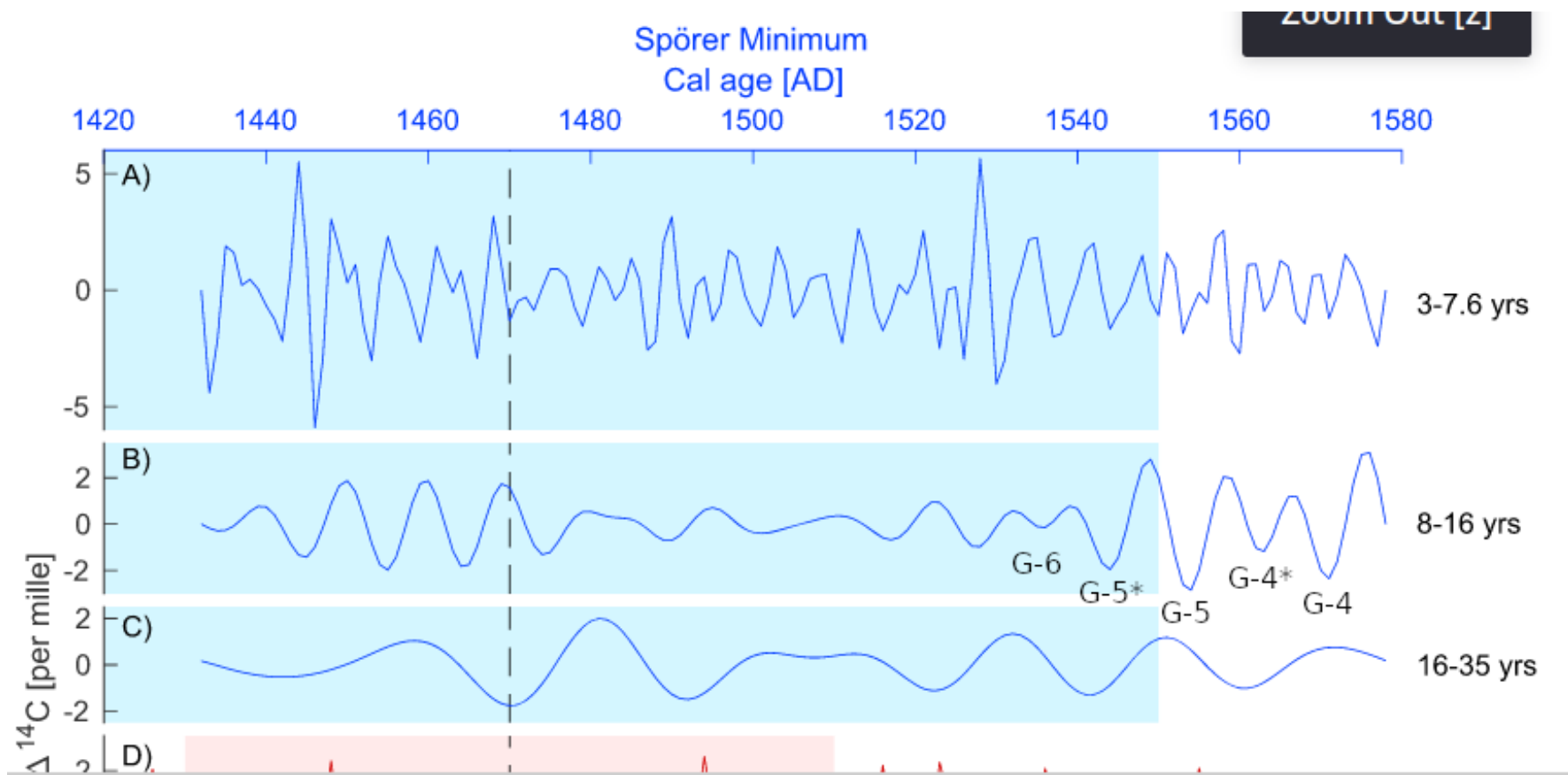


engraving by Kaeppler, Augsburg

CYCLE PHASES IN THE 16th CENTURY

	Cycle no.	Min. year	Max. year	Cycle length
Reconstructed cycle phases from annual cosmogenic radionuclide data: ^{10}Be / ^{14}C	G+2	1630 / 1632	1636 / 1638	11 / 9
	G+1	1620 / 1620	1625 / 1626	10 / 12
	G0	1608 / 1609	1614 / 1615	12 / 11
	G-1	1597 / 1595	1603 / 1601	11 / 14
– ^{10}Be from annual ^{10}Be data of Berggren+ (2009) [epochs determined by Laura Magyar]	G-2	1586 / 1584	1591 / 1591	11 / 11
	G-3	1573 / 1574	1580 / 1578	13 / 12
– ^{14}C from Usoskin+ (2021)	G-4	1559 / 1565	1566 / 1570	14 / 9
Our notation: G or G0 — the “Galilean” cycle, ongoing in 1610.	G-5	... / 1552	1553 / 1555	... / 13
	G-5*	1543 / 1542	... / 1545	... / 10
	G-6?	1530 / 1533	1537 / 1536	13 / 9

A case of missing cycles? Cf. Fogtmann-Schulz+ (2019):



Confront with auroral data:

Number of auroral observations from Krivsky & Pejml (1988, 1996):

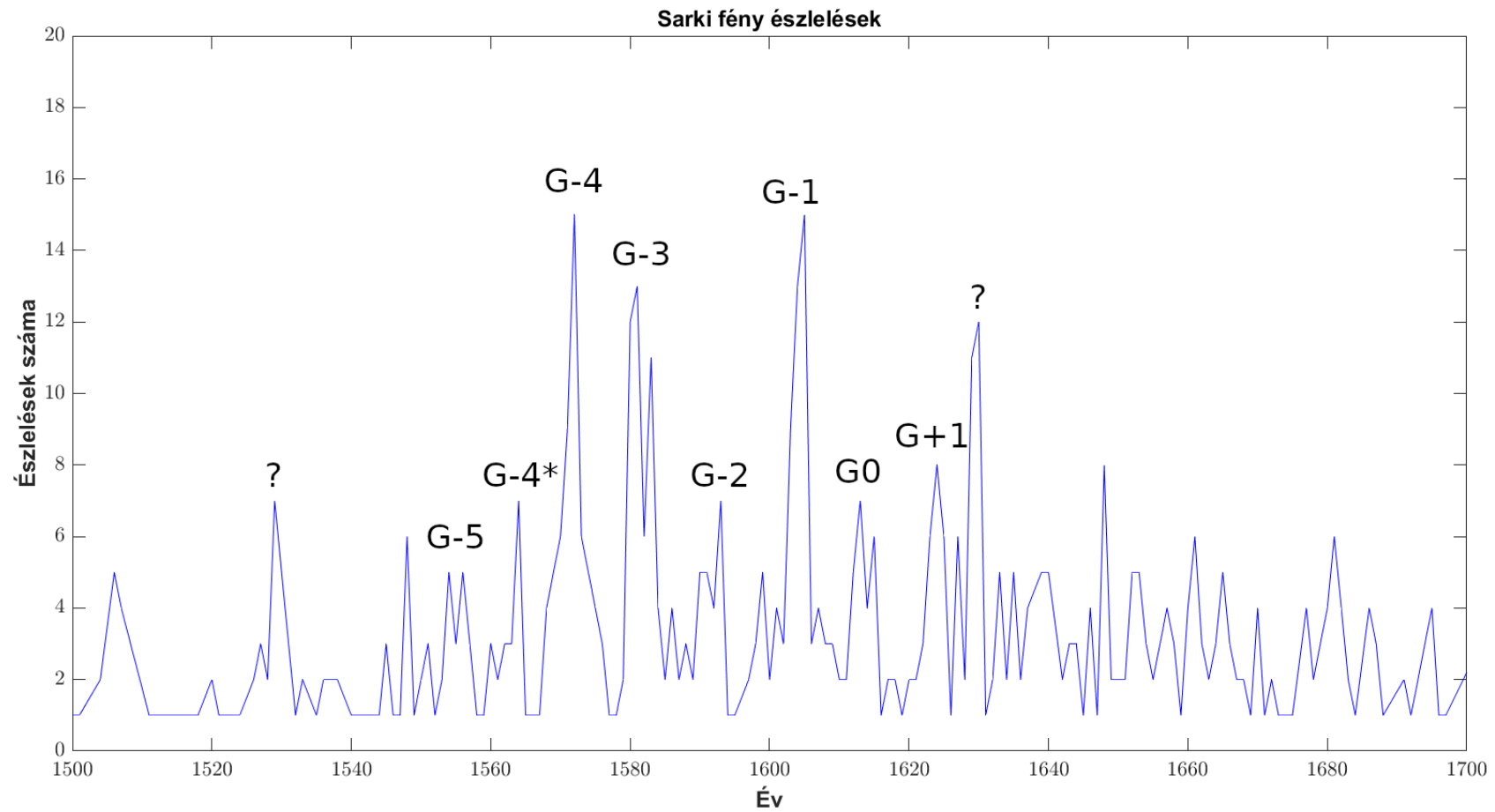
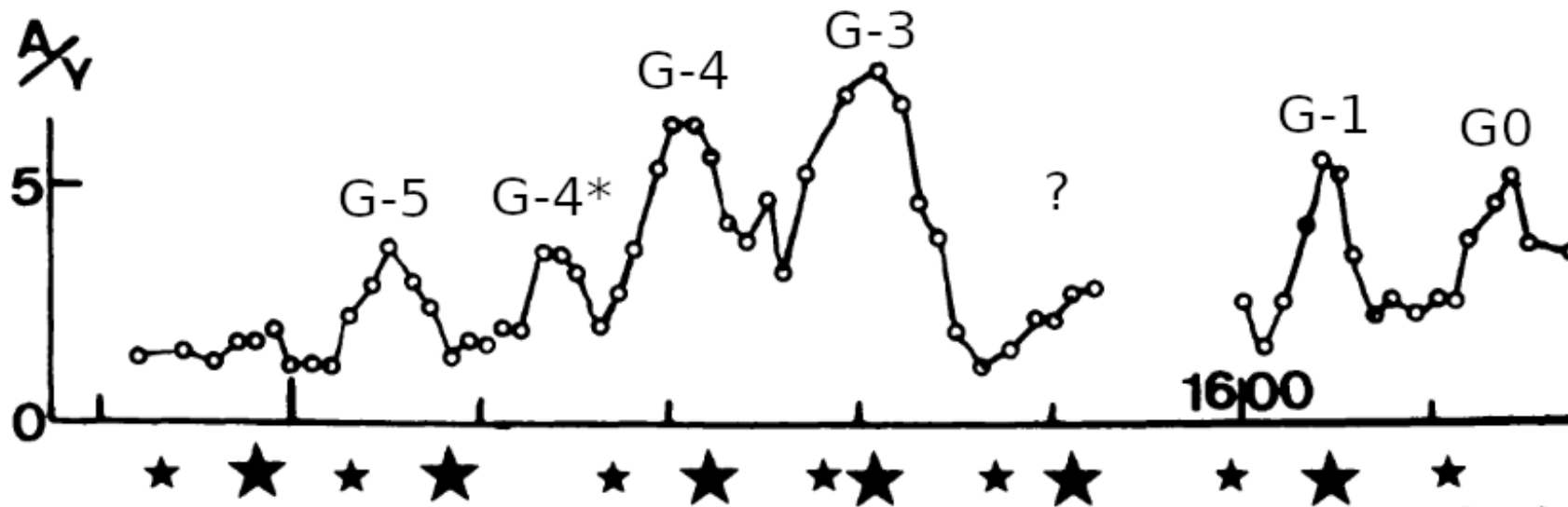


figure by Laura Magyar

...in agreement with Link (1978) [based on Central Eu. data only]:



⇒ fiducial max. years in the missing cycle period:

G-5*	G-5	G-4*	G-4
1544	1553	1562	1571

Agrees also with Schröder & Treder (1999);

(although Schove (1979) has only 2 cycles btw. G-6 and G-4...)

Conclusions

1. Cracow is a cradle of space weather research
2. Around the start and end of grand minima weird things happen.