The dark Universe is not invisible

Konstantin Zioutas

and collaborators (*next slide*)

University of Patras / Greece

Further reading:

- Zioutas, K. ; Tsagri, M.; Semertzidis, Y.K. ; Hoffmann, D.H.H.; Papaevangelou, T.; Anastassopoulos, V. *The 11 years solar cycle as the manifestation of the dark Universe*, Mod. Phys. Lett. **2014**, A29(#37) 1440008, https://arxiv.org/abs/1309.4021 .
- Bertolucci, S.; Zioutas, K.; Hofmann, S.; Maroudas, M. *The sun and its planets as detectors for invisible matter*, Phys. Dark Univ. **2017**, 17 13-21, and ref's therein; https://doi.org/10.1016/j.dark.2017.06.001 .
- Zioutas, K.; Argiriou, A.; Fischer, H.; Hofmann, S.; Maroudas, M.; Pappa, A.; Semertzidis, Y.K. *Stratospheric temperature anomalies as imprints from the dark universe*, Phys. Dark Univ. **2020**, 28, 100497; https://doi.org/10.1016/j.dark.2020.100497 .
- Patla, B.R.; Nemiroff R.J.; Hoffmann, D.H.H.; Zioutas, K. *Flux Enhancement of Slow-moving Particles by Sun or Jupiter: Can they be detected on Earth?*, ApJ. **2014**, 780(#2) 158; https://arxiv.org/abs/1305.2454 .
- Sofue, Y. Gravitational Focusing of Low-Velocity Dark Matter on the Earth's Surface, Galaxies **2020**, 8(#2) 42, https://doi.org/10.3390/galaxies8020042 ; https://arxiv.org/abs/2005.08252 .
- Helmi, A.; Babusiaux, C.; Koppelman, H.H.; Massari, D.; Veljanoski, J.; Brown, A.G.A. *The merger that led to the formation of the Milky Way's inner stellar halo and thick disk* Nature **2018**, 563, 85–88,. https://doi.org/10.1038/s41586-018-0625-x
- More details are given in talks given: 2016 at CERN https://indico.cern.ch/event/520074/ & 2018 in ECT / Trento https://indico.ectstar.eu/event/25.

Conference https://ecu2021.sciforum.net/ : 1st Electronic Conference on Universe ; **Session:** The Universe of Andrei Sakharov

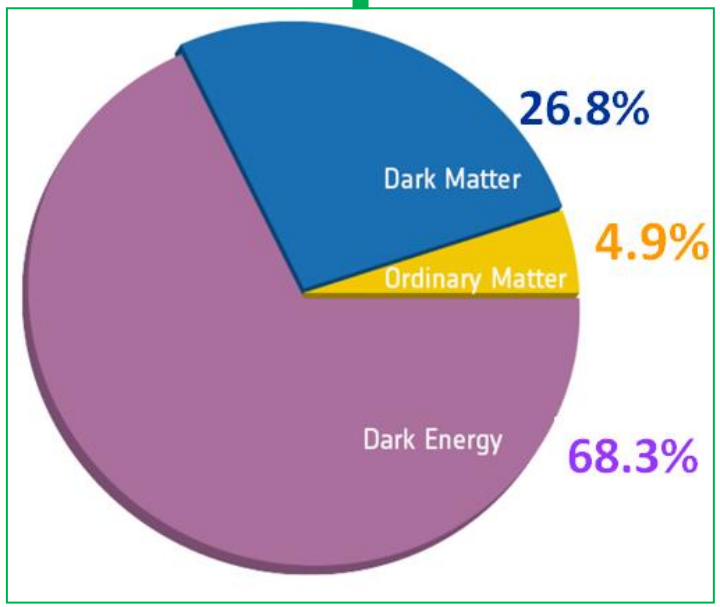
24/2/2021

Co-authors: V. Anastassopoulos[1], A. Argiriou[1], G. Cantatore[2], S. Cetin[3], A. Gardikiotis[1 $], DHH Hoffmann[4], S. Hofmann[5], M. Karuza[6], A. Kryemadhi[7], M. Maroudas[1 &)], EL Matteson[8], K. Ozbozduman[9], T. Papaevangelou[10], M. Perryman[11], YK Semertzidis[12], I. Tsagris[1 #], M. Tsagri[1 #], G. Tsiledakis[10], D. Utz[13], E. Valachovic[14]

1) U. Patras, Patras-Rio, Greece, 2) U. & INFN , Trieste, Italy, 3) Bilgi U., Istanbul, Turkey, 4) XJTU, XiAn, China, 5) Munich, Germany, 6) U. Rijeka, Croatia, 7) Messiah U., Mechanicsburg, PA , USA, 8) Mayo Clinic, Rochester, MN, USA, 9) Bogazici U., Istanbul, Turkey, 10) IRFU/CEA, Gif-sur-Yvette, France, 11) U. Bath, UK, 12) IBS / KAIST, Daejeon, Korea, 13) IGAM / Institute of Physics, U. of Graz, Austria, 14) U. Albany, Albany, NY, USA
Present address: #) Geneva, Switzerland, $) U. Hamburg, Hamburg, Germany,
&) contact, email: marios.maroudas@CERN.CH, Tel. : +306946194195

Abstract: *Dark matter (DM) came from long-range gravitational observations which actually does not interact with ordinary matter. Though, on much smaller scales, a number of unexpected phenomena contradict this picture for DM. Because, some of the solar activity or the dynamic earth's atmosphere might arise from DM streams. Gravitational (self-)focusing effects by the Sun or its planets of streaming DM fits as the underlying process, e.g., for the otherwise puzzling 11-year solar cycle, the mysterious heating of the solar corona with its fast temperature inversion, etc. Observationally driven we arrive to an external impact by as yet overlooked "streaming invisible matter", which reconciles some of the investigated mysterious observations. Unexpected planetary relationships exist for the dynamic Sun and Earth atmosphere and are considered as the signature for streaming DM. Then, focusing of DM streams could also occur in exoplanetary systems, suggesting for the first time investigations by searching for the associated stellar activity as a function of the exoplanetary orbital phases. The entire observationally driven reasoning is suggestive for highly cross-disciplinary approaches including also (puzzling) bio-medical phenomena. Favorite candidates from the dark sector are the highly ionizing anti-quark nuggets, magnetic monopoles, but also particles like dark photons.*

"All we know is dark matter is well hidden" => *"dark"*



16th February 2021: http://spaceref.com/astronomy/the-smallest-galaxies-in-our-universe-bbring-more-about-dark-matter-to-light.html

Our universe is dominated by a mysterious matter known as **DM**. ***Its name comes from the fact that DM does not absorb, reflect or emit electromagnetic radiation***, making it difficult to detect.

Counter examples => this work

Our working hypotheses:

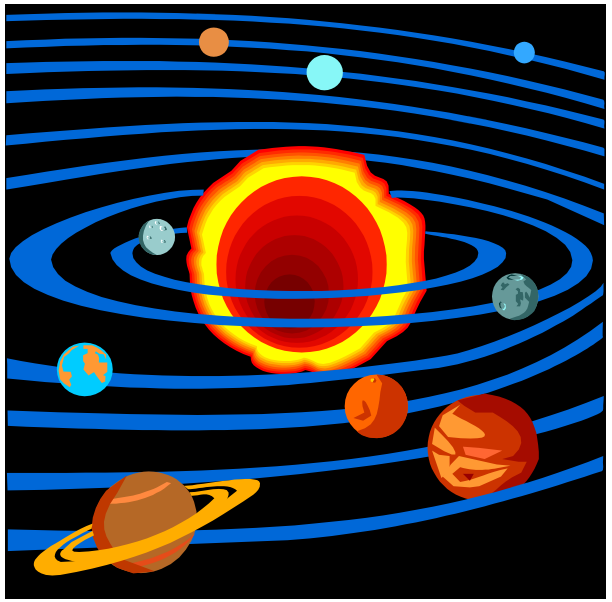
- Planetary (and solar) gravitational focusing of non-relativistic "*invisible massive particles*"
- The focused invisible streaming matter **interacts *"strongly"*** with solar / planetary atmospheres >> **no screening**, …
- Repeating activity enhancement during **planetary alignment**

Project timing => $\Theta_{longitude}$

Search for planetary relationship

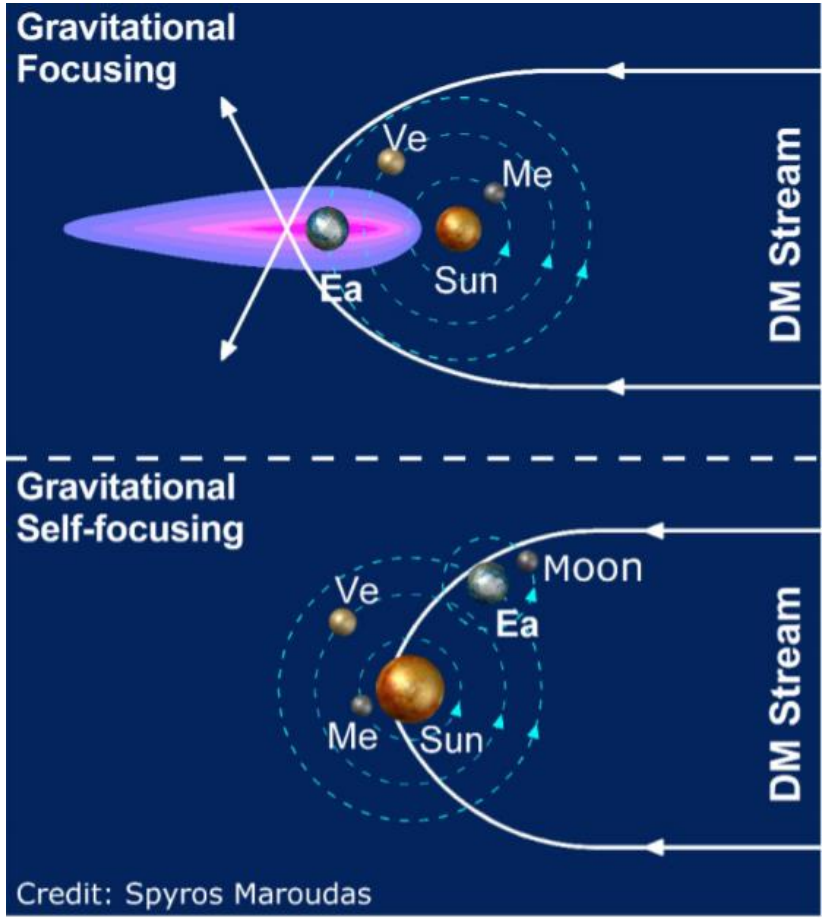
?

origin



Gravitational lensing >>> $\Theta_{deflection} \sim 1/v^2$

1

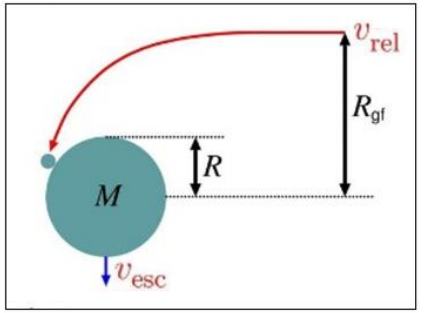


2

18th December

Galactic Centre

Gravit. (self)-focusing ... >> free fall



$$\sigma_{trap} = \pi R^2 \left(1 + \frac{v_{esc}^2}{v_{rel}^2}\right)$$

SUN: v_{esc}=612 km/s

2 peaks ~180° apart!

[Adrien Leleu]

Cartoon illustration of gravitational (self-)focusing effects of DM streams

Within known physics

Dark sector signatures are not expected

Unexpected Solar / terrestrial behavior

?

Are insisting anomalies/mysteries in the solar system the unnoticed manifestation of the dark Universe ➔ **Yes** (this work).

How? Why? >> not ALL!

ZWICKY, 1933: DM from unexpected cosmic scale obs's.

WOLF, 1859: "***first***" to suspect planetary involvement **@** Sun

>> HOW?

Inbetween:

1. Several small scale unexpected observations.
2. **WOLF ZWICKY**
3. clear planetary relationship

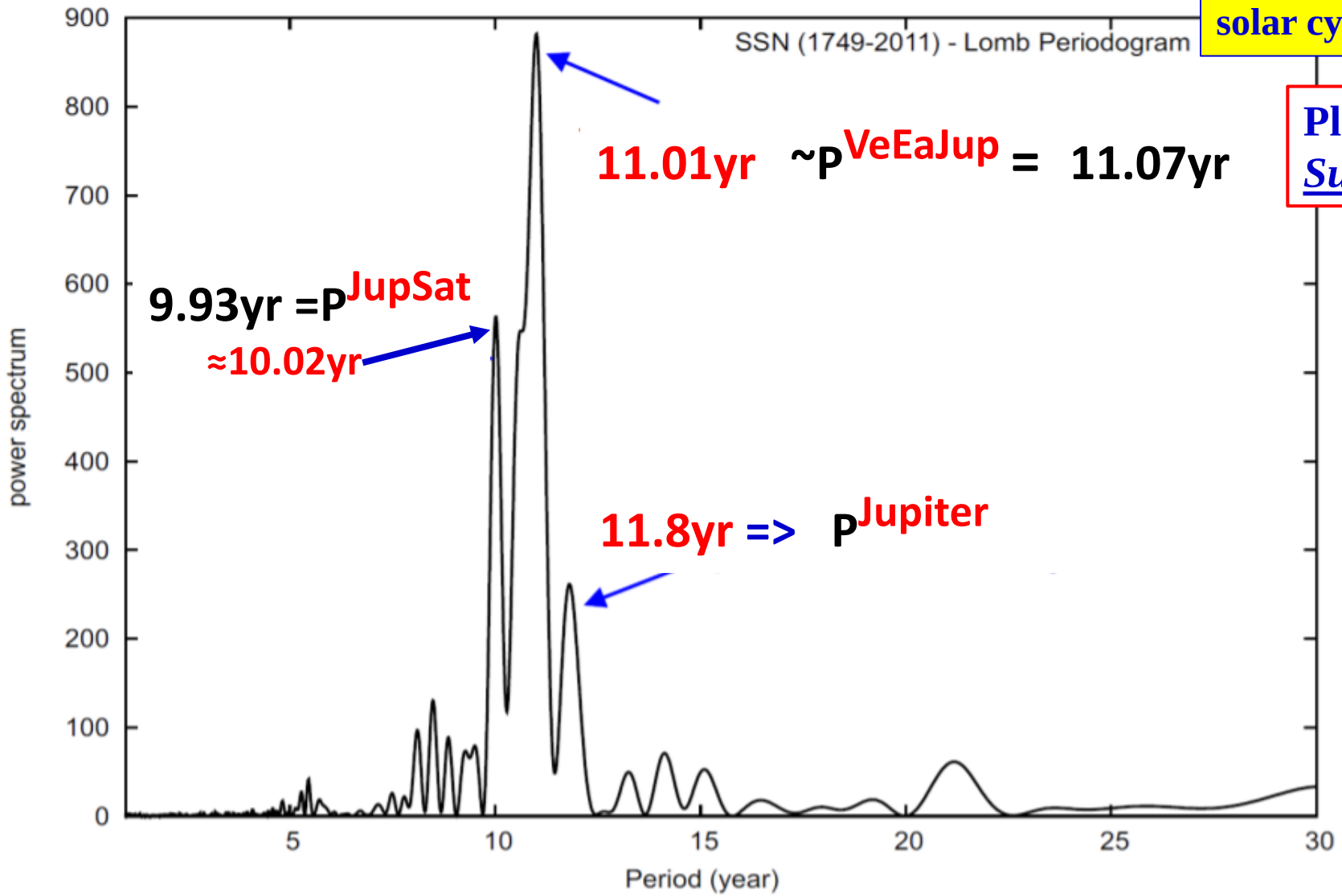
➔ **streaming DM**

The key feature **+** ***driving idea for this work***

= = > *what else?*

The 11-year solar cycle

11yrs ≈ 11.86 yrs
solar cycle ≈ $P^{JUPITER}$



Planetary dependence
Suspected **since 1859**

Remote Force?

The Q ever since!

https://arxiv.org/abs/1309.4021

The theory of a planetary modulation of solar activity

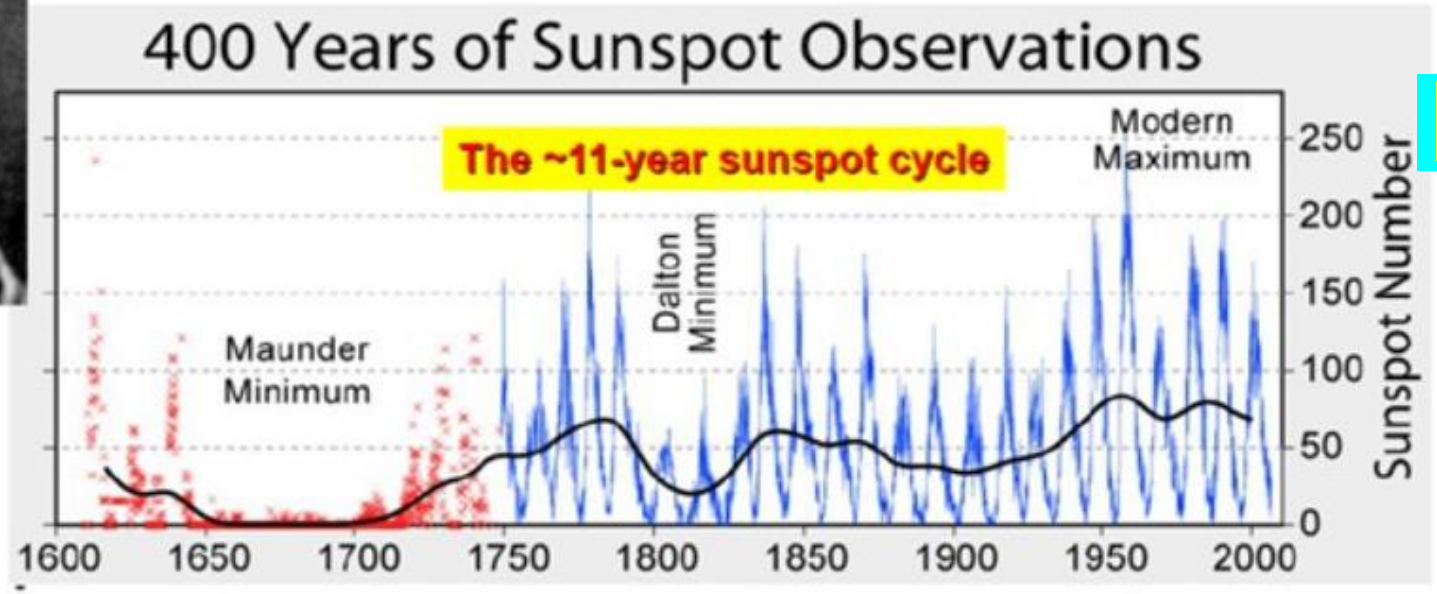
Overlooked!

Too weak within known physics

therefore abandoned!

Extract of a Letter from Prof. R. Wolf, of Zurich, to Mr. Carrington, dated Jan. 12, 1859.

(*Translation.*)



the same planets, the conclusion seems to be inevitable, that my conjecture that the variations of spot-frequency depend on the influences of *Venus, Earth, Jupiter, and Saturn,* will not prove to be wholly unfounded. The preponderating planet

http://people.duke.edu/~ns2002/pdf/Scafetta_AGU-2012.pdf

Scafetta, N.: 2012a, J. Atm. Sol. Terr. Phys., 80, 296

https://slideplayer.gr/slide/7988163/

The key signature:

Planetary relationships of solar system observables

➔ ***remote planetary forces unknown, except:***

=> gravitational tidal forces:

- Smooth change ~$1/R^3$ ➔ do not fit obs's
- too feeble: missing factor $\leq 10^{-11}$ &)
- ***Peaking dependence excludes a remote planetary interaction***

&) **DOI**: 10.1023/A:1022912430585 Sol. Phys. **(2003)**

Discarded... 1967 MERCURY 2017 Planetary dependence

because inconsistent w' $1/R^3$ tidal force

http://adsabs.harvard.edu/abs/1967AJ.....72..463B AJ (**1967**)

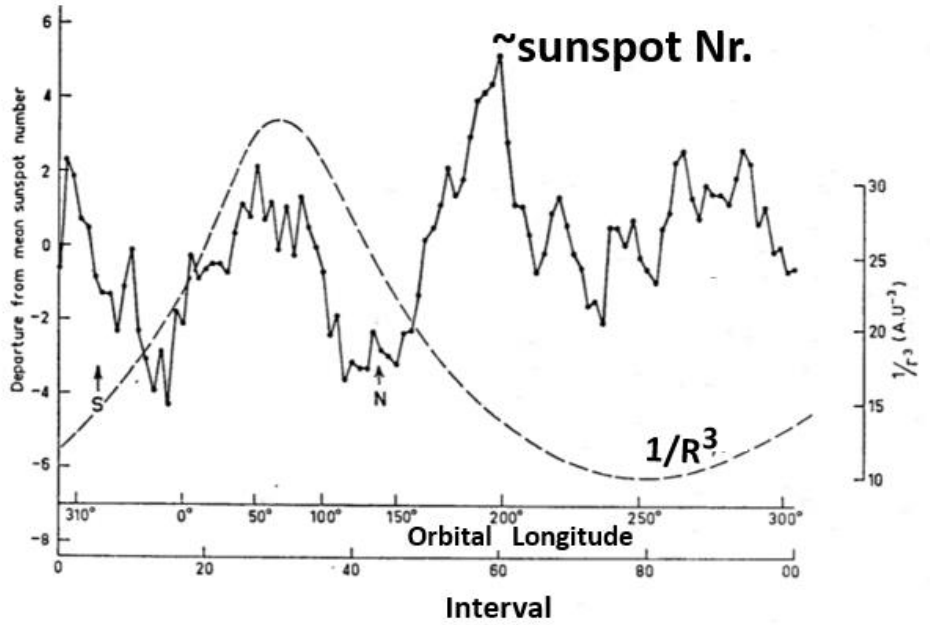
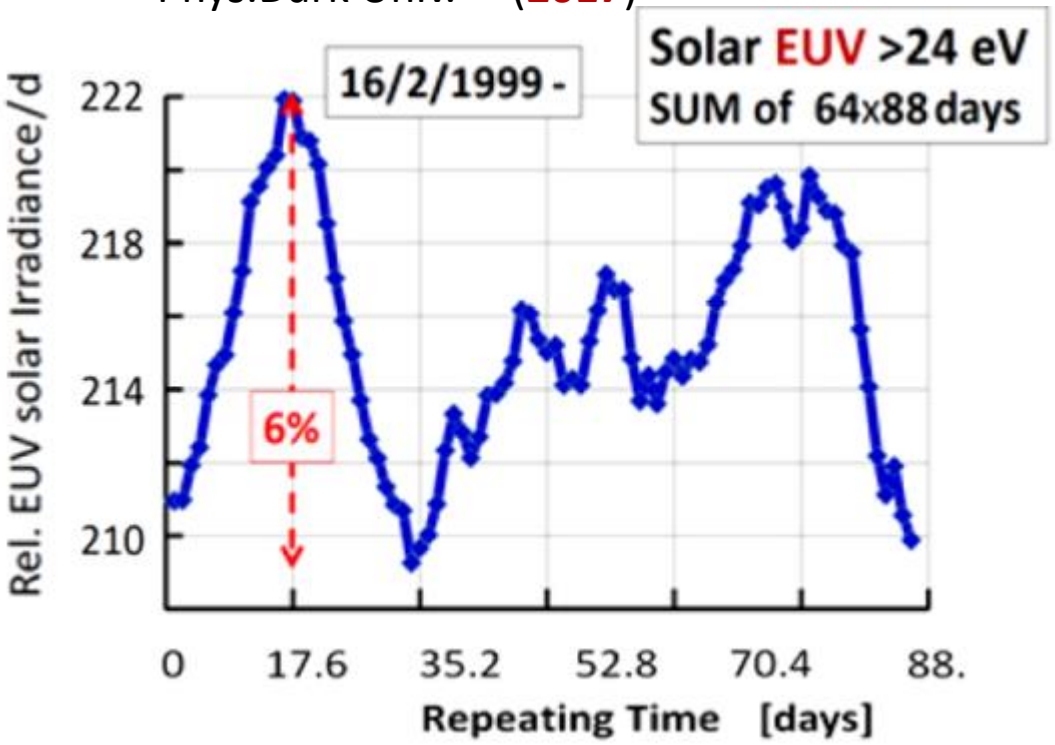


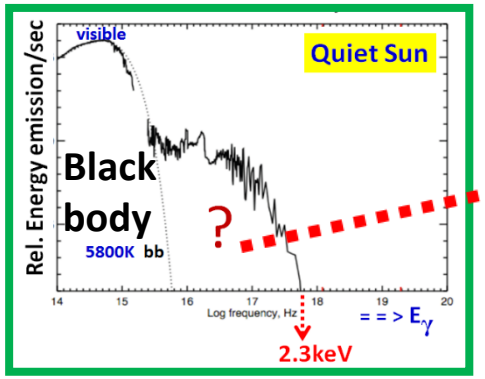
FIG. 4. Departures from mean sunspot numbers as a function of Mercury's position. Equivalent to the mean waveform of the detected signal.

"It is immediately obvious that no simple theory will entirely account for this complex pattern, but one of the maxima occurs near Mercury's closest approach to the sun and the two conspicuous minima occur quite close to the planet's greatest departures from the plane of the earth's orbit (N and S in Fig.)."

http://dx.doi.org/10.1016/j.dark.2017.06.001

Phys.Dark Univ. (**2017**)





The manifestation of the hot corona

Discarded... 1967 ⟷ MERCURY ⟷ 2017 Planetary dependence

because inconsistent w' $1/R^3$ tidal force

http://adsabs.harvard.edu/abs/1967AJ.....72..463B AJ (**1967**)

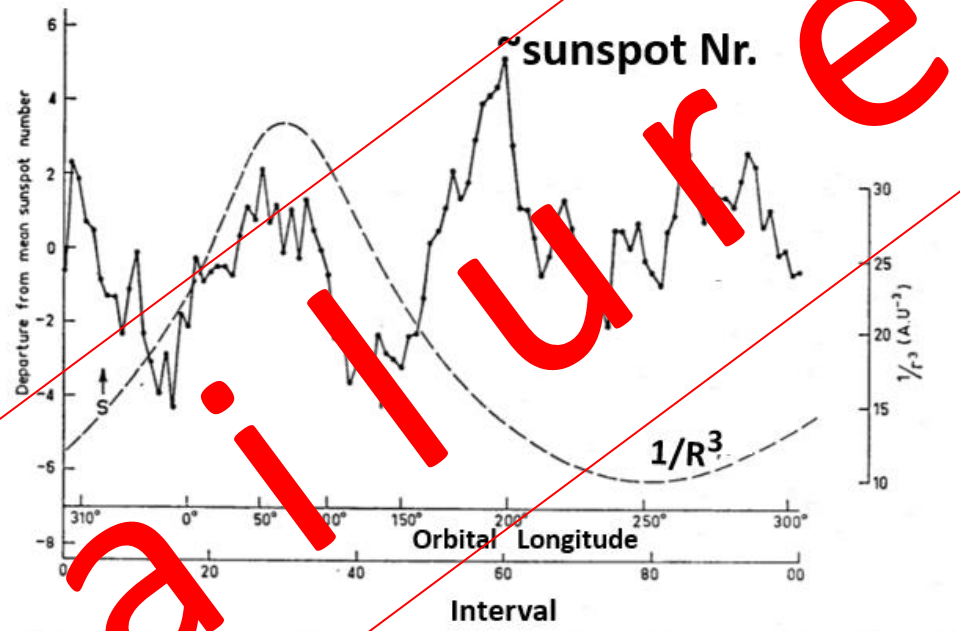


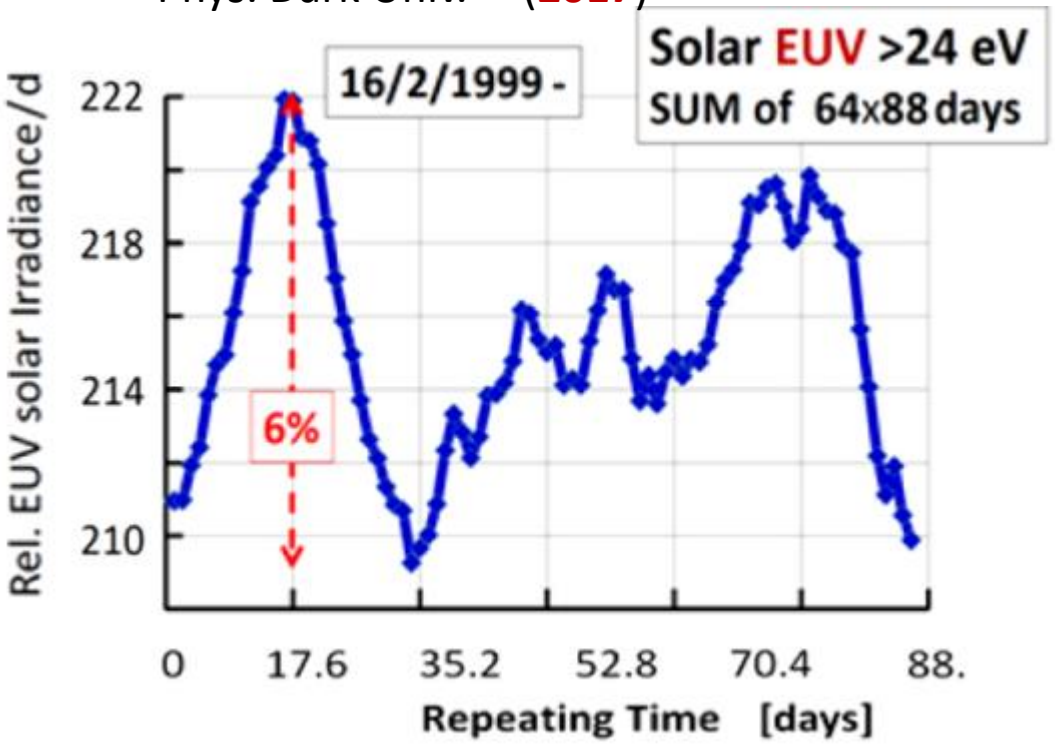
FIG. 4. Departures from mean sunspot numbers as a function of Mercury's position. Equivalent to the mean waveform of the detected signal.

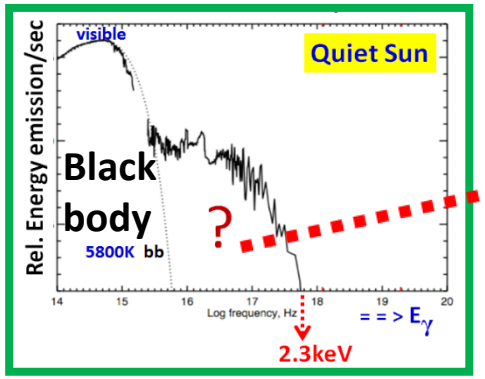
Failure

It is immediately obvious that no simple theory will entirely account for this complex pattern, but one of the maxima occurs near Mercury's closest approach to the sun and the two conspicuous minima occur quite close to the planet's greatest departures from the plane of the earth's orbit (N and S in Fig.).

http://dx.doi.org/10.1016/j.dark.2017.06.001

Phys. Dark Univ. (**2017**)





The manifestation of the hot corona

So far:

Various solar / terrestrial obs's show planetary relationship. ***see below***

Rule of thumb:

An obs' with 11yrs rhythm implies planetary dependence

Note:

! ***a planetary relationship can show-up only if the underlying cause within the solar system is (partly) in form of streams.*** !

More…

…planetary relationships within the solar system

+

in exoplanetary systems?

Solar Flares

1859 - ***unpredictable mysteries***

one of the most important challenges in solar physics [1]

Solar Corona

1939 - ***one of the fundamental problems***

in space science [2].

Ionosphere

1937 - ***a long-standing unexplained annual anomaly*** [3]:

$\rho_e(\text{DEC}) > \rho_e(\text{JUNE})$

Unanswered puzzles within known physics!

Proxy of solar activity

Sunspots + MBPs + solar elemental composition + 2.8 GHz + …

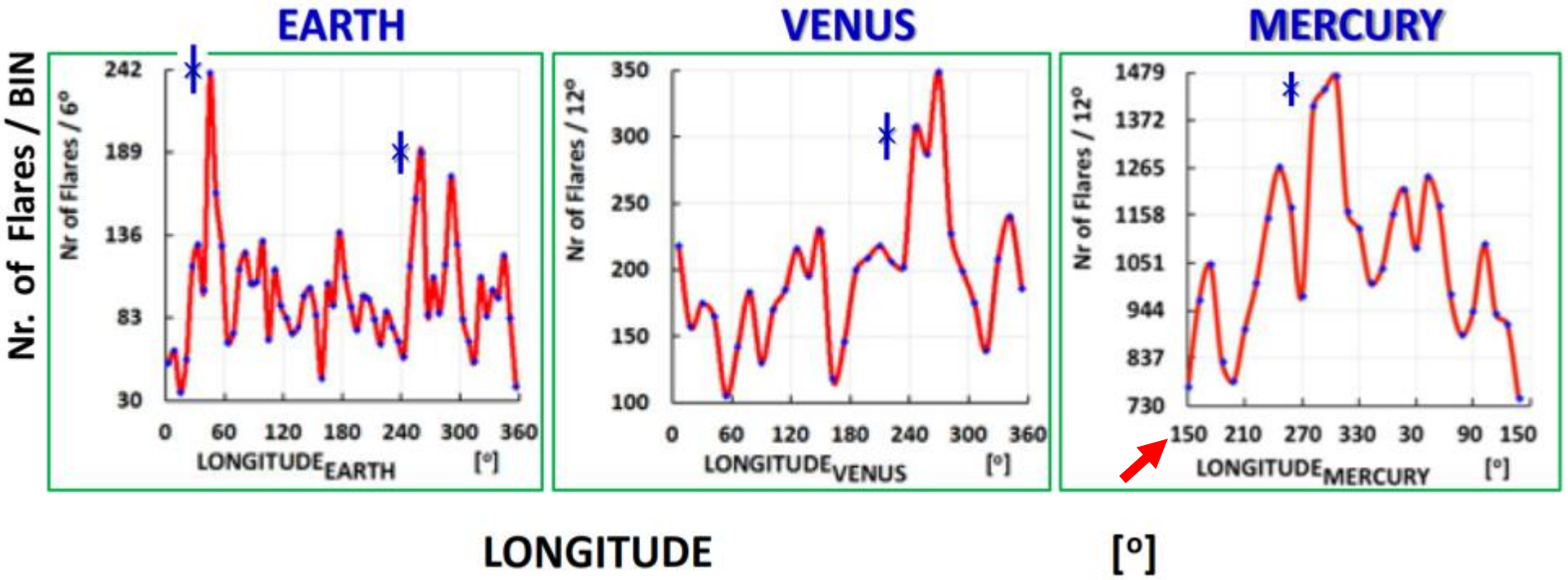
[1] V. Polito *et al.*, *ApJ* 816 (**2016**) 89 ; https://doi.org/10.3847/0004-637X/816/2/89

[2] J.A. Klimchuk et al. , PASJ (**2017**); https://arxiv.org/abs/1709.07320

[3] E.V. Appleton, Proc. Roy. Soc. London A162 (**1937**) 451; http://rspa.royalsocietypublishing.org/content/162/911/451 .

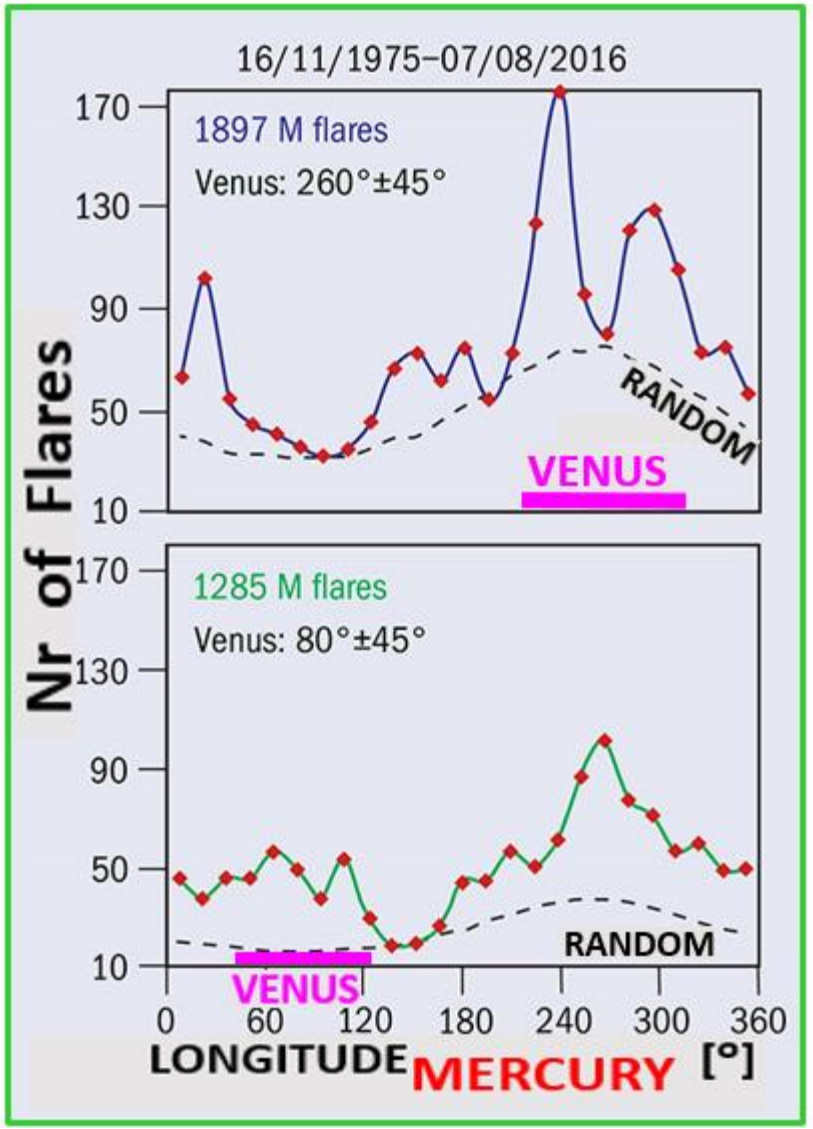
Solar Flares → ***peaking*** [&)] ***planetary relationships*** **!**

&) exclude a remote planetary interaction, e.g., tidal forces



Data from M.J. Aschwanden

CERN COURIER
VOLUME 57 NUMBER 8 OCTOBER 2017 p.7



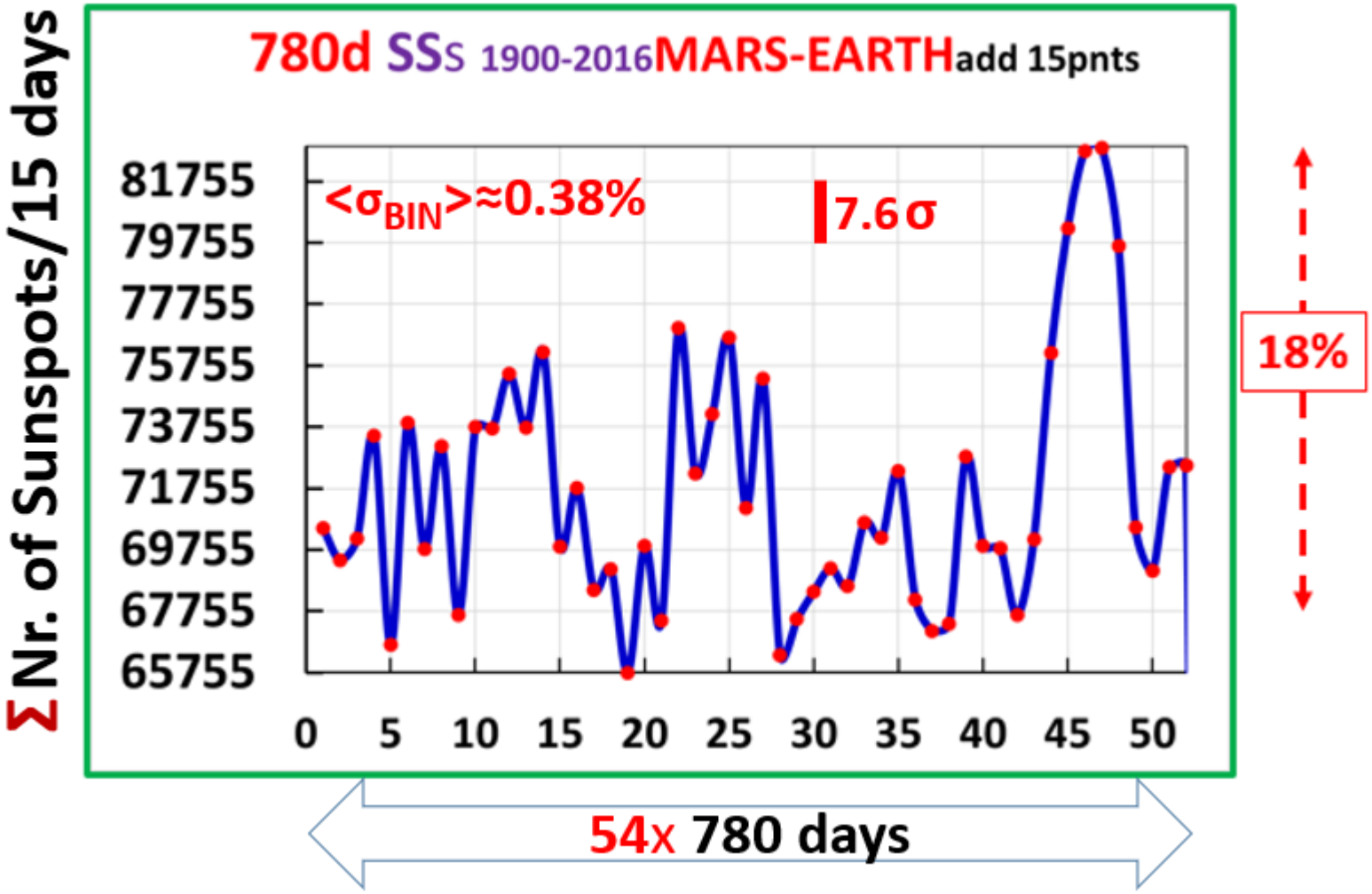
MERCURY ⊗ VENUS

M-class solar flares

- **EXCESS/RANDOM >45%**
  ➔ dominating planetary impact ➔
- **3 NARROW PEAKS =/=> tidal forces**

http://cerncourier.com/cws/article/cern/69886

Sunspots 1900-2016 >> MARS-EARTH synod =780 days => substructure!

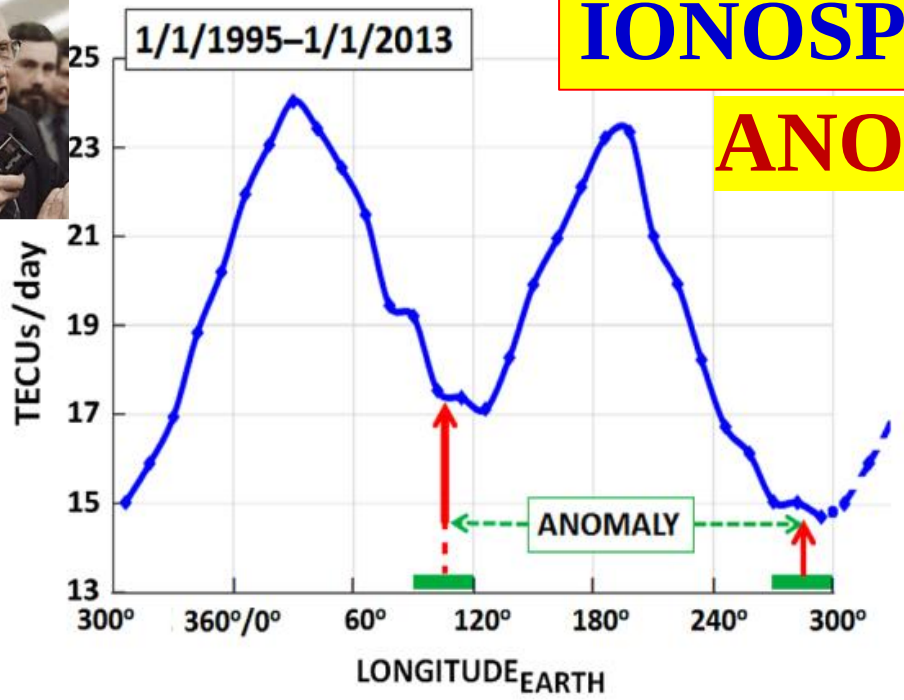


Combined planetary relationship

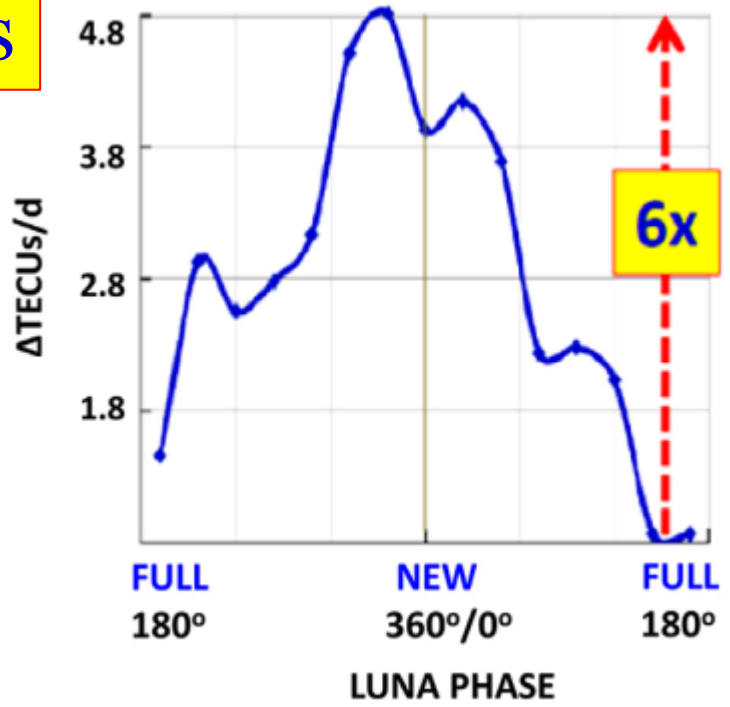
Synod

Simplest FOURIER analysis with time resolution.

IONOSPHERE's ANOMALY



The measured atmospheric total electron content in TECUs, 1 TECU = 10^{16} e/m^2] as a function of the Earths heliocentric longitude averaged over 1 day (**1995–2012**).
PDU (**2017**) http://dx.doi.org/10.1016/j.dark.2017.06.001



ΔTECUs: the difference between the winter–summer solstices (s. Fig. on the right) = f(Moon Phase), while the Earth is in one of the two 30° orbital segments (**green** bars on the left Fig.)
PDU (**2017**) http://dx.doi.org/10.1016/j.dark.2017.06.001

➔**Moon as gravitational lens? >> YES =>**

Moon → **Earth** **focusing:** **≤400 km/s**

amplification **≈10^4×**

Earth intrinsic self-focusing: max @ 17 km/s (10^9×)

[Sofue] **2020** https://arxiv.org/abs/2005.08252

[A.Kryemadhi,M. Vogelsberger, K.Z. *in prepar.*(**2021**)]

→ Overlooked in DM research ←

Stratosphere: temperature anomalies as imprints from the dark Universe

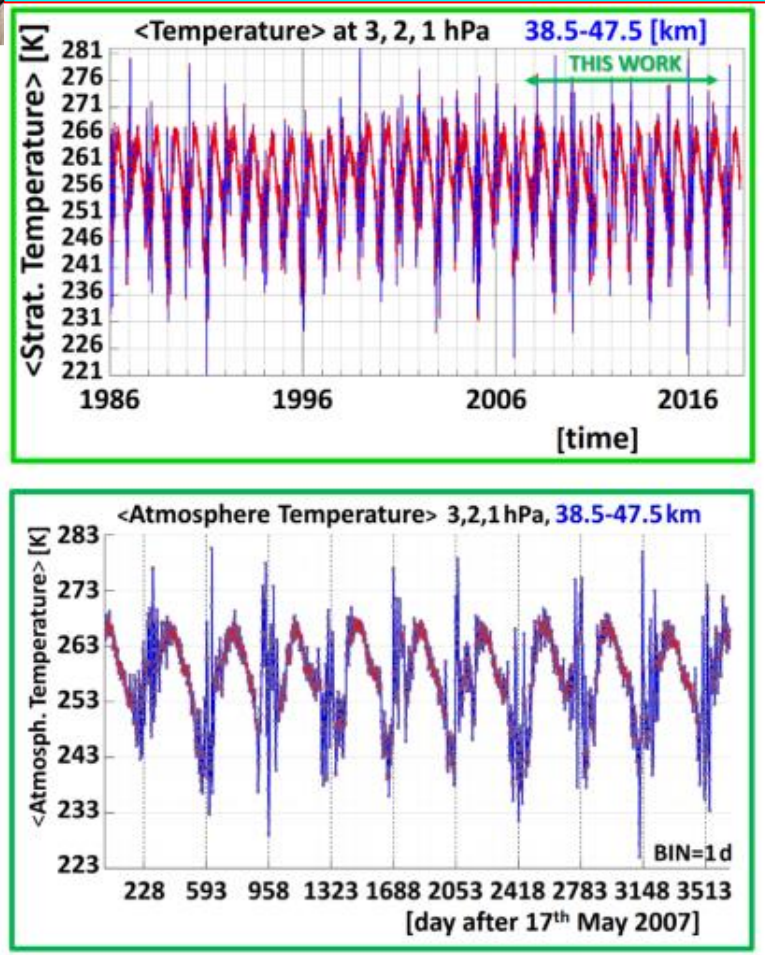


Fig. 1. (Top) Time dependence of the mean daily stratospheric temperature [(00:00+12:00)/2] at 3, 2, 1 hPa (altitude ≈ 38.5, 42.5, 47.5 km), 42.5°N/13.5°E and for the period 1986–2018. The period analysed in this work is indicated and it is also shown expanded (Bottom). The vertical dashed lines are year boundaries: 1st January of 2008 … 2017. The error bar of each point is equal to 0.5 K [19].

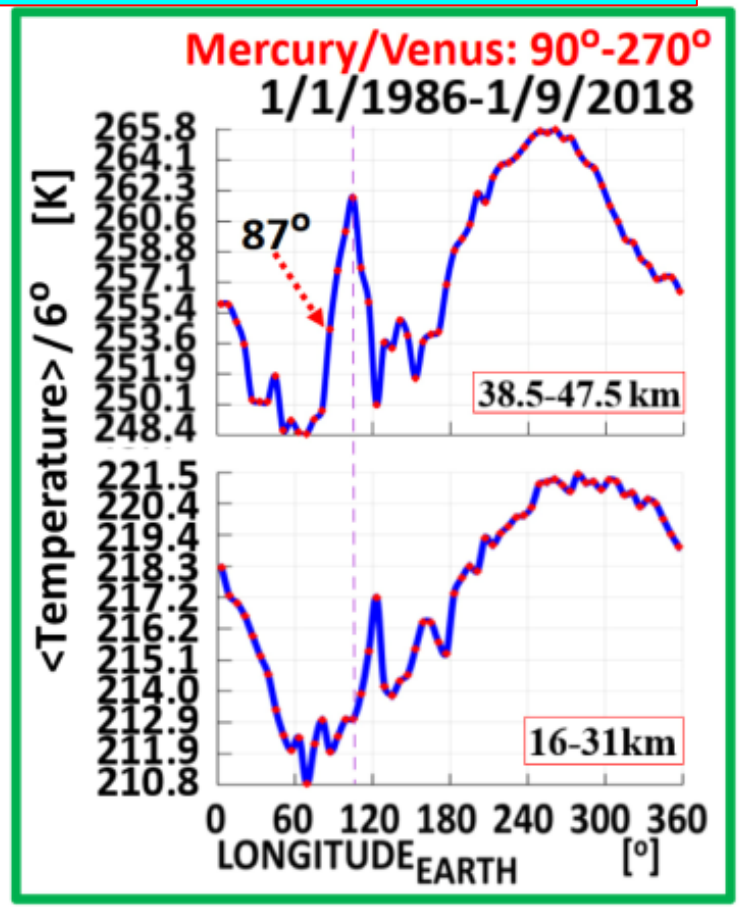


Fig. 8. A comparison between the mean temperature spectra of the upper stratosphere (top) and the lower stratosphere (bottom). The lower stratosphere (16–31 km) is the main Ozone layer, which is strongly affected by the solar UV. The striking difference between both spectra implies that the upper stratosphere (38.5–47.5 km) is marginally or even not affected at all by the solar UV. The position of the Galactic Center in this plot is at ~86.5°, and the upper stratosphere reaches its maximum temperature ~18 days later.

https://doi.org/10.1016/j.dark.2020.100497

“Solar composition problem”

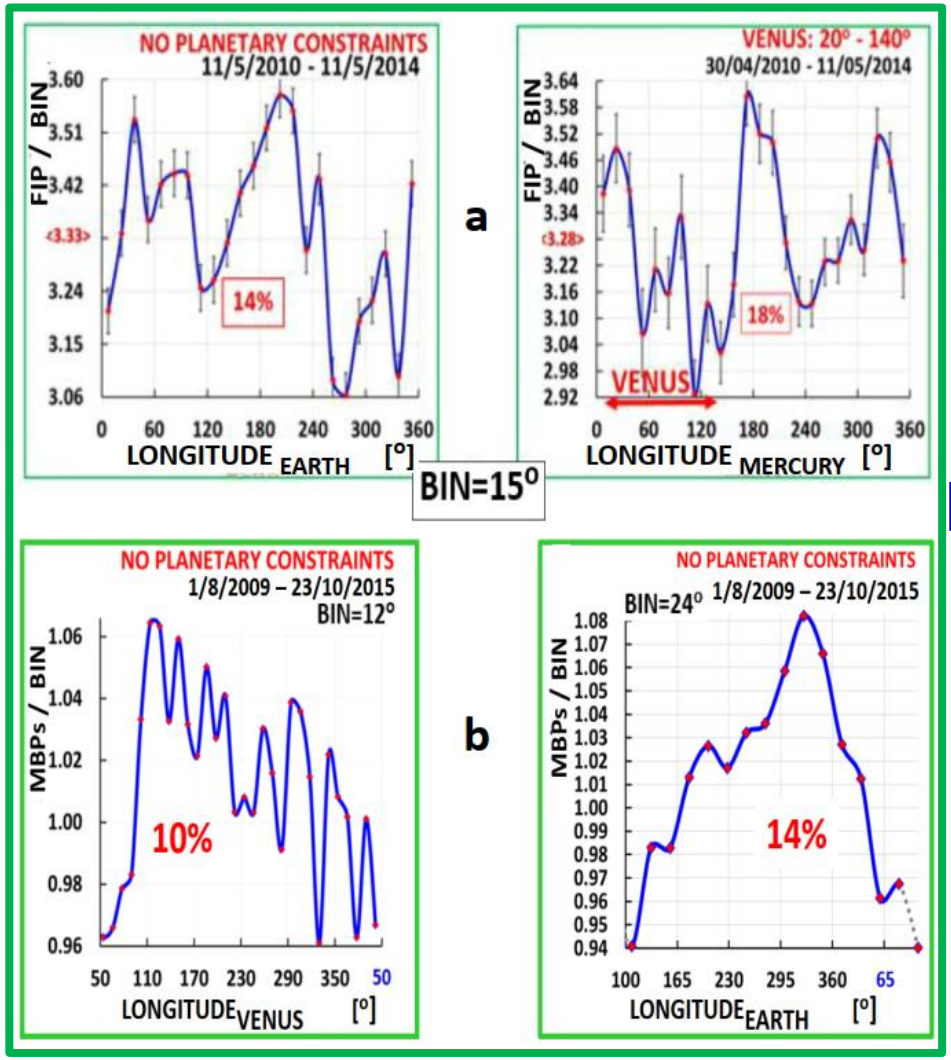
The mystery of the sun’s missing matter

! *“perhaps we are looking at the sun in the wrong way”* !

S. Palus, NEW SCIENTIST (18th Oct. 2017) https://www.newscientist.com/issue/3148/

Elemental Composition ➔

Magnetic Bright points ➔



Planetary relations:
how to reconcile w. conventional picture?

(a) https://www.nature.com/articles/s41467-017-00328-7 NATURE Comm. 2017

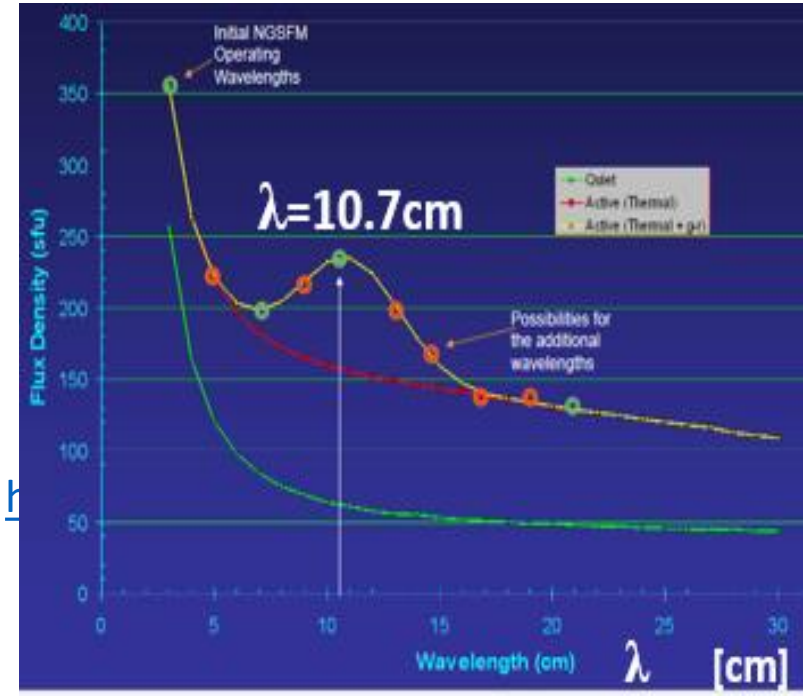
(b) https://arxiv.org/abs/1710.01678 PASJ 2017

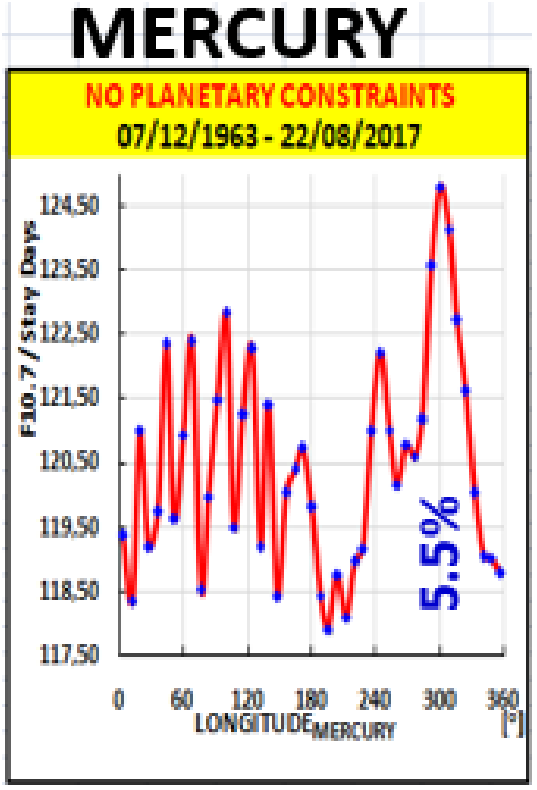
M. Maroudas and D. Utz, work in preparation 2021

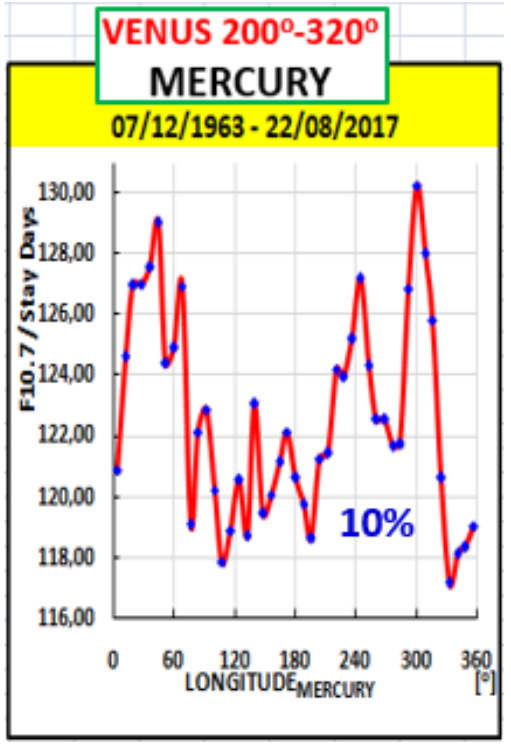
F10.7cm = 2.8 GHz solar line

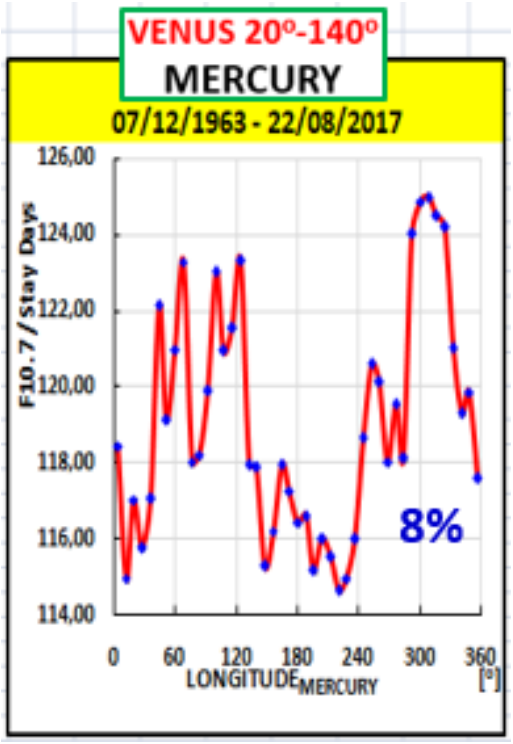
➔ SOLAR PROXY ➔

Solar spectrum: λ=>5-30cm









===== LONGITUDE MERCURY [°] ===== >

Similar relationships in exoplanetary systems?

Focusing of DM streams could also occur there, experiencing streaming DM the same way as with our solar system. Planetary focusing in those systems could be initially investigated by searching for the associated stellar activity as a function of the exoplanetary orbital phases (~Longitude).

TBDone

1 example …

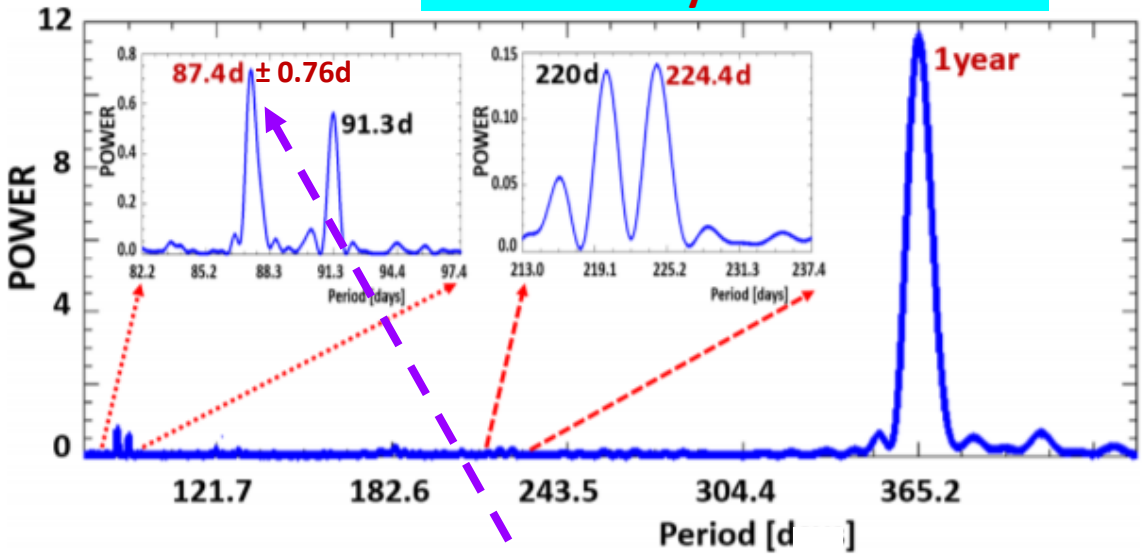
… outside physics ➔

2018 ← *Melanoma* → 2020

Planetary Dependence of Melanoma

http://dx.doi.org/10.1142/S179304801850008X

USA <monthly> data 1973-2011



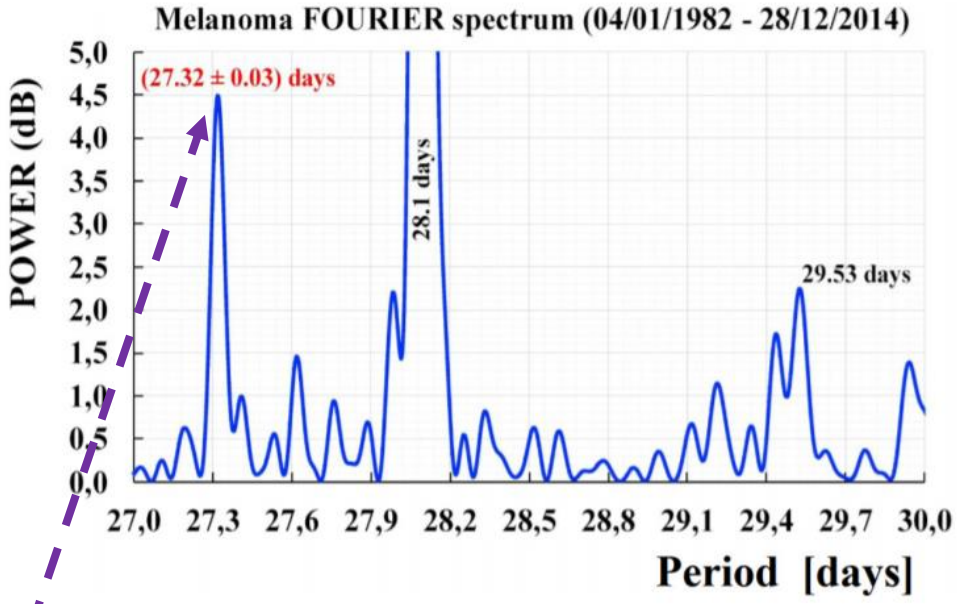
87.97 days

@Mercury's orbit

..a 27 Days Periodicity in Melanoma Diagnosis

https://doi.org/10.1142/S1793048020500083

AUSTRALIA daily data 1982-2015



@Moon's orbit 27.32 days (sidereal)

=> fixed to remote stars

Origin: exo-solar!

Confirmed independently

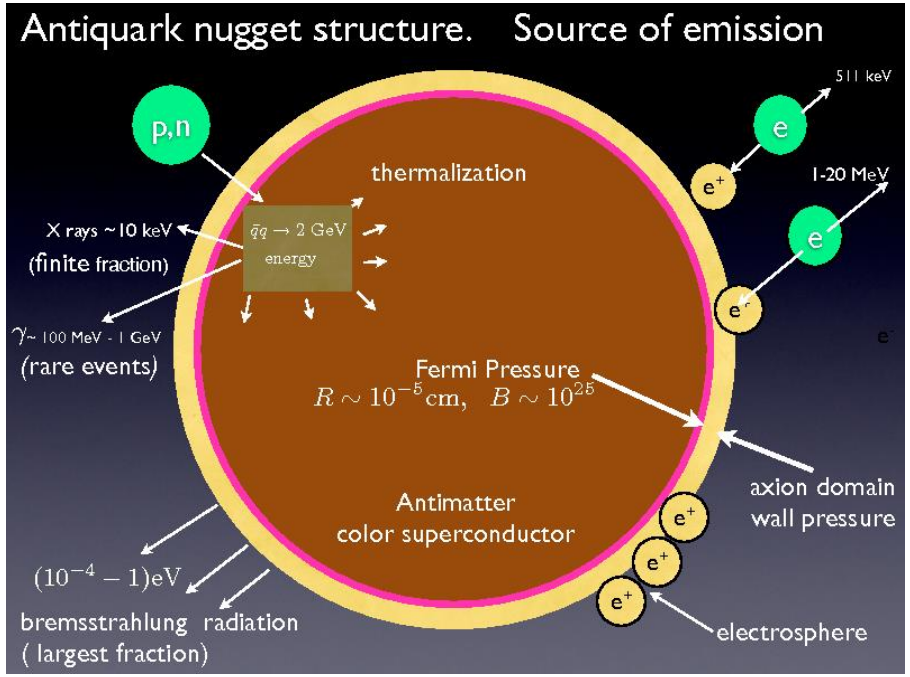
https://doi.org/10.1142/S1793048019200029

AntiQuark Nuggets (AQNs):

dark matter + missing antimatter + (much) more?

https://indico.desy.de/indico/event/20012/session/19/contribution/54/material/slides/0.pdf

N. Raza, L. van Waerbeke, **A. Zhitnitsky**, *Solar Corona Heating by the AQN Dark Matter*, arXiv:1805.01897 (**2018**), Phys. Rev. D 98 (**2018**)103527



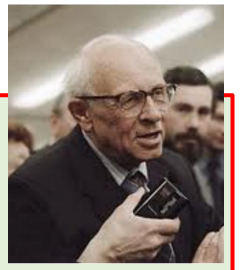
Candidates:

1. **AQNs**
2. Magnetic monopoles
3. Dark photons

Or, a combination from + more.

https://inspirehep.net/record/1235677/plots

Conclusions



- ✓ Various solar obs's fit planetary gravitational focusing of stream(s) of invisible massive particles ⊗ puzzling solar/terrestrial behaviour:
  Hot Corona, Flares, Elemental composition, MBPs, sunspots, …?...
- ✓ Similar searches with the dynamic ionosphere (combining with other data underneath).
- ✓ Nature of the invisible particles not identified yet. Possible candidates:
- ✓ **AQNs,** Magnetic monopoles, Dark photons ➔ *inspiring new search strategies*.
- ✓ Underground DM exp's, **search for new planetary relationships**
  => Any ~11yrs relationship suggestive for re-analysis
- ✓ DM searches may profit from temporal signal enhancement up to $10^{11}\times$**=> NO** screening?
- ✓ Tidal effects on the solar surface are excluded ($\approx 10^{-12}\cdot SUN_{Gravity}$)
  => the planetary working hypothesis: the only viable scheme.
- ✓ More TBD? e.g. various solar / terrestrial obs's **+ exosolar planetary systems (!?)**,
  plus *Biomedicine >> first results with melanoma rates encouraging*
- ✓ *Ultimate goal: decipher the properties of the streaming DM particles.*
- ✓ *novel approaches in ongoing DM searches: design and/or re-analysis*

The Dark World is not dark!

THANK YOU

symmetry

an Open Access Journal by MDPI

IMPACT FACTOR 2.645

The Dark Universe: The Harbinger of a Major Discovery

Guest Editor

Prof. Konstantin Zioutas

Deadline

31 August 2021

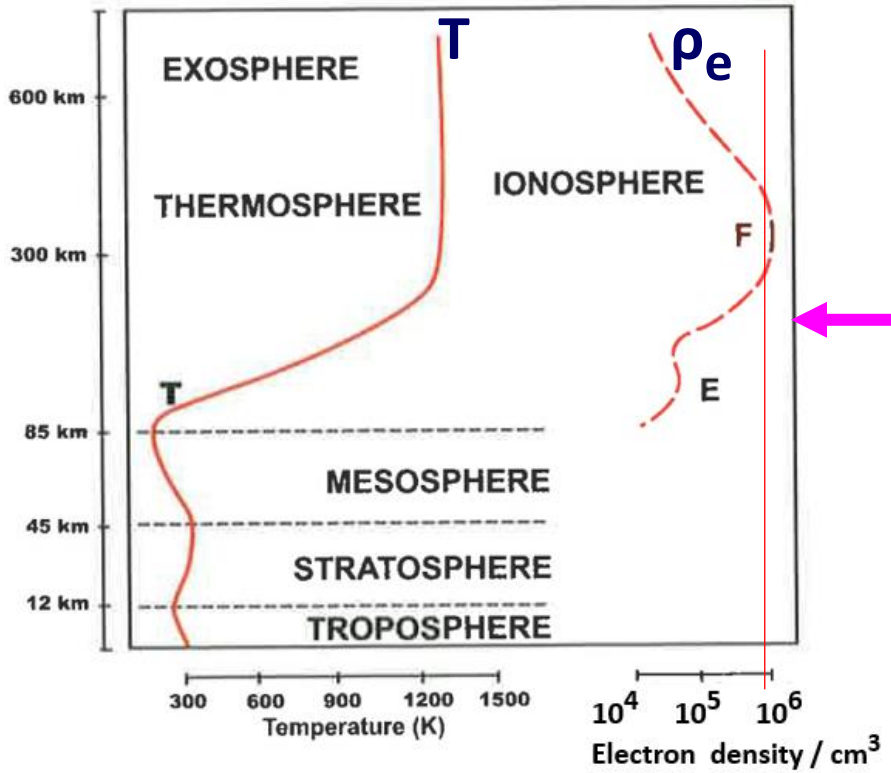
Special Issue

mdpi.com/si/69375

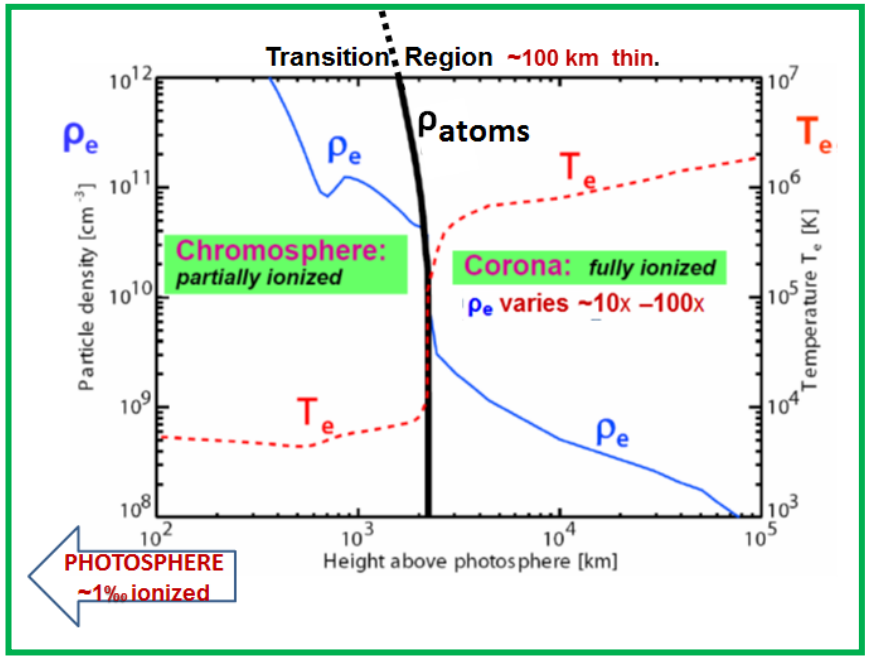
Invitation to submit

Additional slides

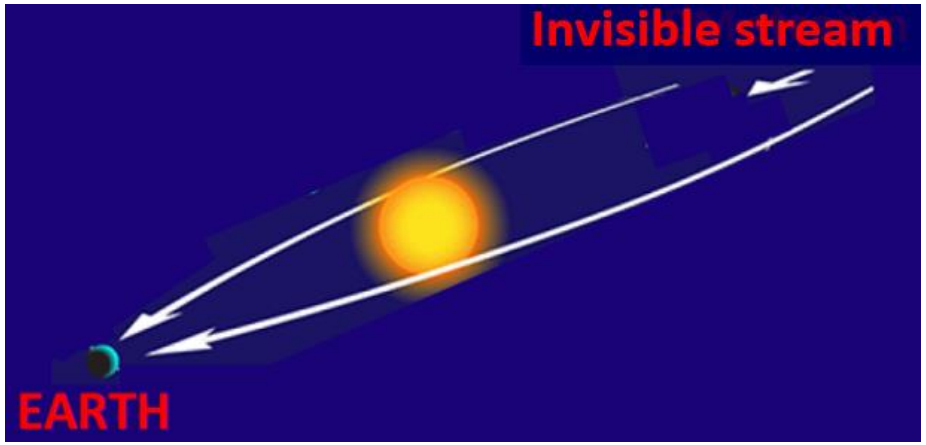
Earth's Atmosphere

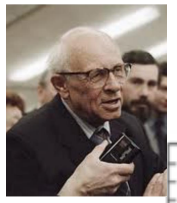


Chromosphere ⇔ Corona



THE SUN, L. Golub, J.M. Pasachoff , REAKTION BOOKS / THE SCIENCE MUSEUM, LONDON **2017**

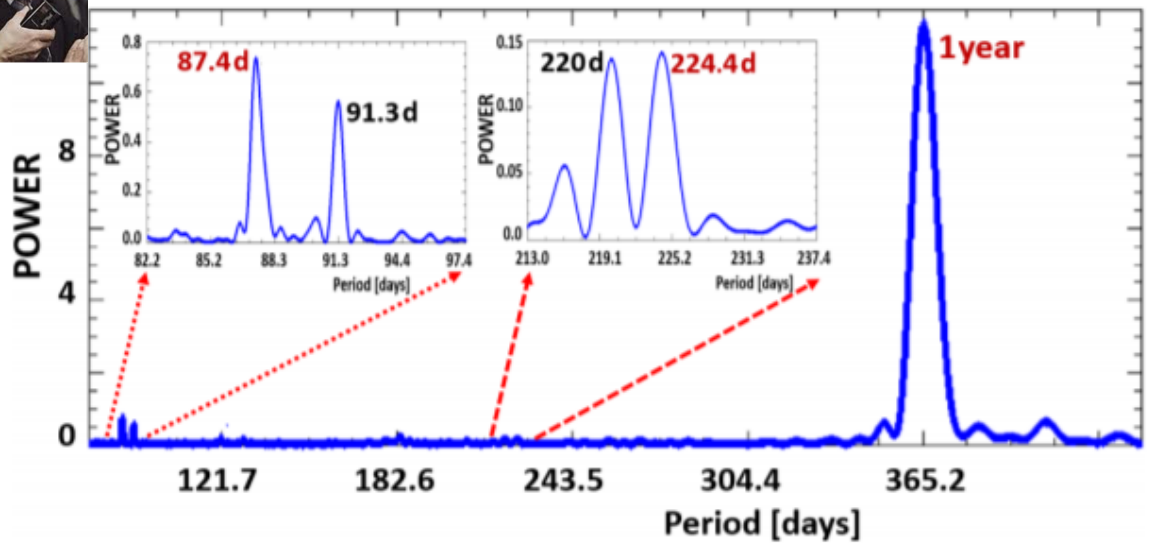




Planetary Dependence of Melanoma

http://dx.doi.org/10.1142/S179304801850008X

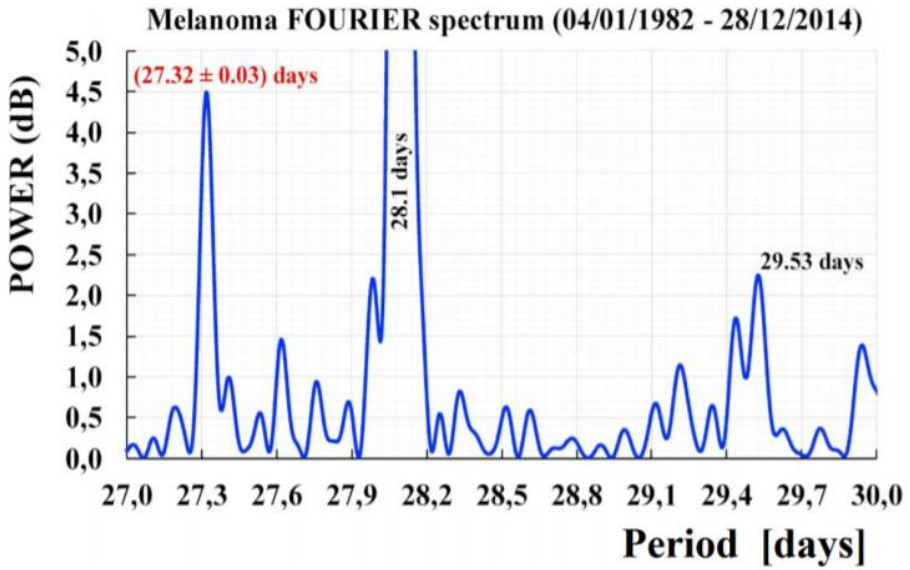
USA <monthly> data 1973-2011



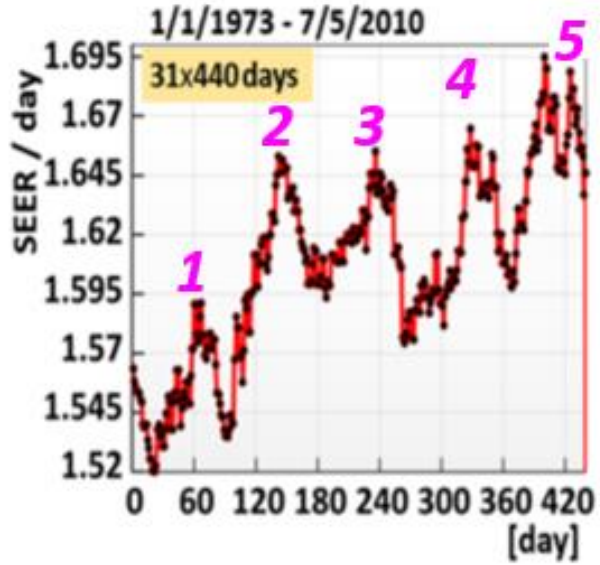
..a 27 Days Periodicity in Melanoma Diagnosis

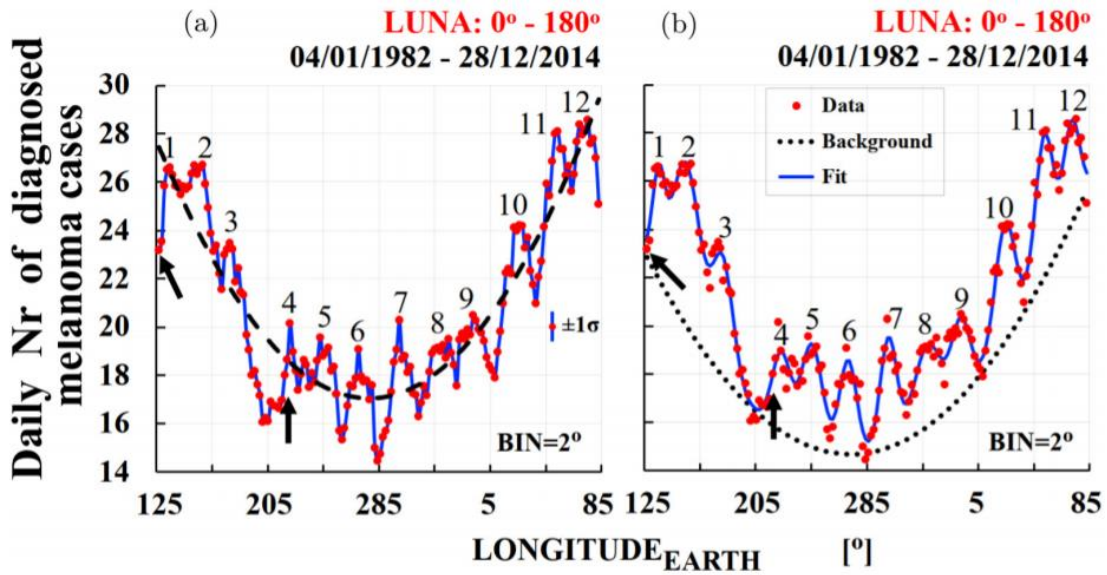
https://doi.org/10.1142/S1793048020500083

AUSTRALIA daily data 1982-2015



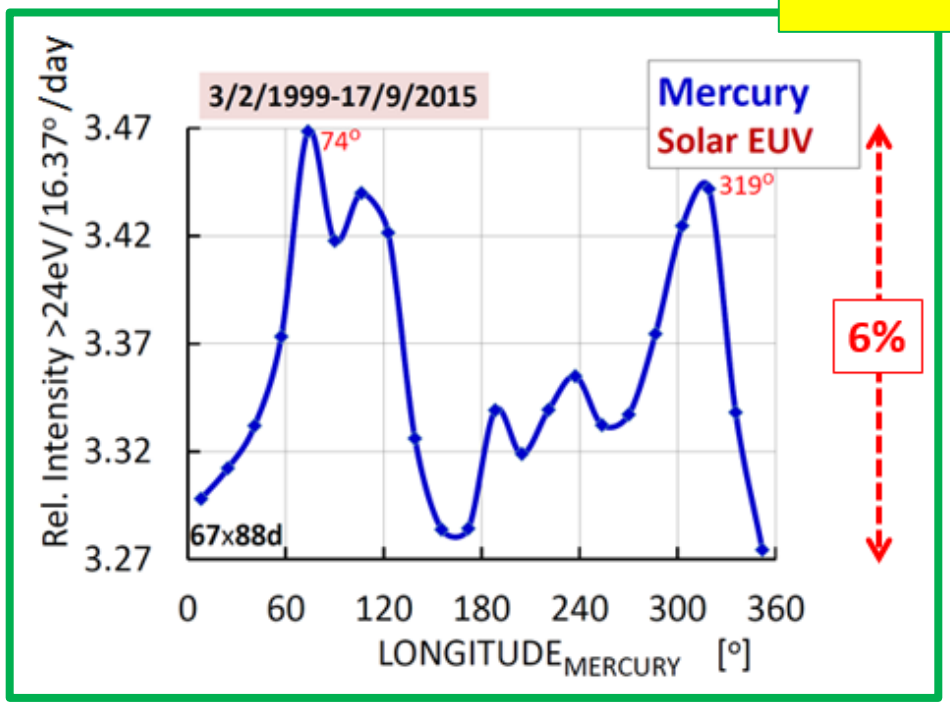
Adding up consecutive 5×88 d => 440days:



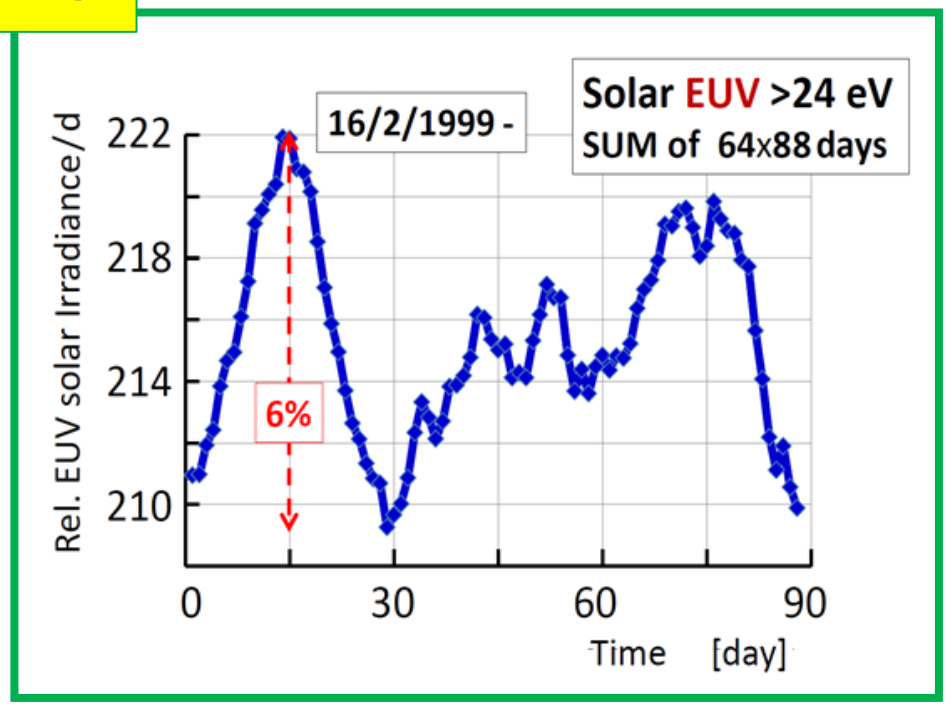


Full disk:

Solar EUV



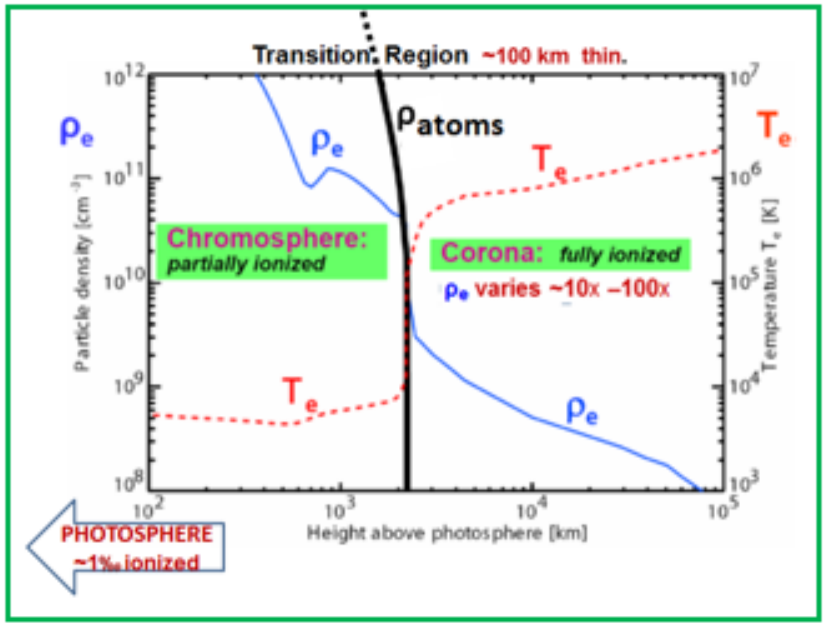
≈

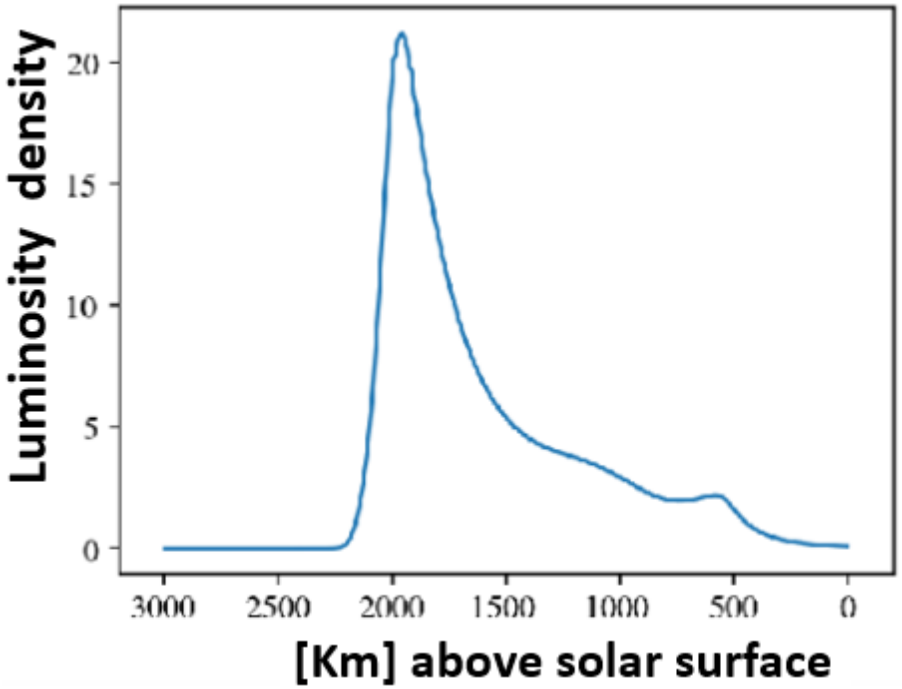


Analysis code #1

Analysis code #2

Chromosphere ⇔ Corona



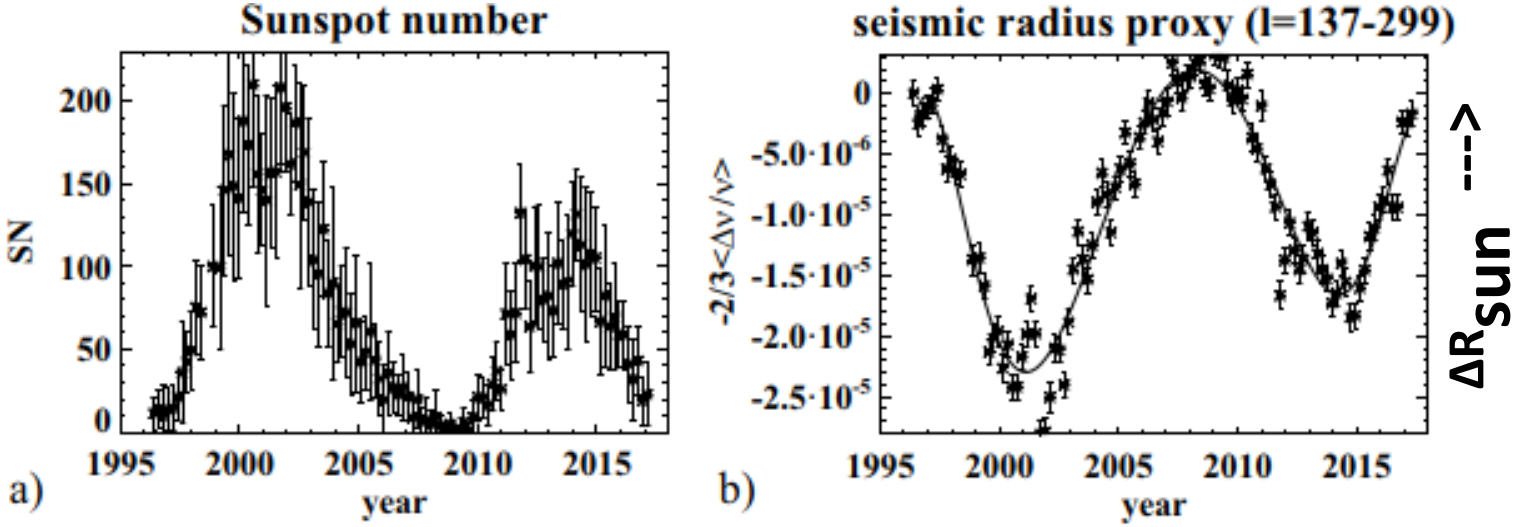


AQNs:

- ***the only solar atmospheric model explaining the ~100 km thin Transition Region***
- ***planetary dependence of the flaring Sun***
- ***more?*** ***>>> unexplained obs'?!***

N. Raza, L. van Waerbeke, A. Zhitnitsky, *Solar Corona Heating by the AQN DM*, arXiv:1805.01897 (**2018**)

“Solar Cycle Variations of Rotation + Asphericity in the Near-Surface Shear Layer”



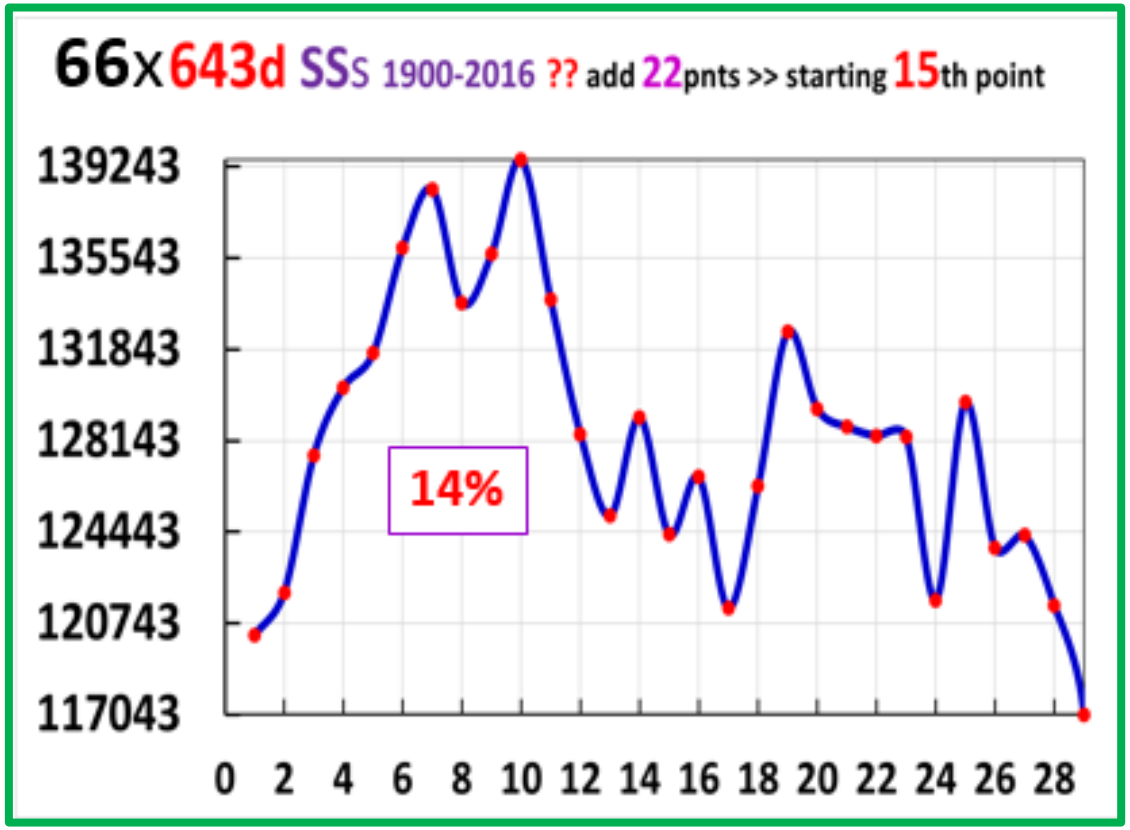
https://spaceweatherarchive.com/2018/09/27/the-chill-of-solar-minimum/ **Sept. 2018**

Figure 3: a) The sunspot number, SN, averaged for the 72-day periods corresponding to the intervals of the helioseismic analysis. b) Variations of the seismic radius proxy (Eq. 3) relative to the first measurement in 1996, as deduced from the analysis of the f-modes extracted from the MDI and HMI data from 1996 to 2017. The relative amplitude modulation of about -2.3×10^{-5} in Solar Cycle 23 and about -1.7×10^{-5} in Cycle 24 is clearly in anti-phase with the solar activity. The error bars show three standard deviations calculated using observational error estimates of the mean f-mode frequencies.

A. Kosovichev, J-P. Rozelot, J. Atm. Solar-Terr. Phys., 176 (**2018**) 21, https://doi.org/10.1016/j.jastp.2017.08.004 ; https://arxiv.org/abs/1804.05081

NO synod

Σ Nr. of Sunspots/22 days



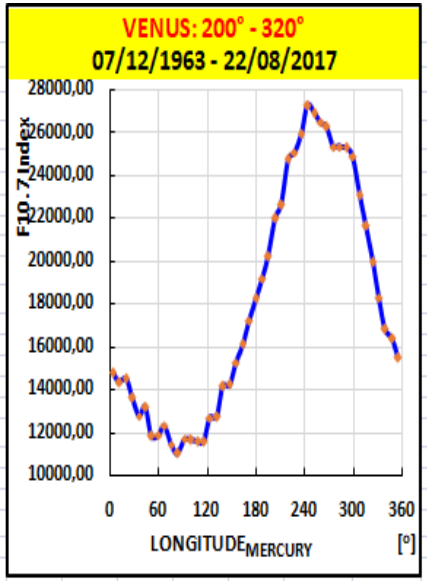
66× 643 days

Date [UTC]	
Minimum	Maximum
07/12/1963	22/08/2017

F10.7 [cm]	
Minimum	Maximum
0,0	400,0

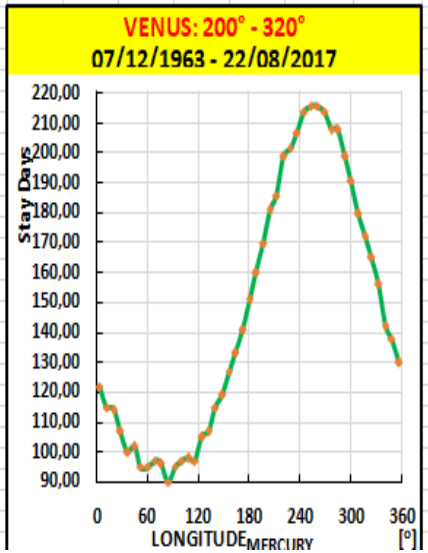
BIN Size [degrees]
8

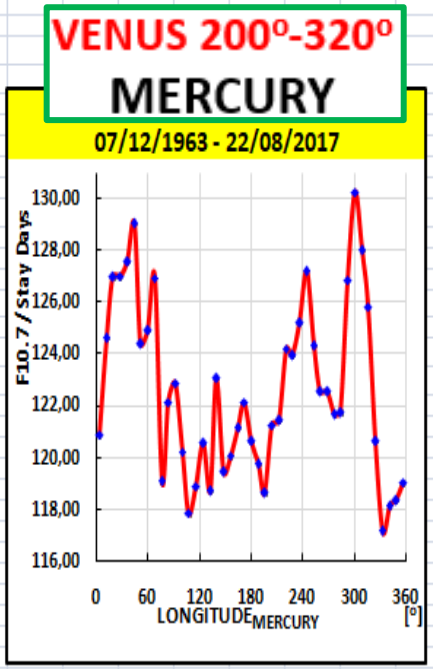
Planet	Planetary Longitude Range [degrees]	
Target	Minimum	Maximum
☉	MERCURY: 0	360
♀	VENUS: 200	320
♁	EARTH: 0	360
♂	MARS: 0	360
♃	JUPITER: 0	360
♄	SATURN: 0	360
☾	LUNA: 0	360



RUN

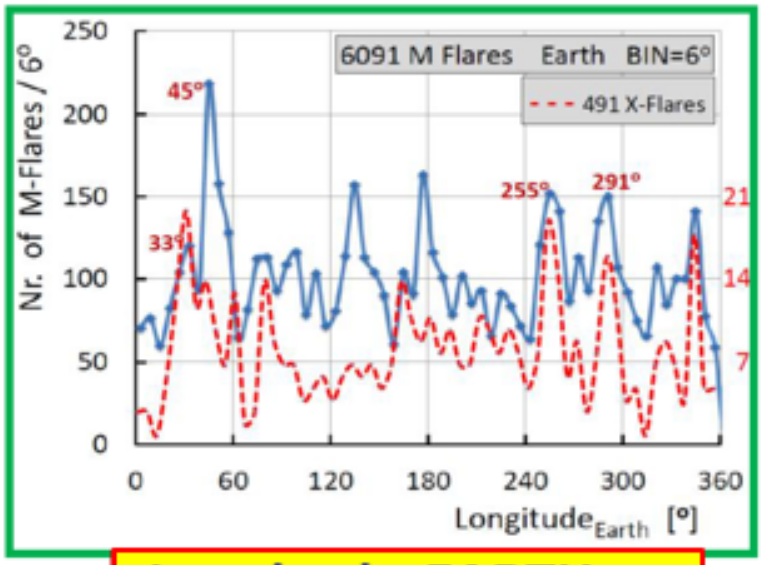
Integral: Flares Class	Integral: Nr of M-Flares	Class / Nr of M-Flares
807038,2	6572	122,7995



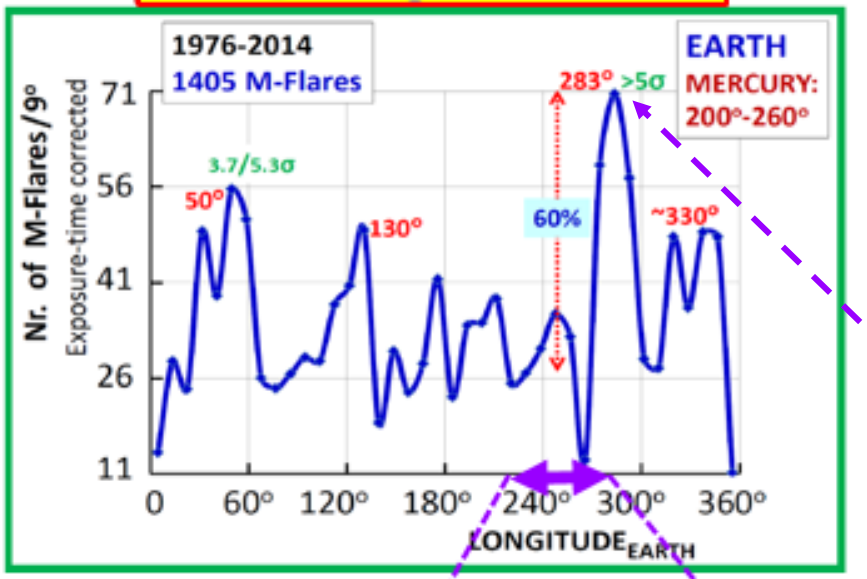


10%

Min <-> Max Value



Longitude-EARTH =>



MERCURY

ALL M-Flares

1405 M-Flares
Mercury:
200°-260°

EARTH

EARTH
⊗
MERCURY

Stream from Galactic Centre mega-BlackHole?

Heliocentric longitude ≈ **266°** + TOF (Earth => Sun)

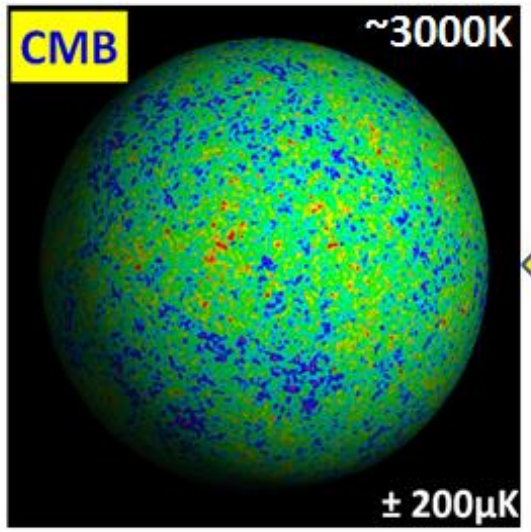
➔ **18th December**

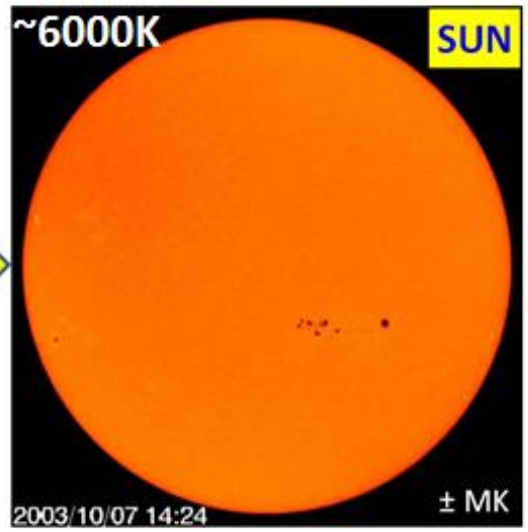
UNIVERSE

SUN

~10^5 years

~10^9 years





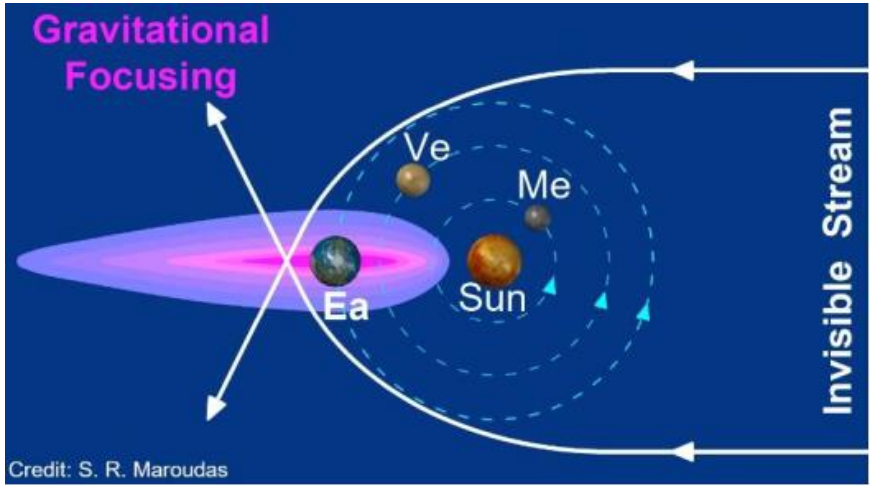
$\Delta T/T \sim 10^{-5}$

$\Delta T/T \sim 10^{+3}$

Gravitational (self)-focusing

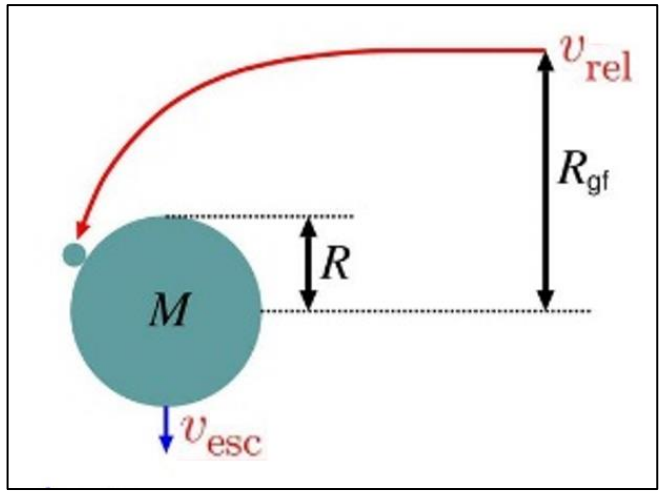
Sun => Cosmic Telescope **+** amplifier

Gravit. focusing: Sun + planets



+

Gravit. (self)-focusing



$$\Delta\Phi = \frac{4MG}{bc^2}$$

b =impact factor
C = velocity

$$\sigma_{trap} = \pi R^2 \left(1 + \frac{v_{esc}^2}{v_{rel}^2}\right)$$

SUN: v_{esc}=612 km/s

In collaboration with **Adrien Leleu** / Bern :

2 peaks ~180° apart!

https://iopscience.iop.org/article/10.1088/1475-7516/2019/06/014/pdf

Evidence for a New Component of HE Solar γ-Ray Production

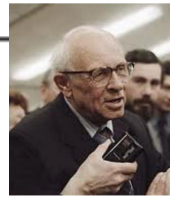
Fermi-LAT
2008-2017

The observed multi-GeV γ-ray emission from the solar disk—sourced by hadronic cosmic rays interacting with gas and affected by complex magnetic fields—is **not understood** ... **Most strikingly**, although six γ rays above 100 GeV were observed during the 1.4 yr of solar minimum, none were observed during the next 7.8 yr. These features, along with a 30–50 GeV dip … were **not anticipated by theory**.

To understand the underlying physics, Fermi-LAT +HAWC obs's of the imminent … solar Minimum are crucial .

Our work:

>>> search for planetary dependence!



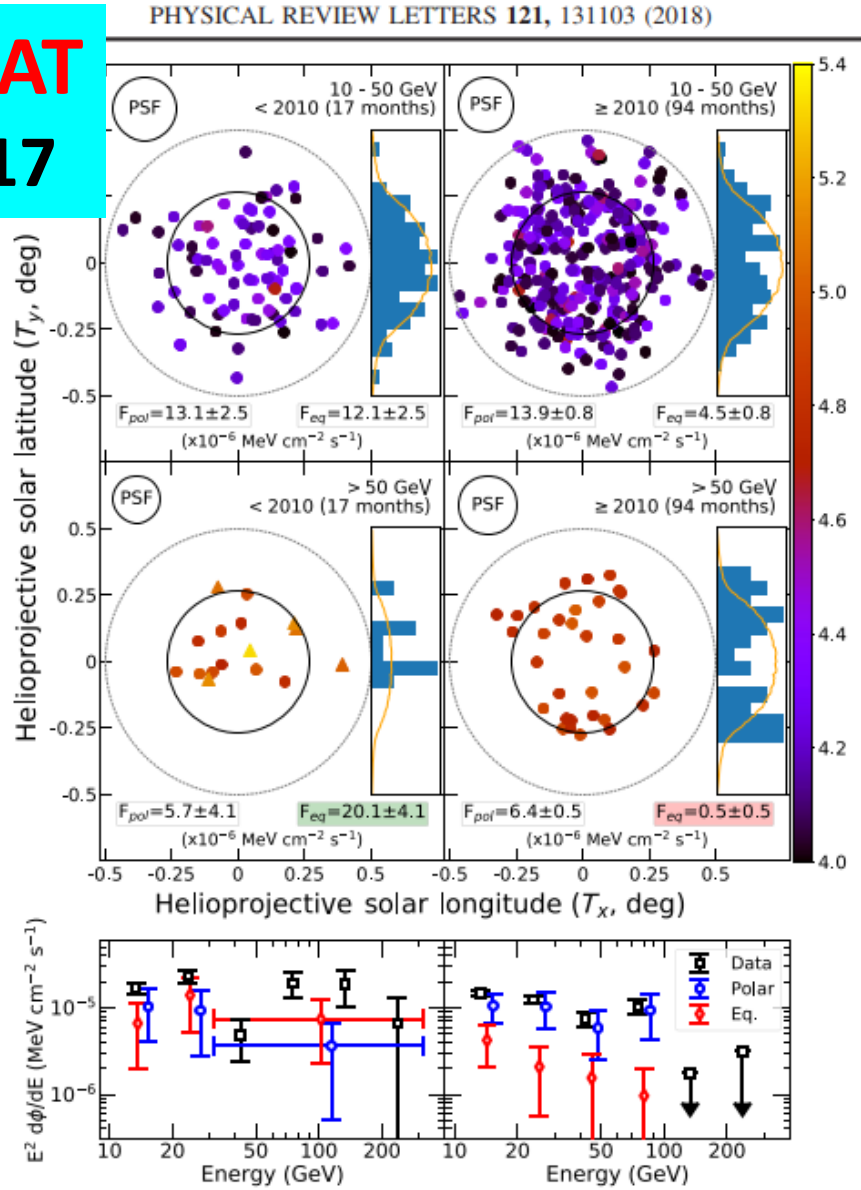


FIG. 2. (Top panel) The location and energy of solar γ rays in helioprojective coordinates. Data are cut into two temporal and two energy bins. The solid disk indicates the solar circle, and the dashed circle indicates the 0.5° ROI. The average 68% containment region of γ rays in each bin is depicted at the top left. The histogram depicts the T_y positions of photons compared to the expectation from isotropic solar emission smeared by the PSF (orange line). Events > 100 GeV are marked with triangles rather than circles. We stress that the exposure after solar minimum significantly exceeds the exposure during solar minimum. Thus, the observed number of counts does not indicate the relative flux. In each bin, we report the flux from the modeled polar and equatorial components, as described in the text. (Bottom panel) The energy spectrum of polar and equatorial emission, divided into regions during (left) and after (right) solar minimum. The polar emission is approximately constant, while the equatorial emission decreases drastically after solar minimum.

T. Linden, B Zhou, JF Beacom, AHG Peter, KCY Ng, Q-W Tang, Phys. Rev. Lett. 121 (**25th Sept 2018**) 131103
https://doi.org/10.1103/PhysRevLett.121.131103

Wolf, 1859: *solar dynamics is partially driven by **planetary tides**.*
a plausible physical mechanism has not been discovered yet…
the planetary tidal forces are too small to modulate solar activity..
although more complex mechanisms can not be excluded.

N. Scafetta, J. Atm. & Sol.-Terr. Phys. 81–82(**2012**)27

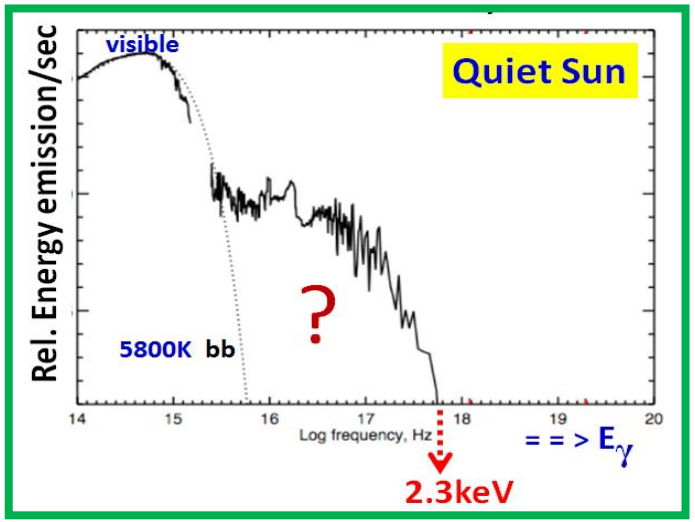
Critical Analysis .. of the Planetary Tidal Influence on Solar Activity
We found … ***artefacts*** caused by the calculation algorithm …
We conclude: the considered hypothesis [A.&A. 548(**2012**) A88]
is not based on a solid ground. S. Poluianov, I. Usoskin, Sol. Phys. 289 (**2014**) 2333

Solar Corona 1939- >>> observational mystery.

Sun's upper atmosphere much hotter than its surface => why?

- *" a major open issue in astrophysics"* **2015**
- *"one of the fundamental outstanding problems in solar physics"* **2015**
- ***"for 77 years…one of the outstanding unsolved problems in astrophysics"*** **2015**

[http://arxiv.org/abs/1502.07401 ; http://arxiv.org/abs/1508.05354; DOI: 10.1098/rsta.2014.0269]



*The striking **EUV excess** of the quiet Sun is the manifestation of the **solar corona problem**.*

H.S. Hudson

Zur Frage der Deutung der Linien im Spektrum der Sonnenkorona.

nachdem schließlich die Anzeichen dafür sich mehr und mehr verdichten, daß in den äußeren Zonen der Sonnenatmosphäre Bedingungen für die Anregung von Spektrallinien vorliegen, die weit über das hinausgehen, was bei thermischem Gleichgewicht zu erwarten wäre, scheint es nicht mehr völlig abwegig, die Frage zu diskutieren, ob die Koronalinien als verbotene Linien hochionisierter Atome zu deuten sind.

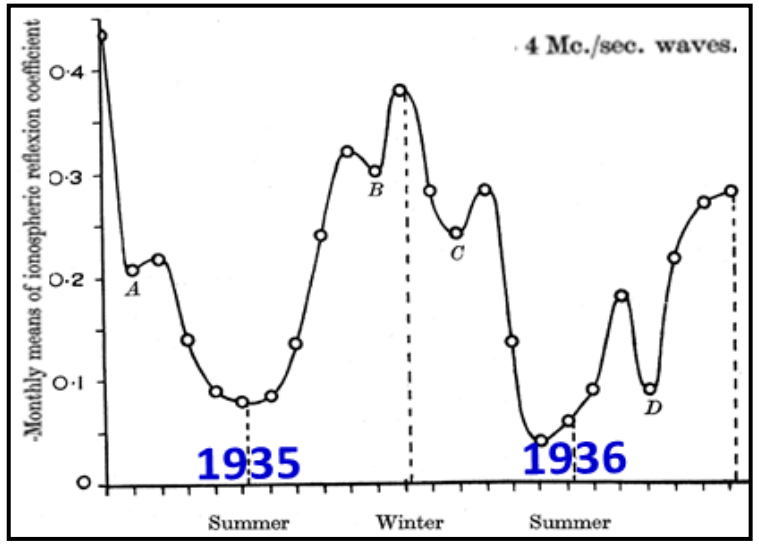
16. März 1939 W. GROTIAN.

http://dx.doi.org/doi:10.1007/BF01488890

Earth's Atmosphere 1937

- *…peak electron density around December*
  is greater than around June ≠ expectation
  a long-standing unexplained annual anomaly
- **"the writers are inclined to the view that the cause is associated with the Earth or its motion…" 1938**
  doi:10.1029/TE043i001p00015
- .. there is a global **annual anomaly.**

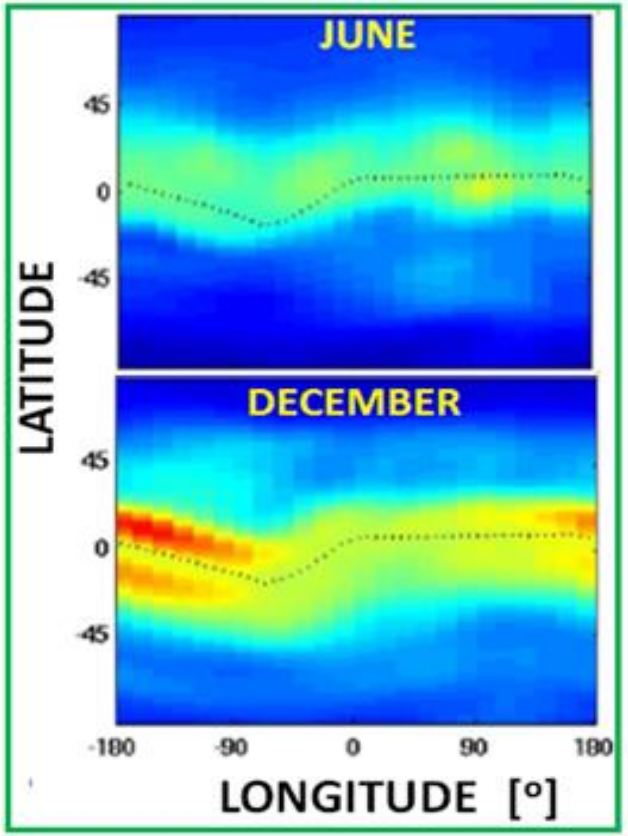
J. Lean *et al.*, J.G.R. 116 (**2011**) A10318, doi:10.1029/2011JA016567

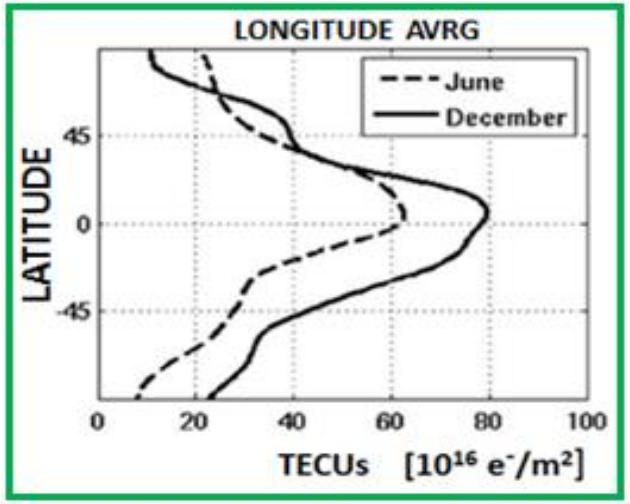


Proc. Roy. Soc. London A162 (**1937**) 451

Total **E**lectron **C**ontent

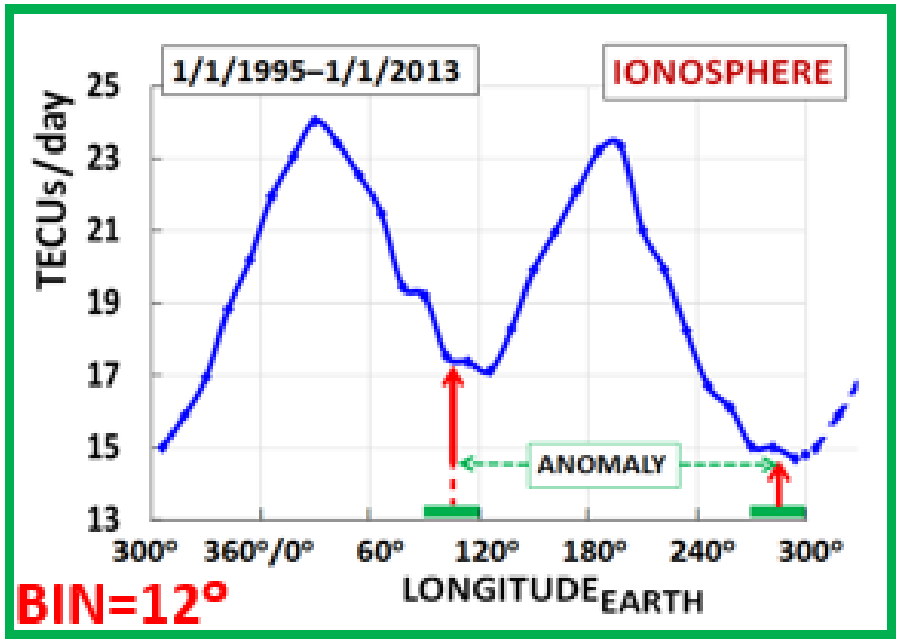
Dec	**June**
2.87	2.12 [10^{32}e$^-$s]



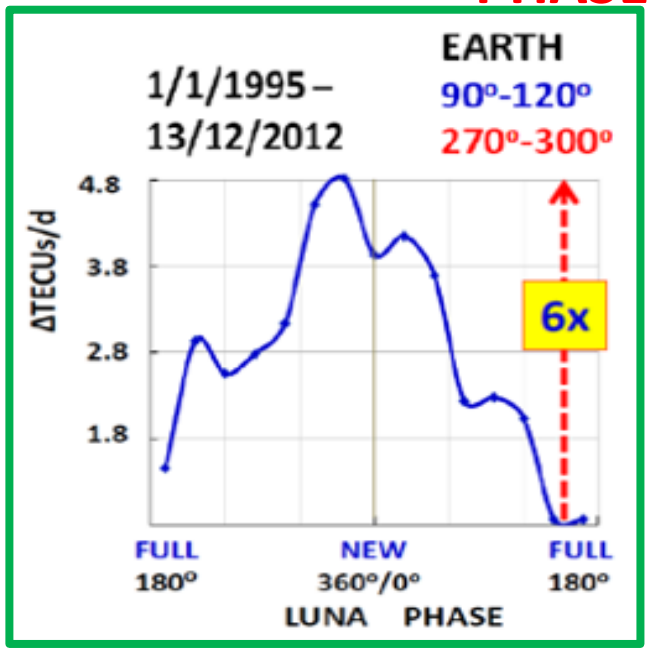


J. Atm. Sol.-Terr. Phys. 67 (**2005**) 1377

EARTH



EARTH ⊗ MOON PHASE



Stream(s) from G.C. mega-Black Hole?

Longitude ≈ **266°** + TOF (Earth => Sun)

➔ **18th December**

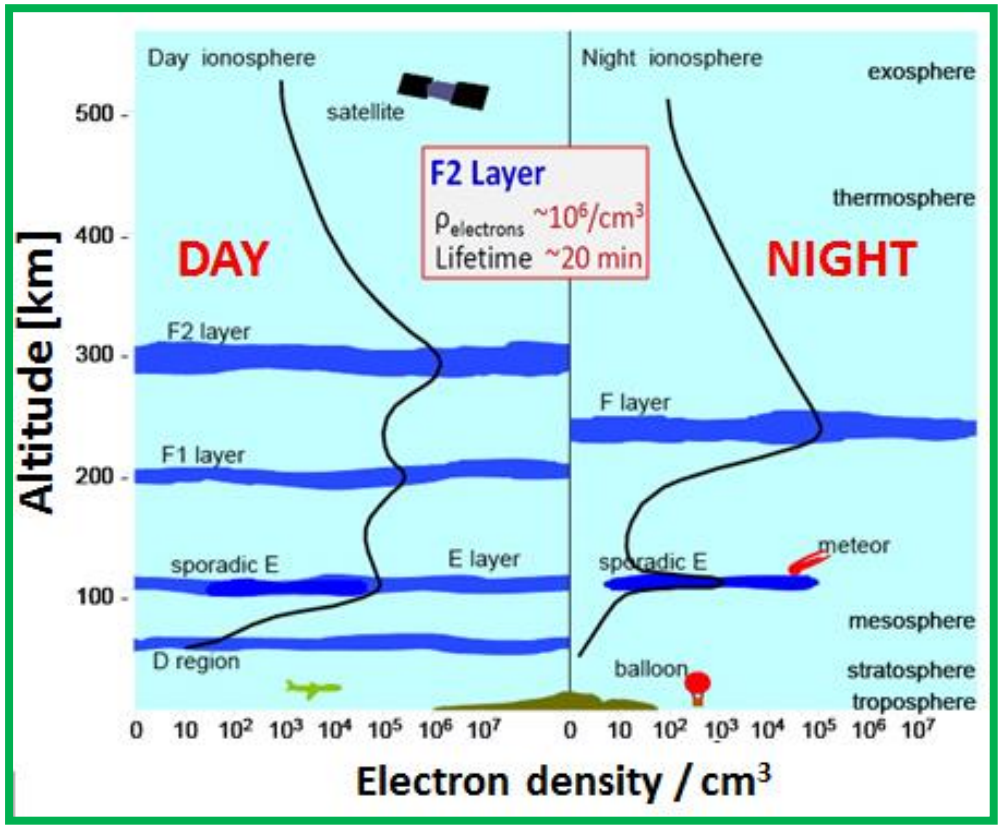
Longitude ≈ **85°** + TOF (Moon => Earth)

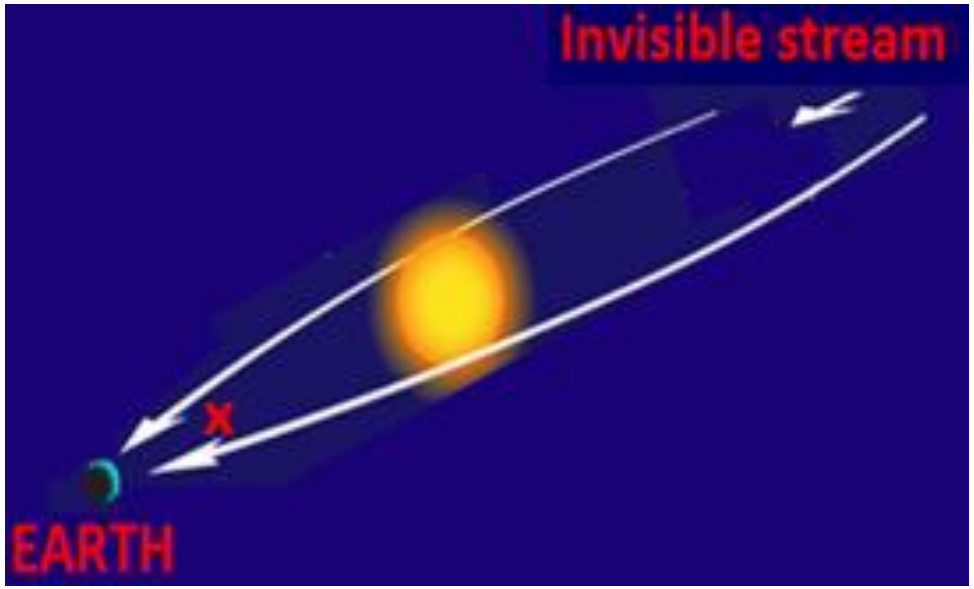
➔ **17th June, ..?..**

EARTH's IONOSPHERE

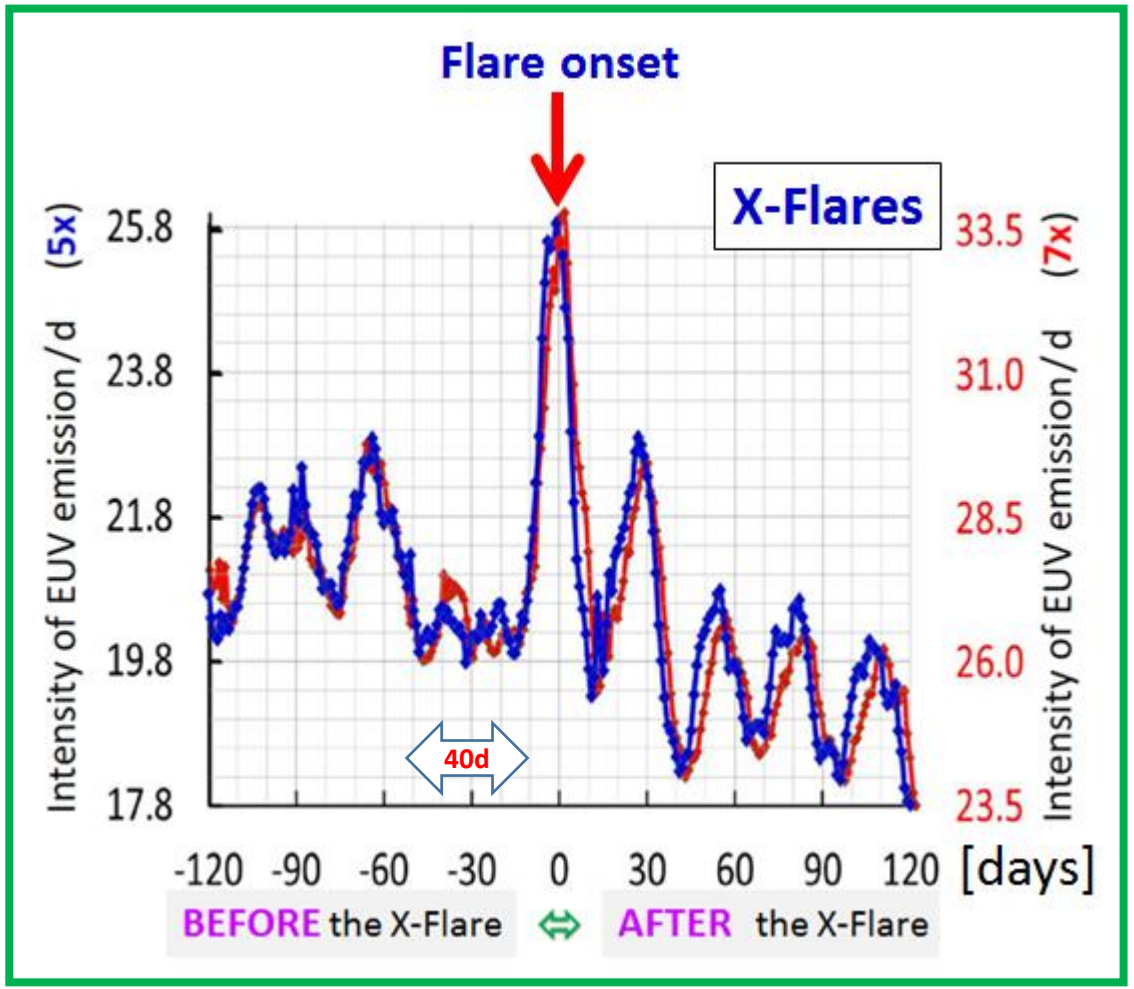
Anomalies lasting for some decades

>>> First obs' 1937/1938

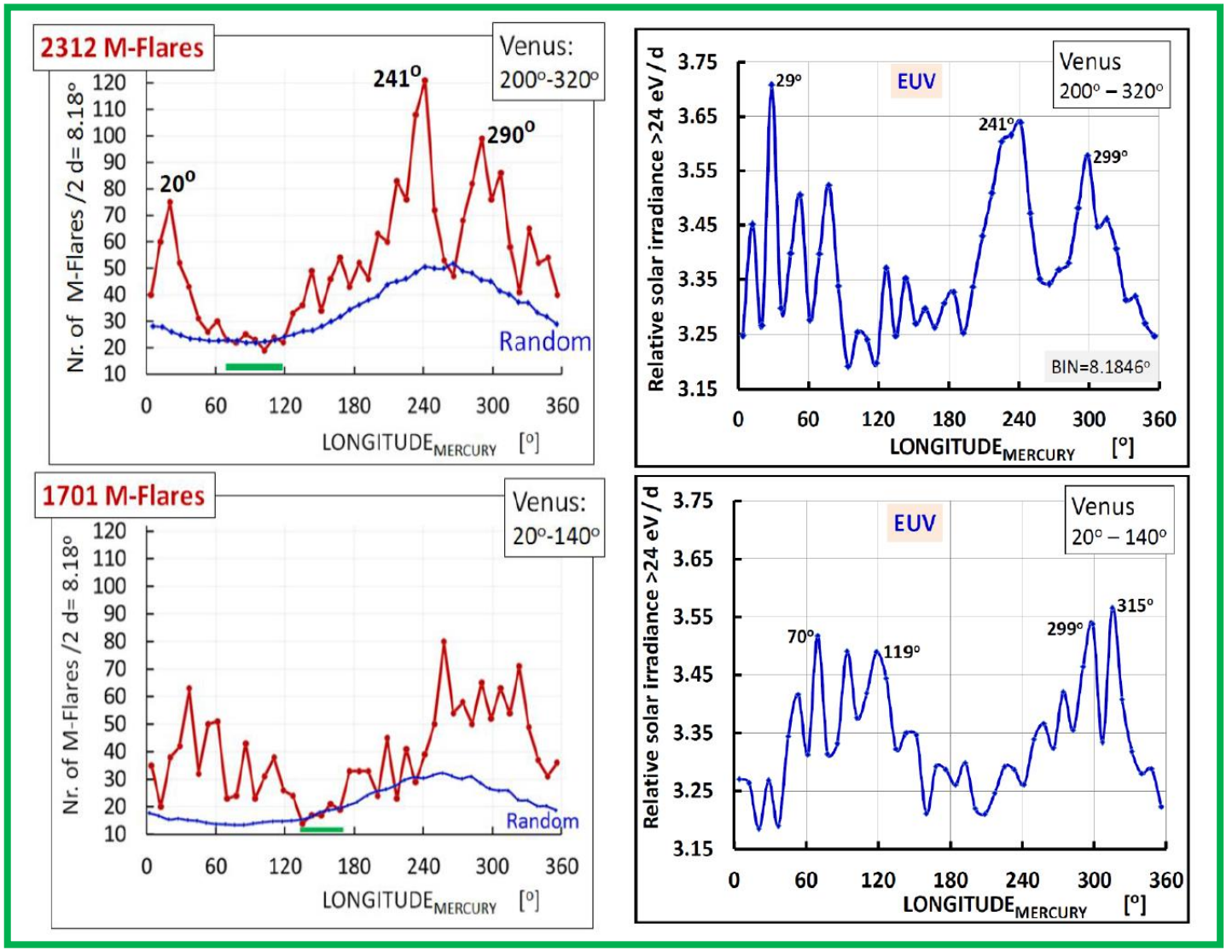




EUV
⊗
X-Flares



12%

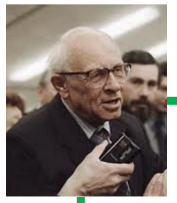


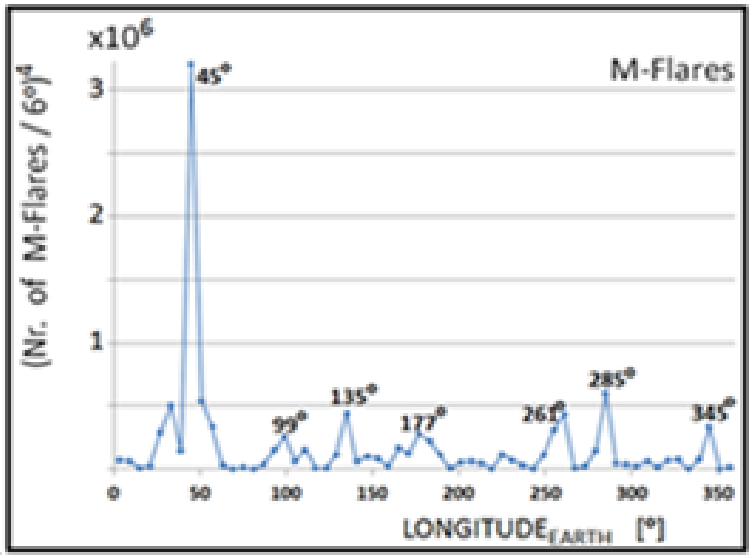
MERCURY

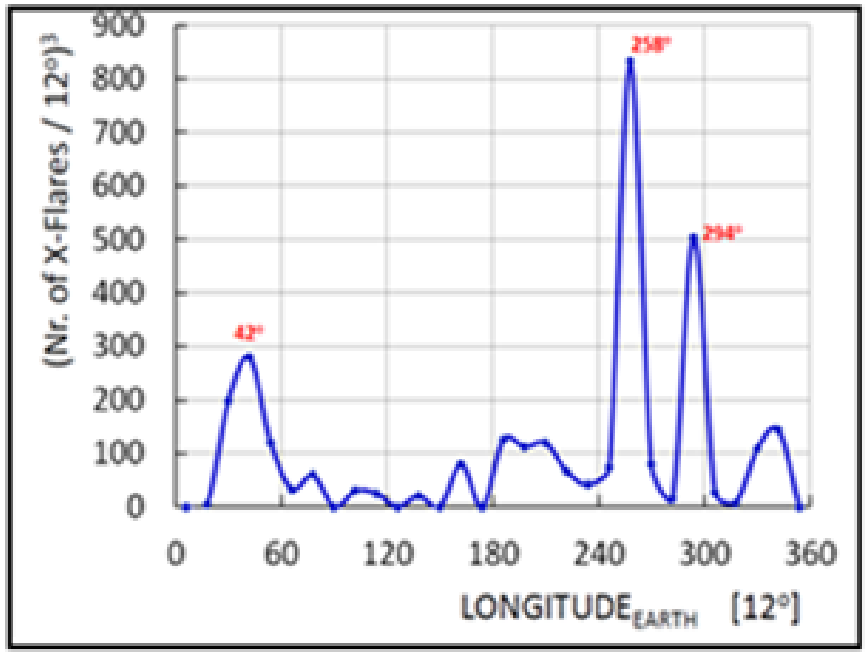
⊗

VENUS

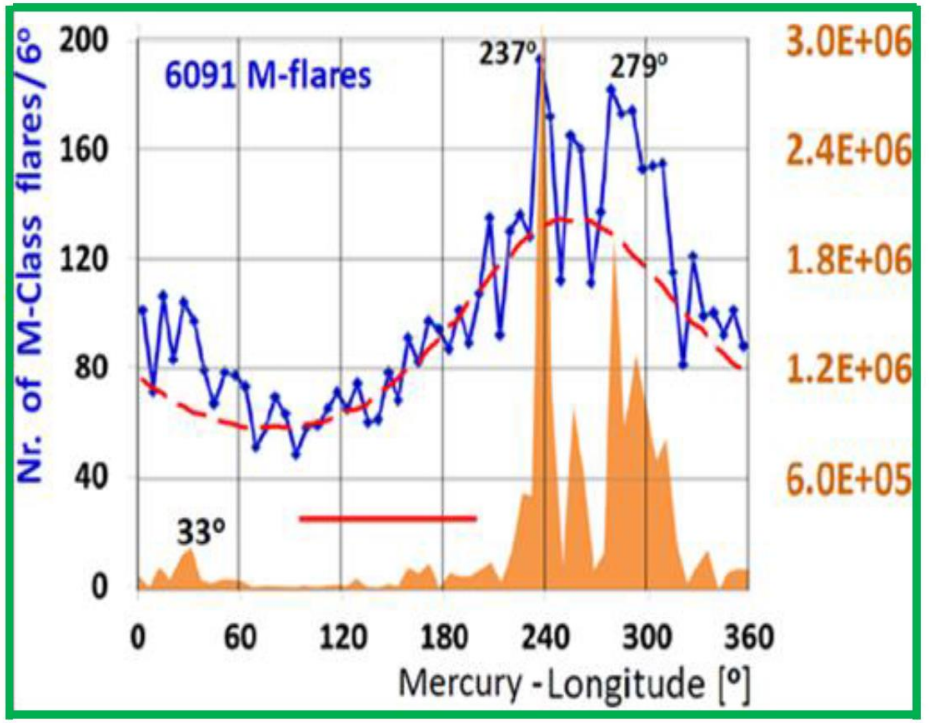
FLARES/EUV

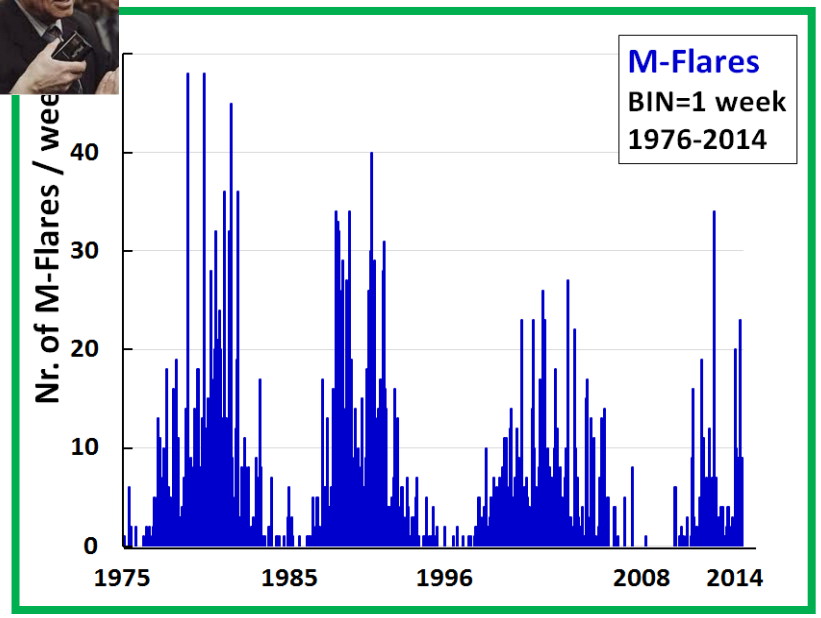


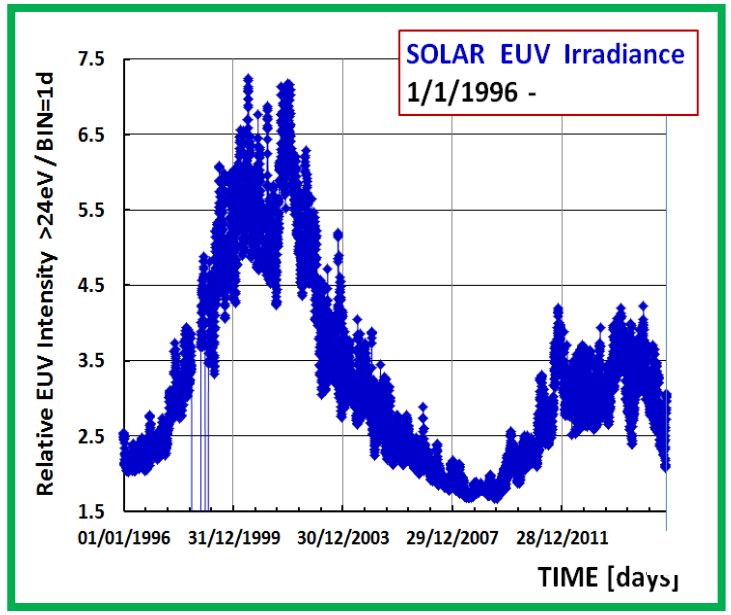

x10^6
M-Flares
(Nr. of M-Flares / 6°)^4
45°
99°
135°
177°
265°
285°
345°
LONGITUDE_EARTH [°]

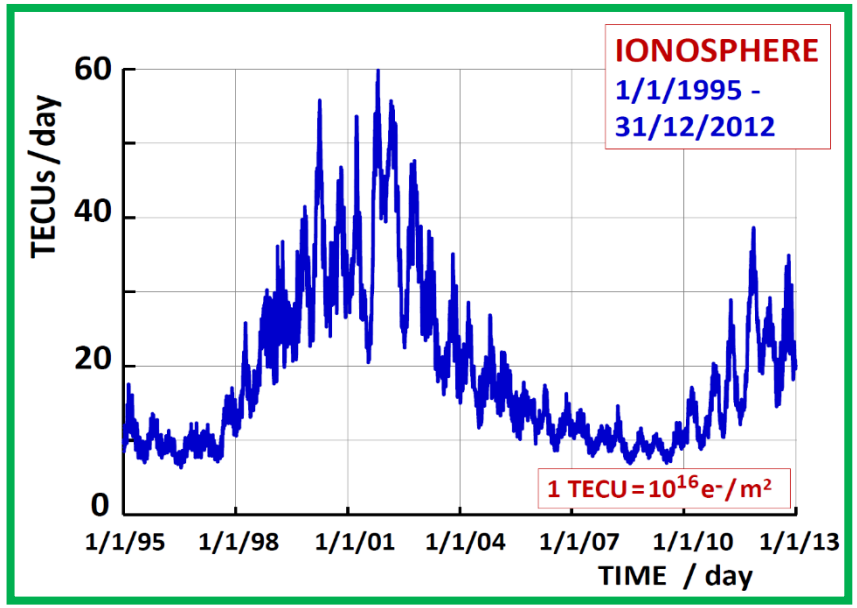

(Nr. of X-Flares / 12°)^3
42°
258°
294°
LONGITUDE_EARTH [12°]

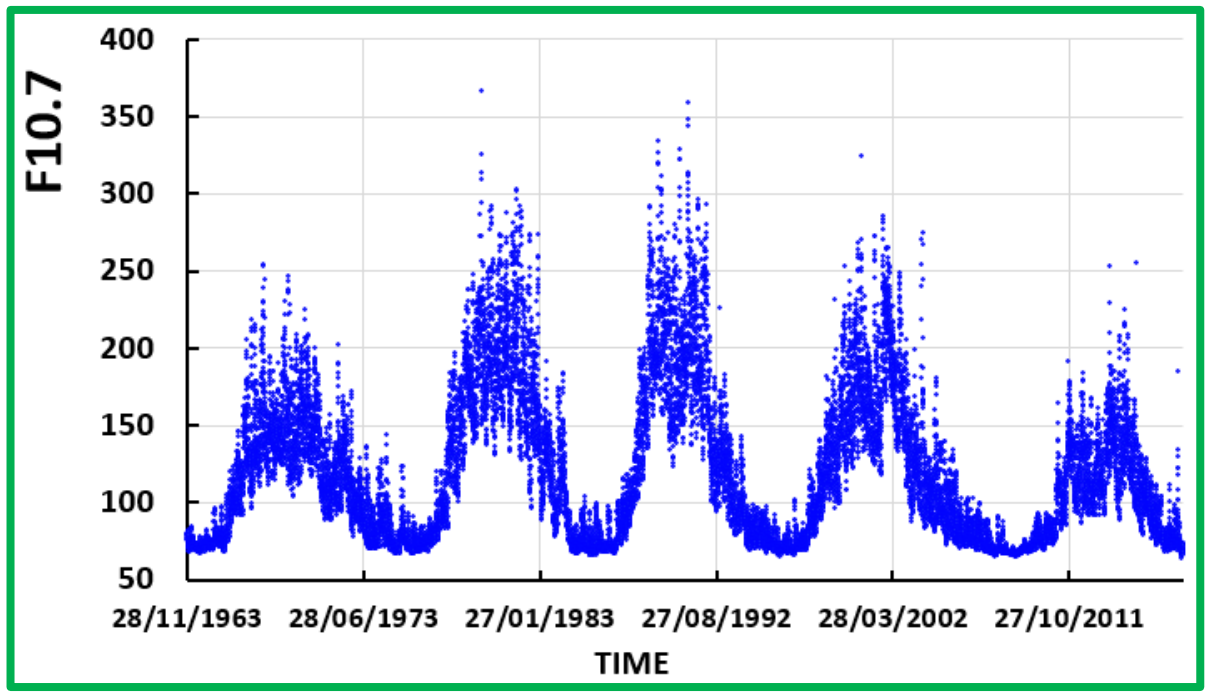
EARTH

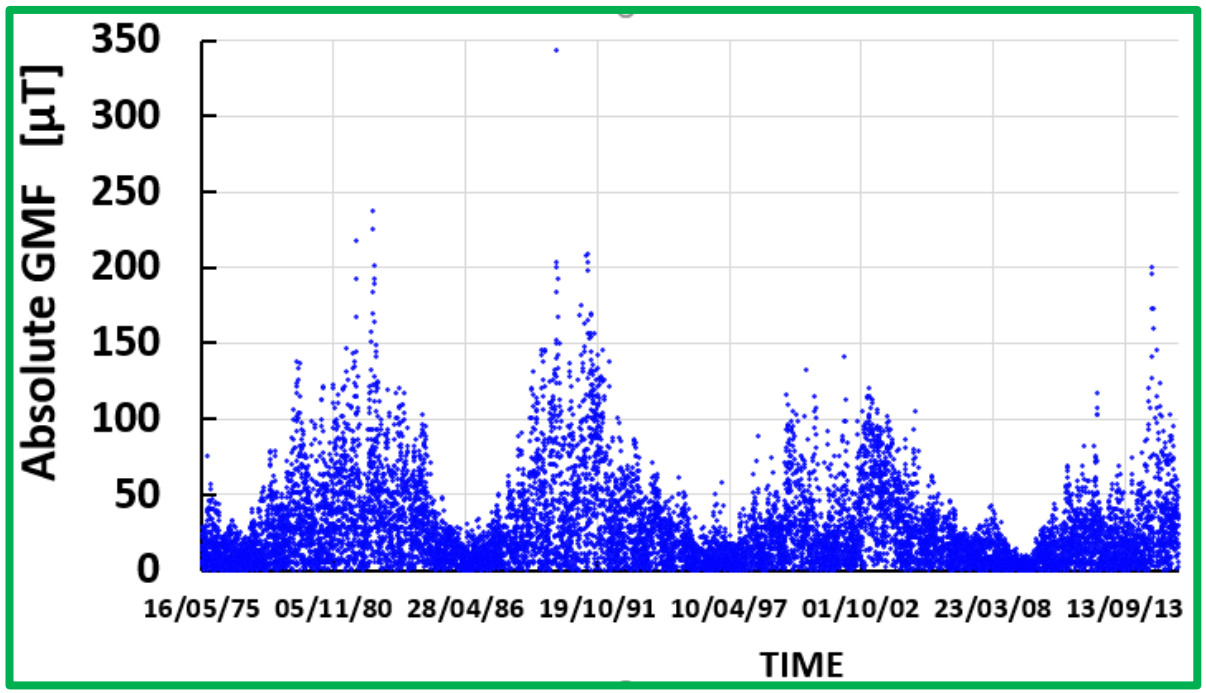

6091 M-flares
Nr. of M-Class flares / 6°
237°
279°
33°
Mercury - Longitude [°]


M-Flares
BIN=1 week
1976-2014
Nr. of M-Flares / wee
0
10
20
30
40
1975
1985
1996
2008
2014


SOLAR EUV Irradiance
1/1/1996 -
Relative EUV Intensity >24eV / BIN=1d
1.5
2.5
3.5
4.5
5.5
6.5
7.5
01/01/1996
31/12/1999
30/12/2003
29/12/2007
28/12/2011
TIME [days]


IONOSPHERE
1/1/1995 -
31/12/2012
TECUs / day
0
20
40
60
1 TECU = 10^16 e^- / m^2
1/1/95
1/1/98
1/1/01
1/1/04
1/1/07
1/1/10
1/1/13
TIME / day


F10.7
50
100
150
200
250
300
350
400
28/11/1963
28/06/1973
27/01/1983
27/08/1992
28/03/2002
27/10/2011
TIME


Absolute GMF [μT]
0
50
100
150
200
250
300
350
16/05/75
05/11/80
28/04/86
19/10/91
10/04/97
01/10/02
23/03/08
13/09/13
TIME