# The Ionosphere: the outermost anomalous layer of the atmosphere.

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( zioutas@cern.ch )

**Edward V. Appleton**
**NOBEL in physics 1947**

**Thanks to Maxim Khlopov**, for 2 reasons:

**1) for the invitation!**

**2)** Zioutas,Tsagri,Semertzidis,Hoffmann,Papaevangelou, Anastassopoulos,The 11 years solar cycle as the manifestation of the dark Universe. *Mod. Phys. Lett.* **2014**, *A29*, 1440008. [Google Scholar] [CrossRef] [Green Version]

Zoom connection: https://cern.zoom.us/j/4420940189?pwd=LzVjQlYra0NQVVFqb3d6czRKYW1Ydz09

Meeting ID 442 094 0189 pass code (if required) 628661

**14th March 2024 , 17:00h CET**

**Abstract:**

The ionosphere is being studied since the 1930s. Its dynamical behavior shows unexpected annual variation dubbed by atmospheric physicists as anomalous. In addition, the GPS system needs to measure continuously its plasma properties for self-calibration purposes. Its total electron content (TEC) shows also unexpected planetary dependencies, which makes temporally its anomalous behavior more of a riddle. Also, an underlying stratosphere layer around a height of (40±5) km shows annually anomalous temperature excursions with unexpected planetary dependency. Of note, no correlation is found yet between the layer's heating up at ~40 km and the ionosphere (~100 to 1000 km height). Both anomalous layers might hide overlooked new physics.

A common viable explanation for planetary dependent observations is based on streams from the dark sector, which undergo gravitational lensing between solar system objects including the Moon towards the Earth. This, because of the $1/(\text{speed})^2$ dependence of the gravitational focal region.

After more than 110 years the Earth's atmosphere has the potential to become a detector also for cosmic radiation from the dark sector using parasitically widespread networks of communication satellites in space but also climate related measurements. This would be a welcomed spin-off, and *vice versa*, hopefully. More cross-disciplinary observations will also be mentioned. Recently, relationships have been established between the global ionosphere's plasma density and appearance of earthquakes. One society relevant implication of the Ionosphere is as a month-long precursor of earthquakes of magnitude above 8.

## Related REFERENCES:


[**1**] https://doi.org/10.1016/0370-2693(91)90330-S , On the possibility of Bose-star formation
[**2**] https://arxiv.org/abs/0711.1105 , The fine-grained phase-space structure of CDM halos.
[**3**] https://arxiv.org/abs/0812.0362 , Phase-space structure in the local dark matter distribution and its signature in direct detection experiments
[**4**] https://arxiv.org/abs/0906.4341 , Caustics in growing Cold Dark Matter Haloes.
[**5**] https://arxiv.org/abs/1002.3162 , Streams and caustics: the fine-grained structure of ΛCDM haloes

[**6**] https://doi.org/10.1016/S0927-6505(03)00138-5, Gravitational lensing by the Sun of non-relativistic penetrating particles.
[**7**] https://arxiv.org/abs/1305.2454 , Flux Enhancement of Slow-moving Particles by Sun or Jupiter: Can they be Detected on Earth?
[**8**] **https://arxiv.org/abs/1309.4021 , The 11-years solar cycle as the manifestation of the dark Universe**.
[**9**] https://arxiv.org/abs/1507.07009 , Dense Dark Matter Hairs Spreading Out from Earth, Jupiter and Other Compact Bodies.
[**10**] https://arxiv.org/abs/1602.03666 , The Sun and its Planets as detectors for invisible matter.
[**11**] https://arxiv.org/abs/1809.02555 , Planetary dependence of melanoma.
[**12**] https://doi.org/10.1142/S1793048020500083 , Observation of a 27 Days Periodicity in Melanoma Diagnosis.
[**13**] https://arxiv.org/abs/2004.11006 , Stratospheric temperature anomalies as imprints from the dark Universe.
[**14**] https://arxiv.org/abs/2005.08252 , Gravitational Focusing of Low-Velocity Dark Matter on the Earth's Surface.
[**15**] https://arxiv.org/abs/2012.03353 , On the Direct Detection of Dark Matter in the Stratosphere.
[**16**] https://arxiv.org/abs/2108.11647 , The dark Universe is not invisible.
[**17**] https://arxiv.org/abs/2106.15408 , Gaia, Fundamental Physics, and Dark Matter.
[**18**] Marios Maroudas, PhD thesis, 2022 University of Patras /Greece.

## Sun's & Earth's dynamical behaviour

=> a multiple mystery: e.g. corona heating & its T – inversion 1939 – , 11 years cycle, sunspots, flares, EUV, solar radius variation, … F10.7 radio line (=**solar proxy**), upper atmosphere

- so far: every solar-terrestrial observable showed planetary dependence

***?Best choice?***

- **Frank Wilczek** (CERN seminar):

**"~focus on anomalies / mysteries"**

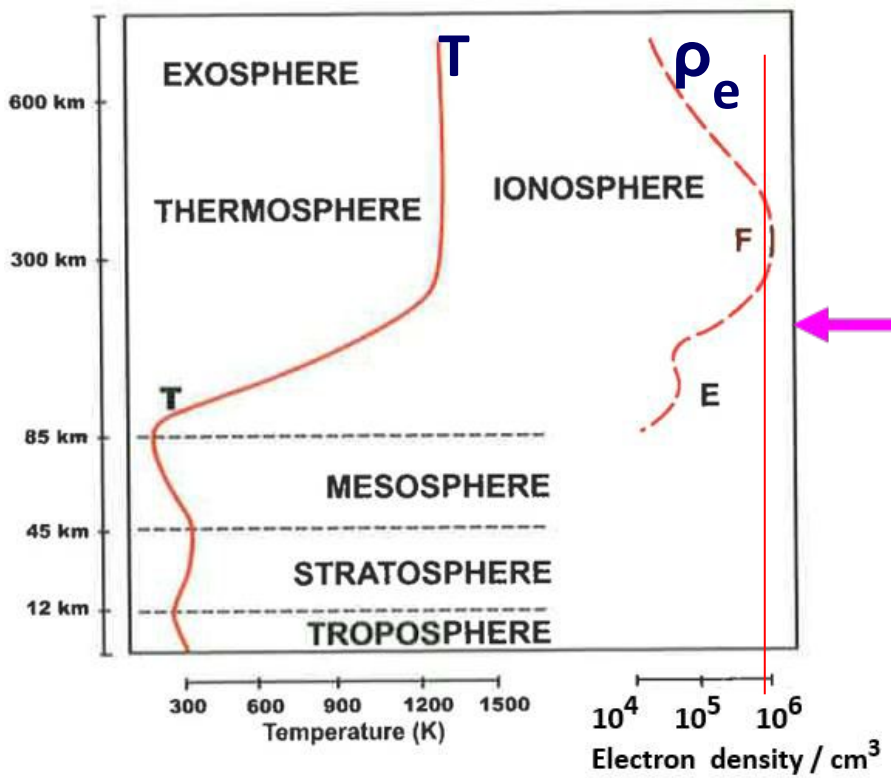
**Search for...**

**Local anomalies / mysteries**
showing planetary relationship

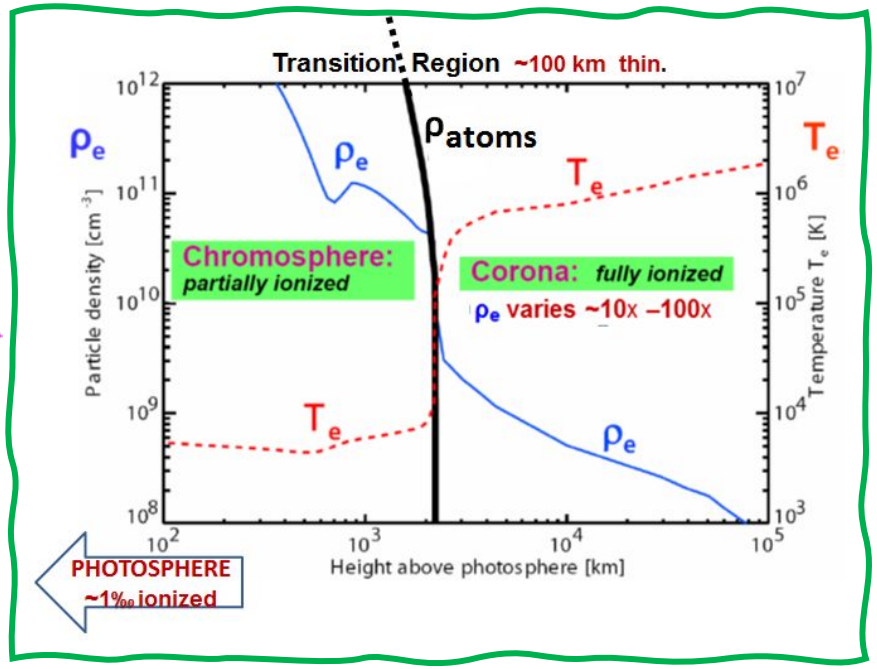
**Rule of thumb:**

An 11years rhythm ⊗ planetary dependence, IF within the solar system the underlying cause is (partly) in form of streams.

## Earth's Atmosphere

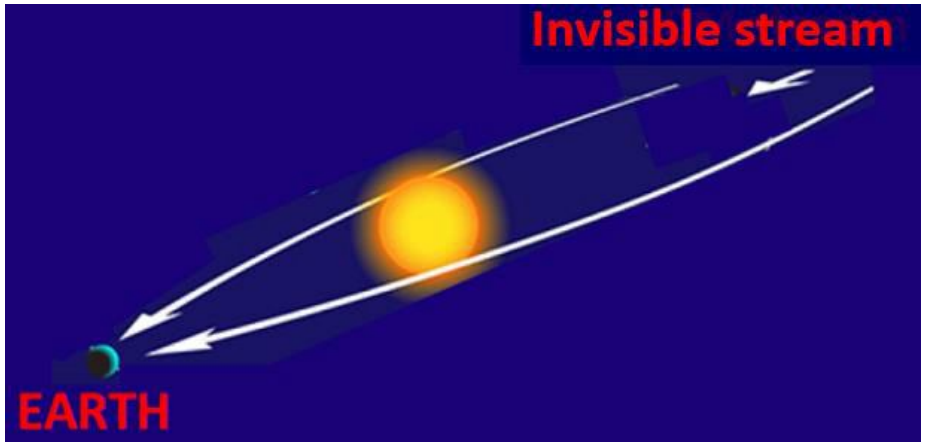



## Chromosphere ⇔ Corona




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

**2017**

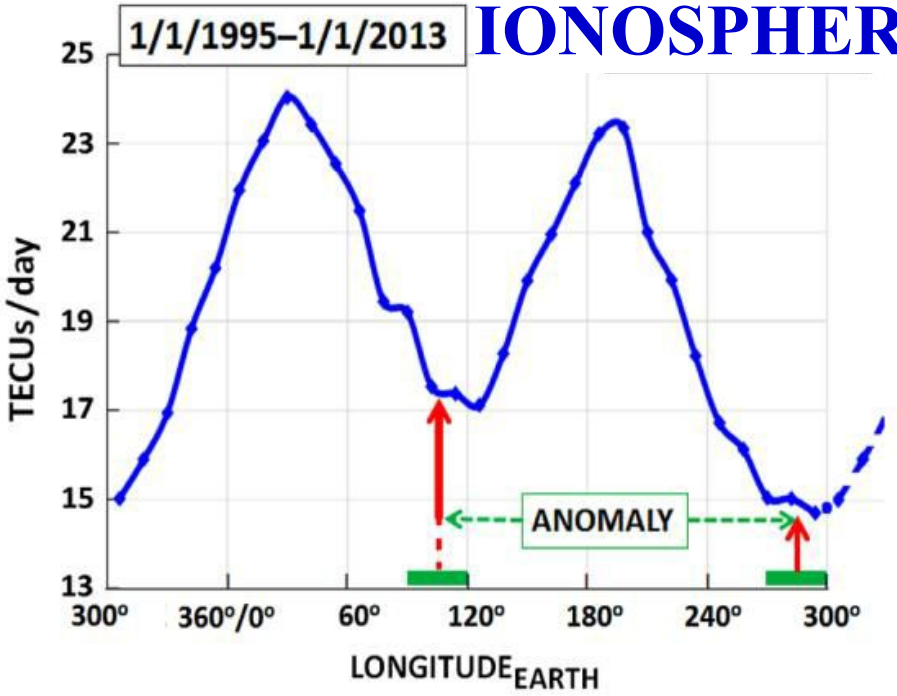


…… the heating of the solar atmosphere – one of the long-standing and most intensely studied questions in solar physics.

# Febr 2024

>submitted to a Journal I was asked to be referee>>I did not accept

# 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

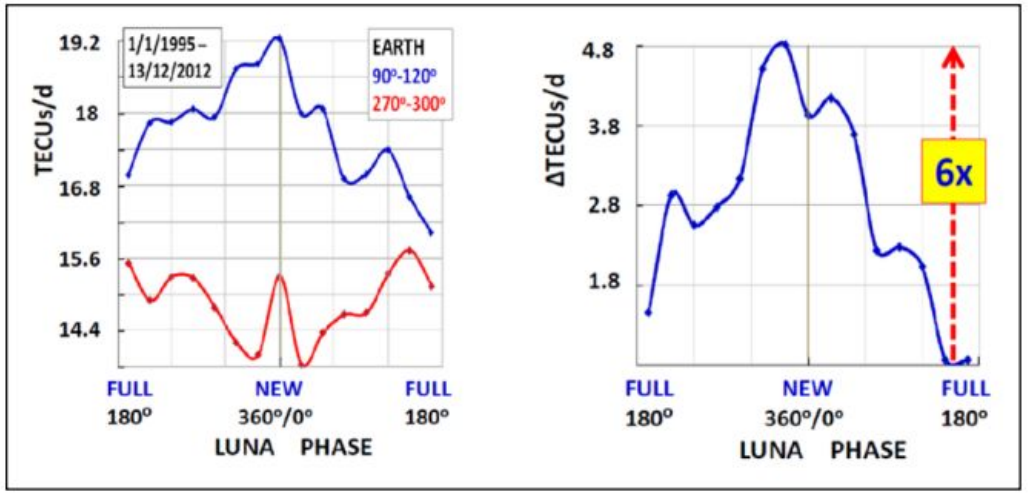


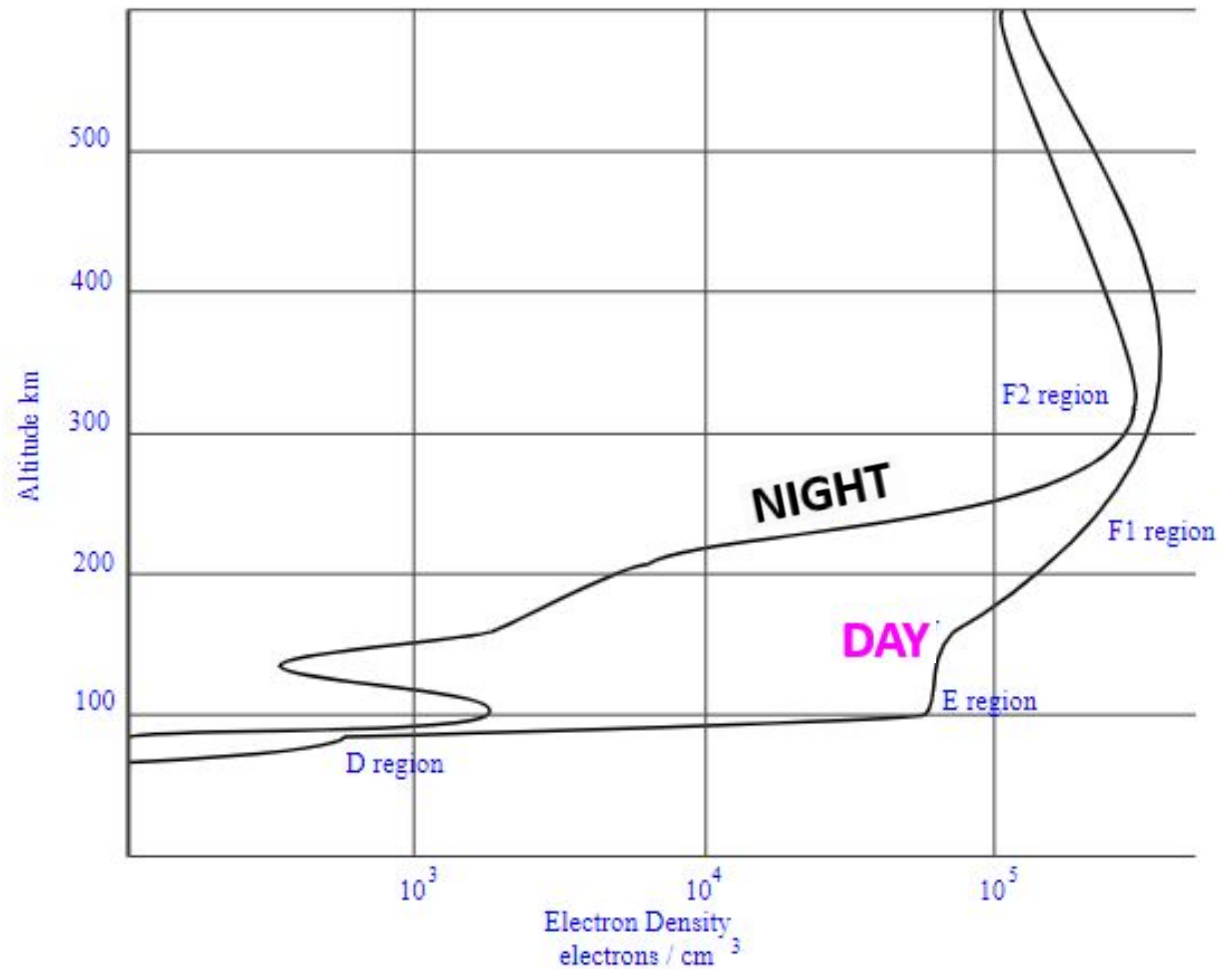

**Figure 14.** TECUs as a function of the **Moon Phase**, while the Earth is in one of the two 30° orbital segments around the solstices (*left*) and the difference between the winter-summer solstices (*right*) (see Figure 12).

**LUNA PHASE**

**ΔTECU**s: 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

**18th Dec.: EARTH SUN G.C.**

**Moon as gravitational lens!**




The typical electron distribution in the ionosphere

**Relaxation time IONOSPHERE ~hours**

https://www.electronics-notes.com/articles/antennas-propagation/ionospheric/ionospheric-layers-regions-d-e-f1-f2.php

# Earth's Atmosphere1937

- *…peak electron density around December*

  *is greater than around June* ≠expectation

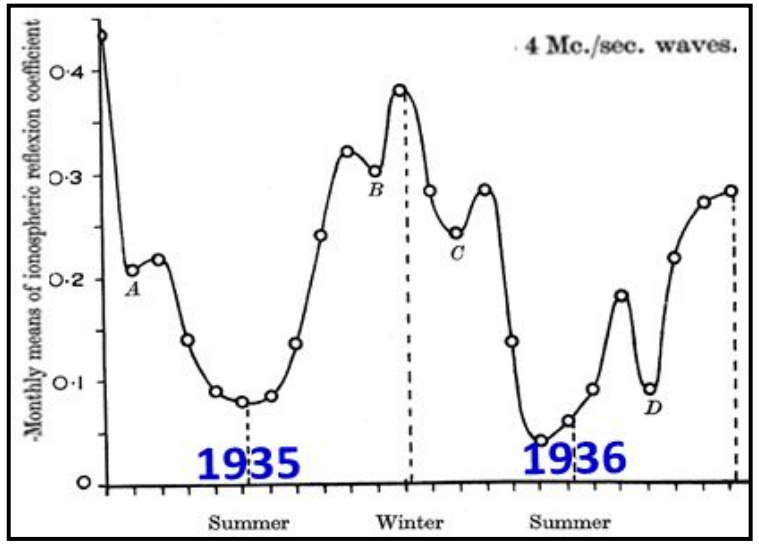
  ***a long-standing unexplained annual anomaly***

- **"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

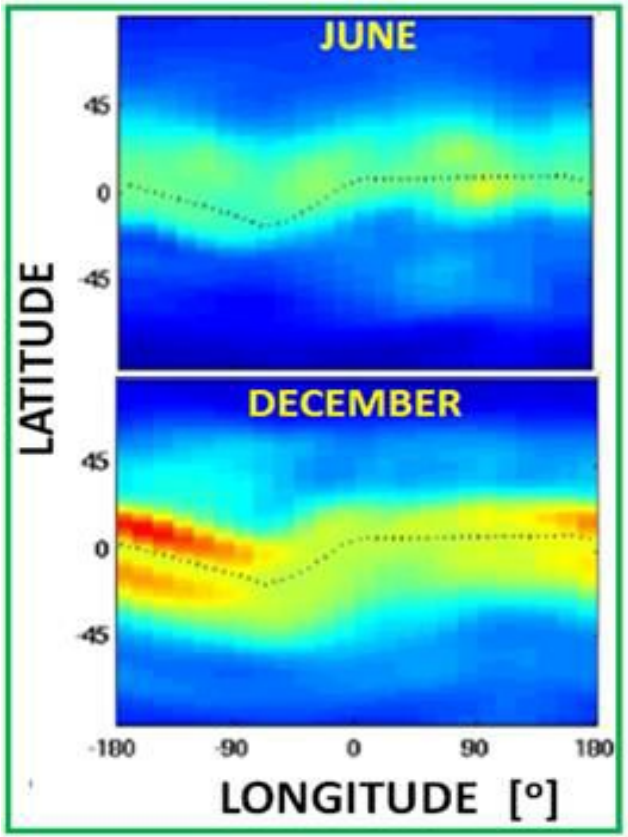


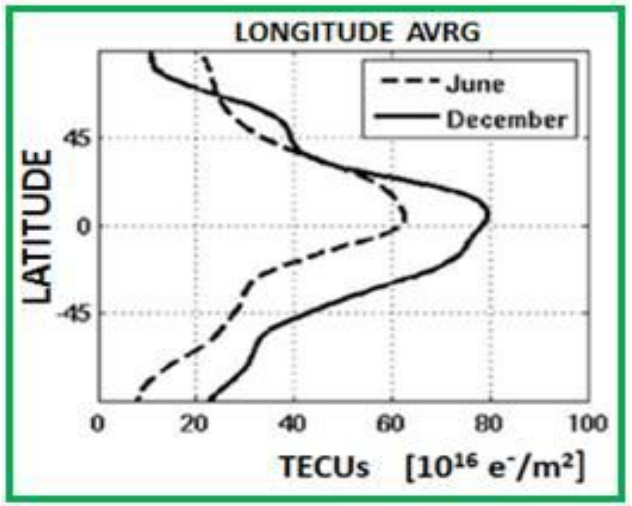

Proc. Roy. Soc. London A162 (**1937**) 451

**T**otal **E**lectron **C**ontent

**DecJune**

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




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

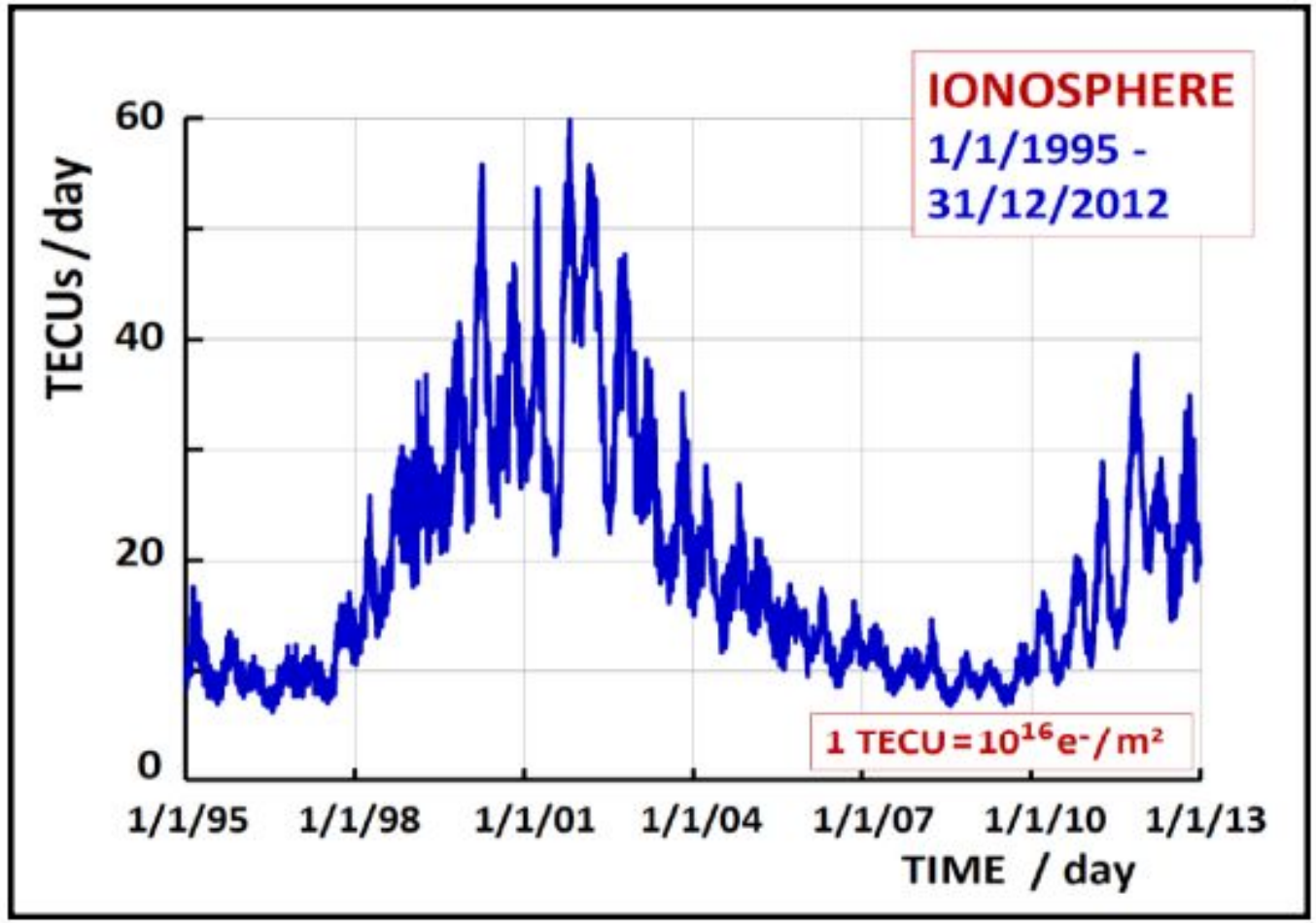
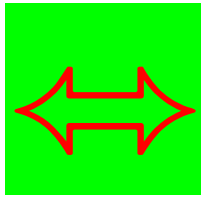



**Figure 11.** The time series of the measured total electron content (TEC) of the Earth's ionosphere averaged over one day during the 18 year period 1995 – 2012 [12]. During this period the Moon performed 223 geocentric orbits.

**Sun's UV ==> expected: NO planetary dependency!**

ATMOSPHERE$_{SUN}$ 

ATMOSPHERE$_{EARTH}$

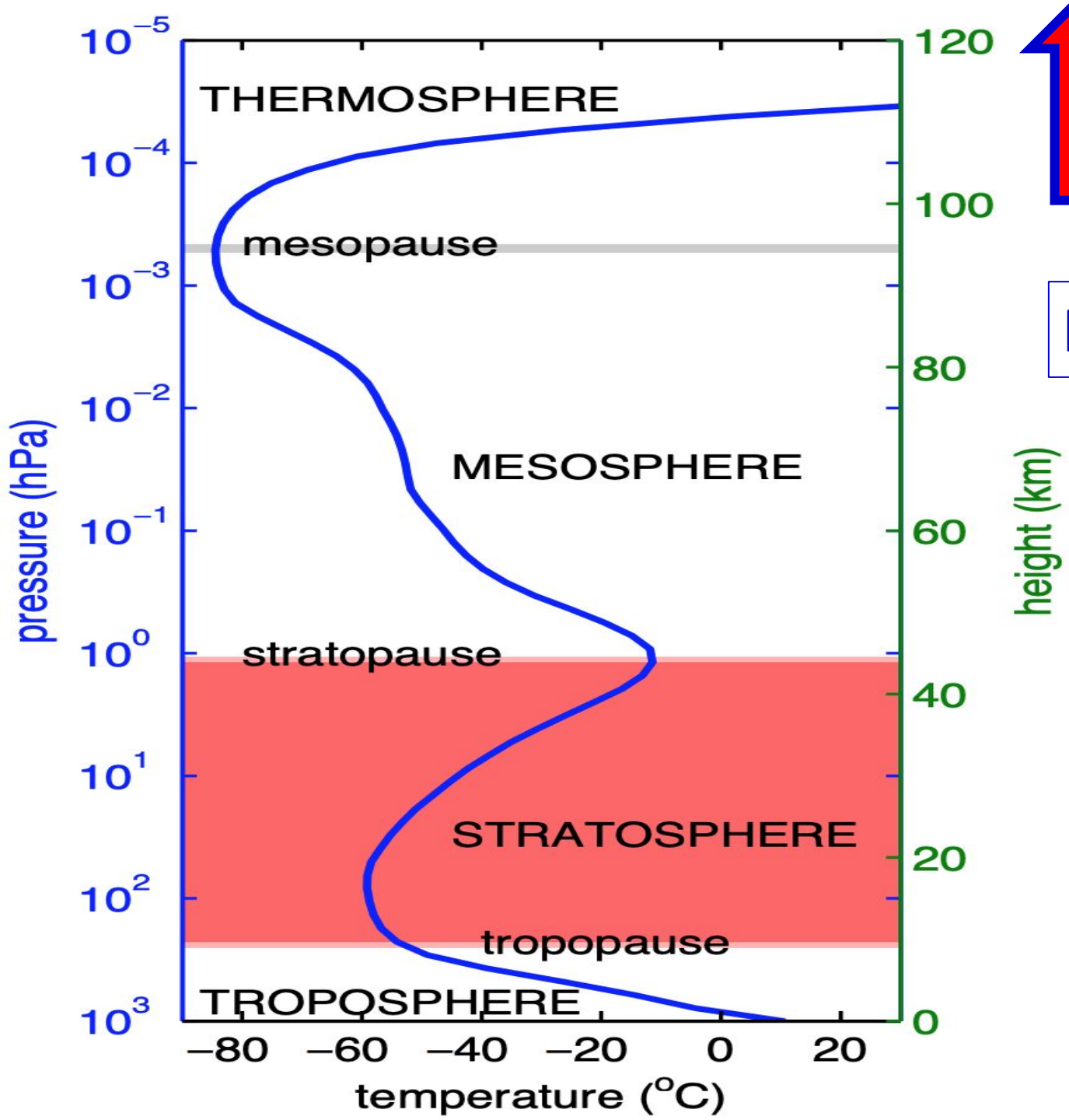
***Something common*!?**

**may be!**

**Ionosphere** annual anomaly **1937**-: planetary relationship [10]

- *Where atmosphere meets outer space.*

**=> ~$10^{12}$ electrons/cm$^2$ & ~ 100 µgram/cm$^2$**




~ 100 µgram/cm$^2$

**Ionosphere's column density**

11A

# 1st take away:

**A peaking dependence excludes the remote planetary / tidal force !**

+

**confirms this work**

+

**Planetary relationship ⇔ exo-solar origin**

# Planetary relationship as a key signature from the dark sector

Konstantin Zioutas[1], Giovanni Cantatore[2], Serkant Cetin[3], Antonios Gardikiotis[1], Eleni Georgiopoulou[1], Sebastian Hofmann, Marin Karuza[4], Abaz Kryemadhi[5], Marios Maroudas[1], Andreas Mastronikolis[6], Kaan Ozbozduman[7], Yannis K. Semertzidis[8], Ioannis Tsagris[1], Mary Tsagri[1]

https://www.qeios.com/read/0XHYID/pdf

**Planetary relationship ⇔ exo-solar origin**

**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

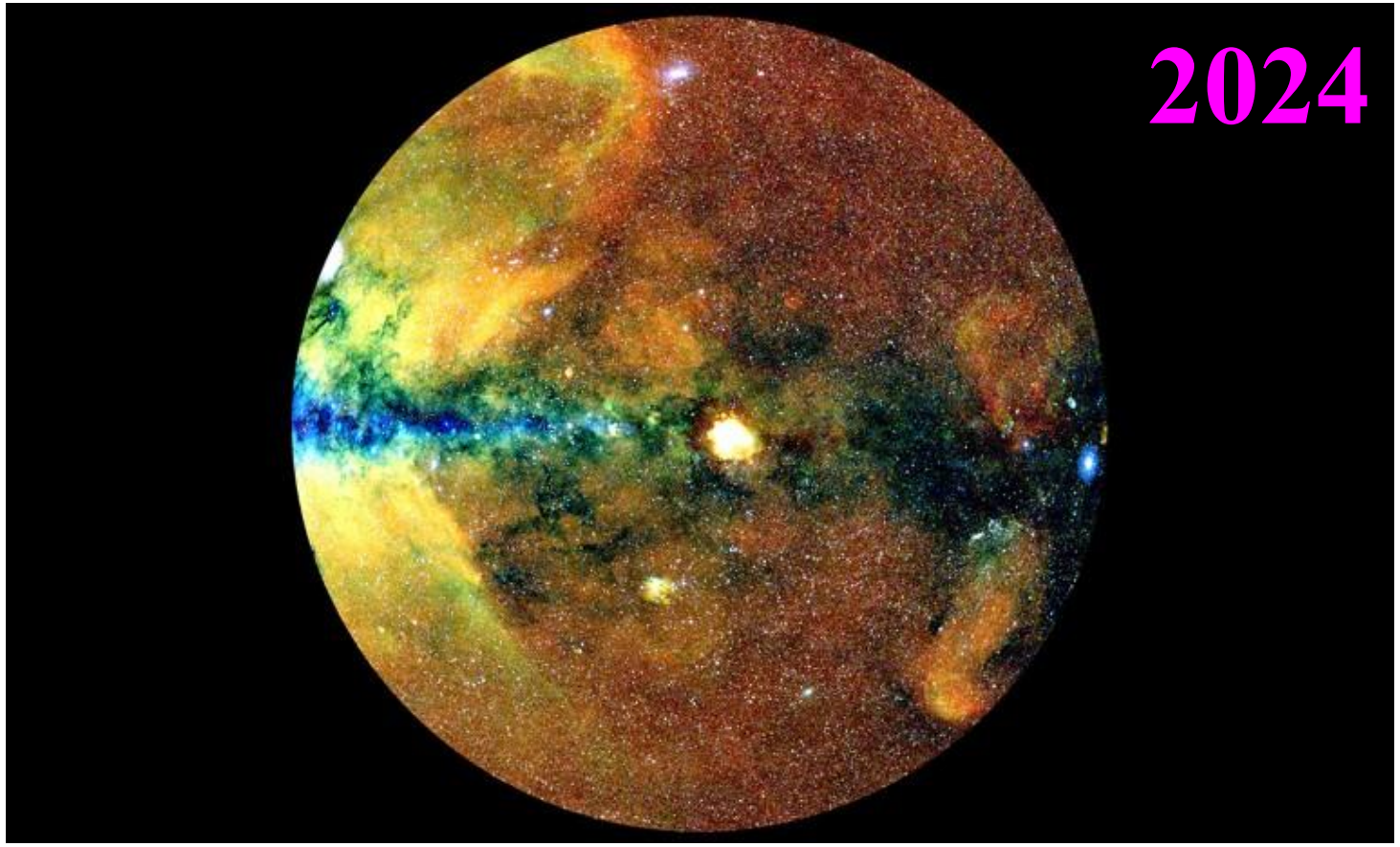
[A. Kryemadhi, M. Maroudas, A. Mastronikolis, K. Zioutas **(2022) Published PRD (2023)**

***Overlooked in DM research***

**G. Prezeau** [9]

! **Also: planetary grav. self-focusing: Streams □ "hairs"** !

**Flux enhancements : > $10^5$×**




In this **map of a celestial hemisphere** — compiled from data from the **eROSITA telescope** — the colours reflect the wavelengths of X-rays. Hot gas haloes surrounding galaxy clusters have broad-band emissions (white), as do black holes (white dots); diffuse emissions have long wavelengths (red); and in the central regions of the Milky Way, dust blocks longer-wavelength emissions, so that only short-wavelength X-rays are visible (blue or black). Multicoloured clouds are supernova

This new map of the Universe suggests dark matter shaped the cosmos (nature.com)

**14th Febr 2024**

The eROSITA telescope's pictures are among the most precise measurements ever made.

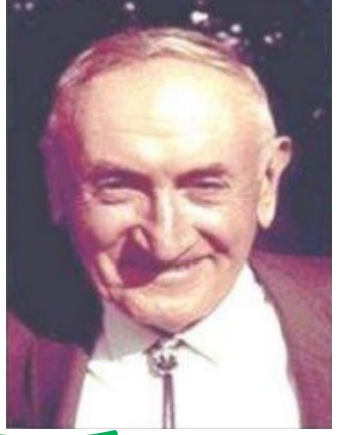
# This new map of the Universe suggests

# DM shaped the cosmos

# => dominating

Unexpected cosmic observations  DM

Dunkle Materie



ZWICKY

**Anomaly / mystery => missing explanation**

Insisting local anomalies / mysteries  **the unnoticed trigger by the dark Universe!**

**> Why?**  **[6-19]**

**For diverse observables:**

Unexpected planetary Relationships ⇔ invisible streams

**dynamic Sun => dynamic Earth.**

**The key signature**

**what else?**

**DM presence is known through its gravitational pull on visible matter in space.**

# DM does not emit, absorb, or, reflect light.

- **Misleading =>** **counter examples => this work. E.g.:**

  ***various energetic events of unknown origin, like***
  ***Flares, Solar EUV, and terrestrial obs's, etc…***

https://www.nasa.gov/feature/goddard/2020/hubble-observations-suggest-a-missing-ingredient-in-dark-matter-theories

## This work: DM => "Invisible matter"

## Solar Flares

Flares

**1859 -** ***unpredictable mysteries***

***one of the most important challenges in solar physics***

[1]

## Solar Corona

Corona

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

*in space science* [2].

## Ionosphere

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

$\rho_e(DEC) > \rho_e(JUNE)$

*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. Klimchuket al. , PASJ (**2017**); https://arxiv.org/abs/1709.07320

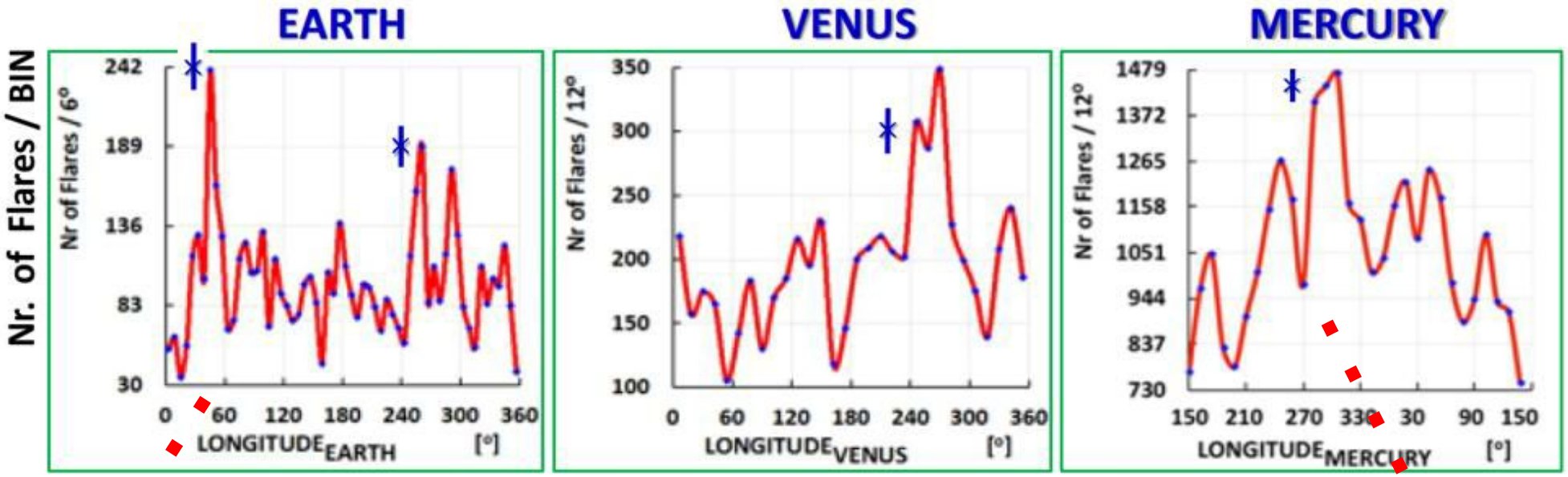
[3] E.V. **Appleton**, Proc. Roy. Soc. London A162 (**1937**) 451; http://rspa.royalsocietypublishing.org/content/162/911/451.

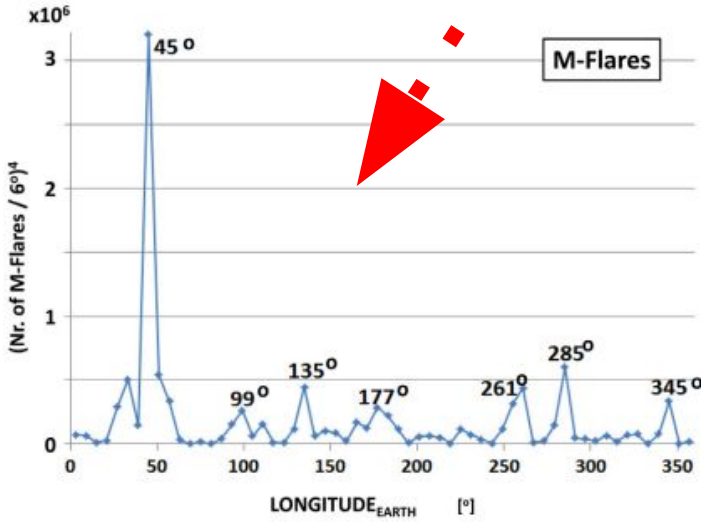
# Solar Flares

Biggest + unpredictable solar system "*explosions*"

***Peaking planetary relationship,***

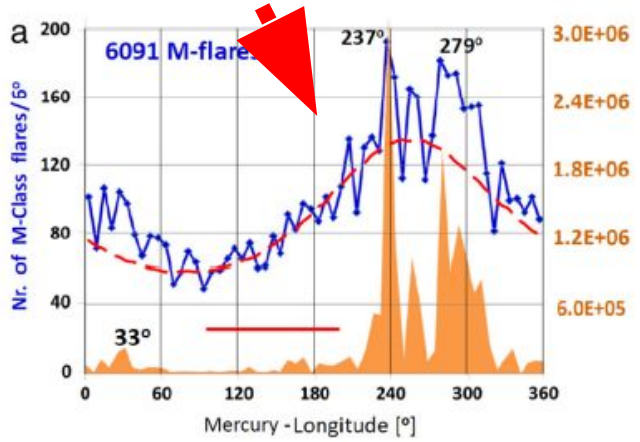
**excludes remote planetary interaction, like: tidal forces**



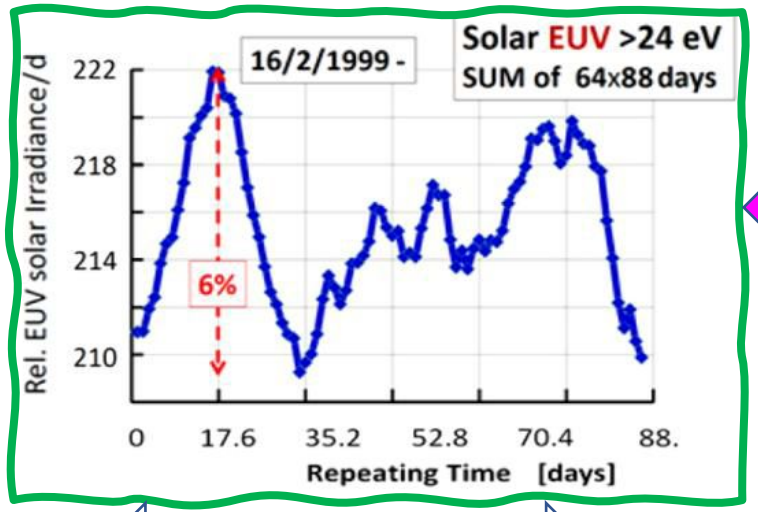

**LONGITUDE [°]**

Polished flares data
M.J. Aschwanden



# The solar corona paradoxon.

**2017** [10]



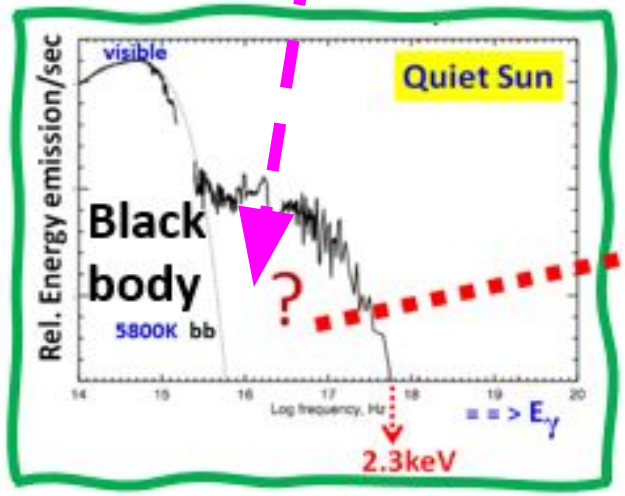

Solar EUV / d

Repeating time 88 d
=Mercury orbit

**Planetary relationship**

NOT EXPECTED

**2002**




**The manifestation of the hot corona**

NOT EXPECTED

[H. Hudson]

[**L. Di Lella**, K. Z., AP 19 (**2003**) 145]; https://arxiv.org/abs/astro-ph/0207073

Paradoxon$^2$

But….

# Past “misfortune”

# MERCUR

1967 2017

Discarded... Planetary dependence

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

http://adsabs.harvard.e (1967)

**the ONLY remote force!**

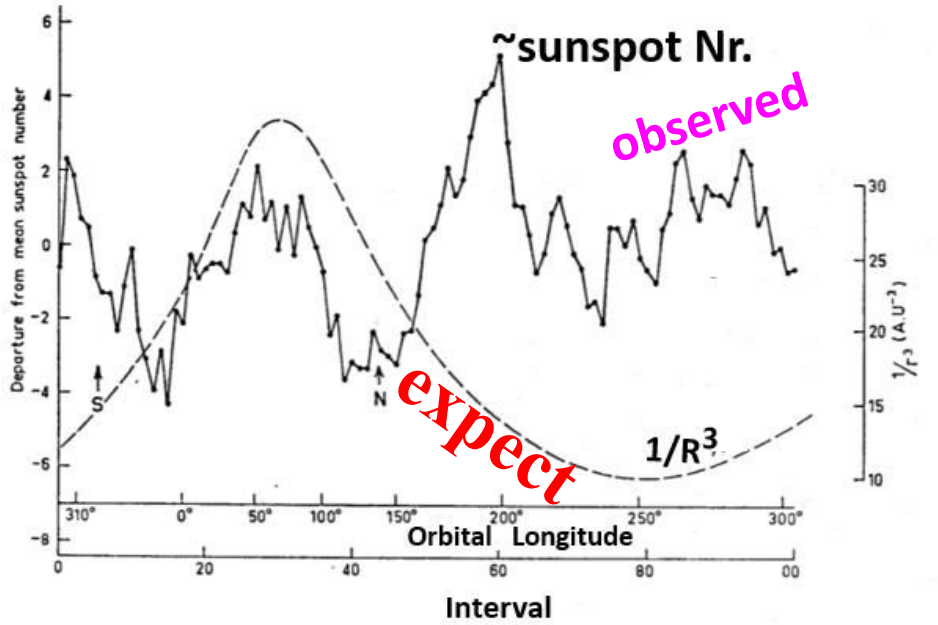
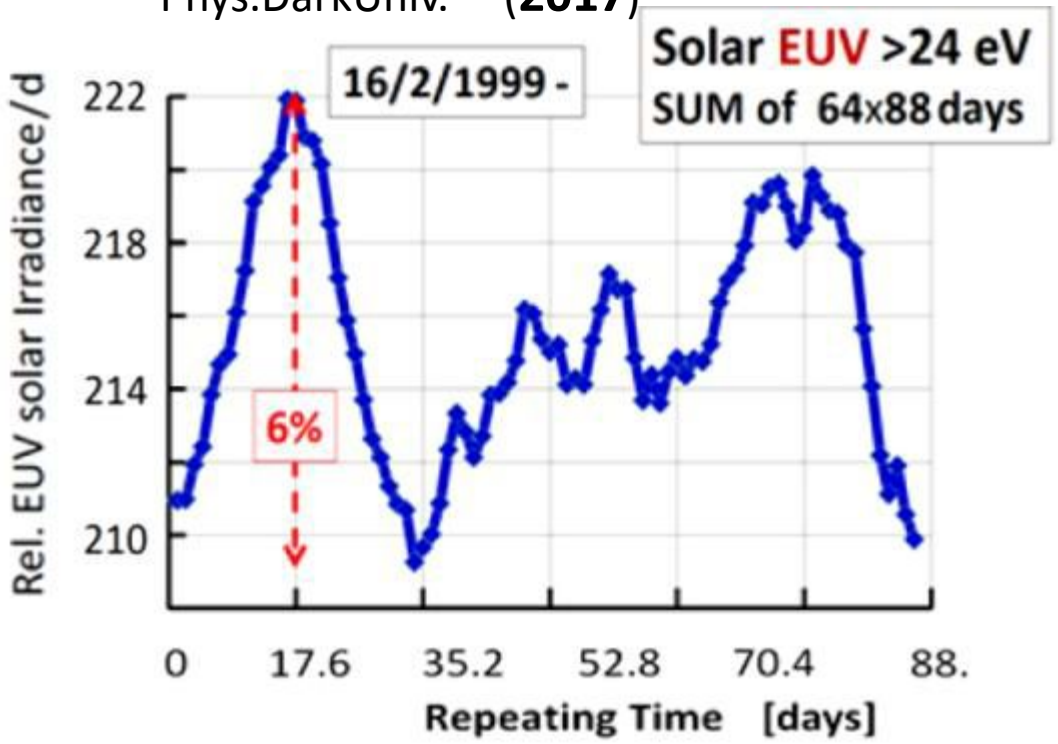


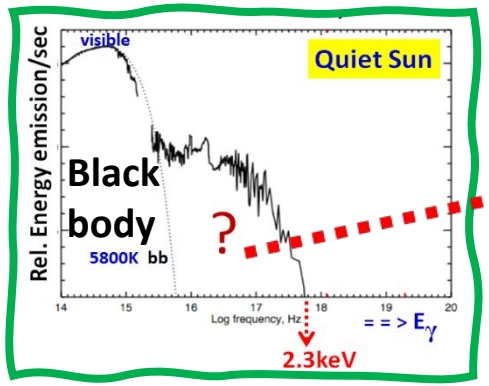

FIG. 4. Departures from mean sunspot numbers as a function of Mercury's position. Equivalent to the mean waveform of the detected signal.

*"Itisimmediatelyobviousthat**nosimpletheory will entirely accountforthiscomplexpattern**,butoneof Themaximaoccurs nearMercury'sclosestapproachtothe Sunandthetwo conspicuousminimaoccurquitecloseto theplanet'sgreatest departuresfromtheplaneoftheearth's orbit(NandSinFig.)."*

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

Phys.DarkUniv. (**2017**)



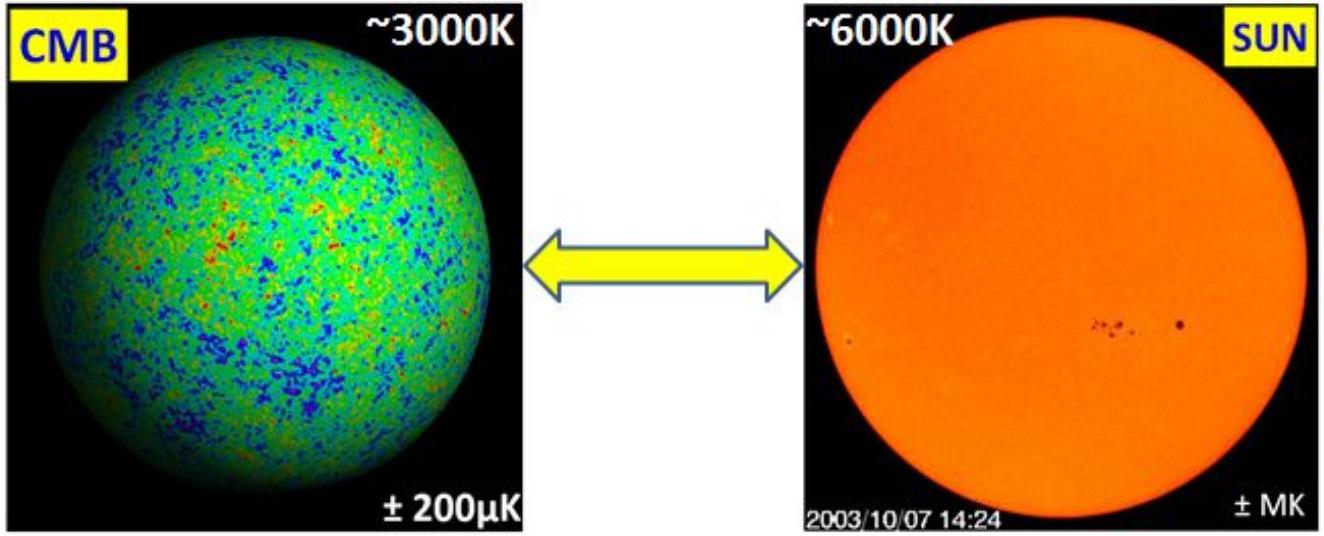




**The manifestation of the hot corona**

**UNEXPECTED**

**UNIVERSE** **SUN**

~$10^5$ years ~$10^9$ years




$\Delta T/T \sim 10^{-5}$ $\Delta T/T \sim 10^{+3}$

**SUN:**
not thermalized after 4.5 Gyrs
=> **WHY NOT?**

**look at!**

Observation & cosmology
**invisible streams** @ solar system

p.t.o.

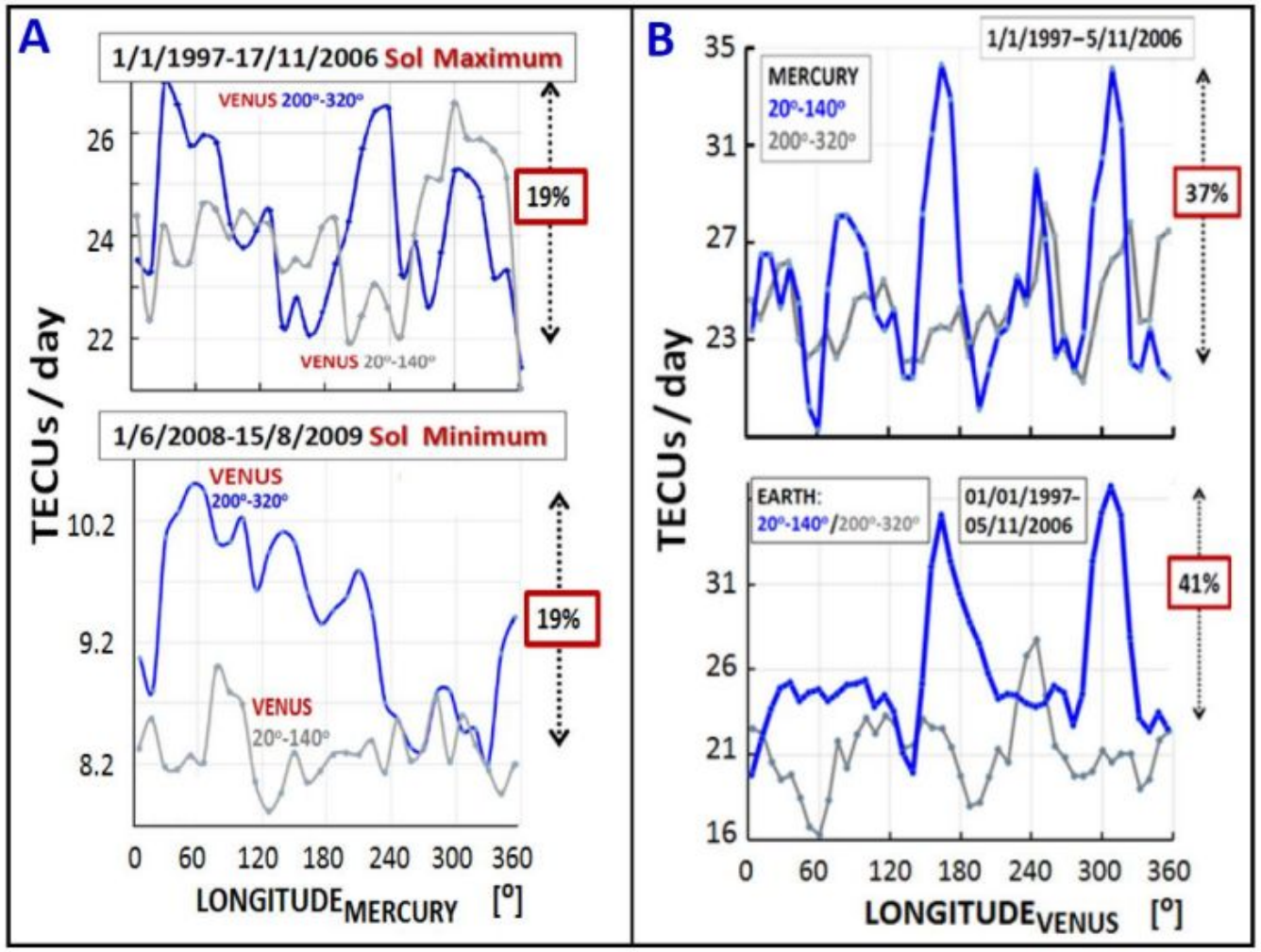



**Figure 13.** The daily measured longitudinal distributions of Earth's atmospheric total electron content [12] for different planetary configurations and time periods of the solar cycle: (A) The total electron content [TECUs] as a function of **Mercury** heliocentric longitude during the solar maximum period 1997-2006 (UP) and during theextremely deep solar minimum 2008-2009 (DOWN). The thick blue and the thin grey lines are associated with Venus being in one of the two opposite 120° wide orbital arcs. (B) TECUs as a function of the **Venus** longitude during the same solar maximum requiring Mercury (UP) and Earth (DOWN) to be in one of the 120° segments. Note that the two strongest peaks (in blue) appear in both.

**The Sun + its Planets as detectors for invisible matter**
Bertolucci, Zioutas, Hofmann , Maroudas,
Phys. Dark Universe 17 (**2017**) 13

- Something strange takes place @ ionosphere
- How can be atmosph. plasma depend on planetary position?

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

Astrophysics > Solar and Stellar Astrophysics

[Submitted on 3 Jan 2017]

# Solving the Coronal Heating Problem using X-ray Microcalorimeters

Steven Christe, Simon Bandler, Edward DeLuca, Amir Caspi, Leon Golub, Randall Smith, Joel Allred, Jeffrey W. Brosius, Brian Dennis, James Klimchuk

**Even in the absence of resolved flares, the corona is heated to several million degrees. However, despite its importance for the structure, dynamics, and evolution of the solar atmosphere, the origin of this heating remains poorly understood**. Several observational and theoretical considerations suggest that the heating is driven by small, impulsive energy bursts which could be Parker-style "nanoflares" (Parker 1988) that arise via reconnection within the tangled and twisted coronal magnetic field. The classical "smoking gun" (Klimchuk 2009; Cargill et al. 2013) for impulsive heating is the direct detection of widespread hot plasma (T > 6 MK) with a low emission measure. In recent years

# How is the solar corona heated?

A long-standing **enigma in solar + stellar physics** is how the atmosphere can be orders of magnitude hotter than the surface of the star itself.

***JUNE 2023***

https://arxiv.org/ftp/arxiv/papers/2306/2306.11777.pdf

# Spacecraft Makes Progress on Solar Heating Mystery

October 14, 2022• *Physics* 15, 157

Data from the Parker Solar Probe confirms ***a long-suspected heat source*** for the Sun's ***surprisingly hot corona***, *but there may be others*.

ASTROPHYSICS[Spacecraft Makes Progress on Solar Heating Mystery]

October 14, 2022Data from the Parker Solar Probe confirms a long-suspected heat source for the Sun's surprisingly hot corona, but they have several theories. Researchers have now confirmed one suspected source of heating. there may be others.

**Physical Review Letters - Week ending 14 October 2022**
**OR**
**https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.129.165101?utm_source=email&utm_medium=email&utm_campaign=prl-alert**
**Or better, https://journals.aps.org/prl/pdf/10.1103/**

**2023** Flare frequency distributions represent a key approach to addressing ***one of the largest problems in solar + stellar physics: determining the mechanism that counter-intuitively heats coronae to temperatures that are orders of magnitude hotter than the corresponding photospheres.*** **It is widely accepted that the magnetic field is responsible for the heating**, but .. two competing mechanisms.. could explain it: nanoflares or Alfv´en waves. To date, neither can be directly observed. Nanoflares are, by definition, extremely small, but their aggregate energy release could represent a substantial heating mechanism, presuming they are sufficiently abundant. One way to test this presumption is via the flare frequency distribution, which describes how often flares of various energies occur. If the slope of the power law fitting the flare frequency distribution is above **a critical threshold**, **α = 2** as established in prior literature, then there should be a sufficient abundance of nanoflares to explain coronal heating. We performed >600 case studies of solar flares, made possible by an unprecedented number of data analysts via three semesters of an undergraduate physics laboratory course. This allowed us to include two crucial, but nontrivial, analysis methods: pre-flare baseline subtraction and computation of the flare energy, which requires determining flare start and stop times. We aggregated the results of these analyses into a statistical study to determine that **α = 1.63 ± 0.03**. This is below the critical threshold, suggesting that Alfv´en waves are an important driver of coronal heating. https://arxiv.org/abs/2305.05687

***other factors that affect TEC more strongly than $F_{10.7}$ and mask the effects of daily solar EUV variations.***

***TEC=TotalElectronContent***

*https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2002JA009731*

***"…when they did not see a correlation they even did NOT publish it,.."***

**2003**

# 1st take away:

**A peaking dependence excludes a remote planetary / tidal force !**

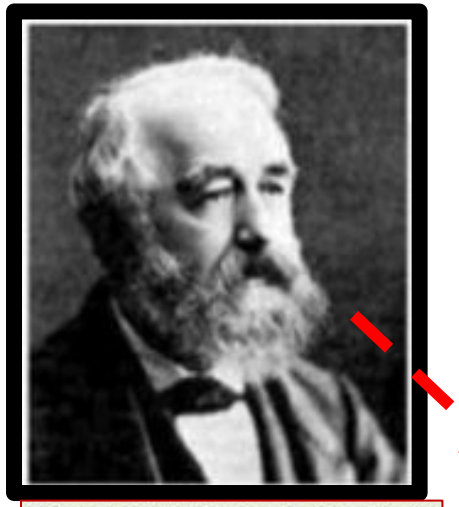
+

**confirms this work**

+

**Planetary relationship ⇔ exo-solar origin**

R. WOLF



The variations of sunspots depend on Venus, Earth, Jupiter & Saturn

# The 11-year solar cycle

$P^{JUPITER} = 11.86 \text{ years} \approx 11 \text{ years}$

**1859- Suspected as first planetary dependence**

**The only remote tidal planetary force => too weak!**

Following known physics

missing factor $\sim 10^{11}$

**follow-up!** …. more quantitatively

**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

..tidal effects of planets on the solar surface are = $10^{-11}$ · SUN Gravity

J. Javaraiah, Solar Physics 212(**2003**)23

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

1st spinoff

ELSEVIER

Astroparticle Physics
Volume 20, Issue 1, October 2003, Pages 73-78

# Gravitational lensing by the Sun of non-relativistic penetrating particles

2003

D.H.H Hoffmann [a], J Jacoby [b], K Zioutas [a c d]

Show more

+ Add to Mendeley  Share  Cite

https://doi.org/10.1016/S0927-6505(03)00138-5  Get rights and content

## Abstract

The flux of weakly interacting particles from celestial sources, moving with a velocity $v \approx 0.2c$, can be temporarily amplified at the site of the Earth, due to gravitational lensing effects by the Sun. The effective amplification factor can be as much as $\sim 10^3$ to $\sim 10^4$, for a velocity bin-width of ~0.1%. The theoretically motivated solar Kaluza-Klein axions provide a generic example of particles with a wide velocity spectrum, filling the gap between $v \approx c$ (e.g. neutrinos) and $v \approx 10^{-3}c$ (e.g. dark matter (DM) candidates). If the putative particles come from a direction along the projected path of the Sun in the Sky, within a strip of ~0.1° along the ecliptic, then, time windows of possible enhanced flows can be predicted. This suggestion can be implemented in the (re)-analysis of data from DM-experiments, and, it does not need any major experimental modification. In particular, performing a cross-correlation of data taken over a period more than 1 year, from the same or even also from other experiments, this can result to (un)predictable time windows of interest. Because, if burst-like events re-appear in following years in fixed dates, this will be an unambiguous identification of the cosmic origin of underground events, which were ignored before. Thus, thanks to solar gravitational effects, DM-experiments can be transformed to telescopes of penetrating non-relativistic particles with a field-of-view of ~0.1°, or even more, along the ecliptic.

The missing access to DM-data does not allow us to test this technique. We therefore suggest to the astroparticle physics community to release its data.

Gravitational lensing ⇔ c ✔

DM  *a "first"*  ⇔ 0.001c

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

All you need is ..

STREAMS

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

**b** =impact factor
**c** = velocity .... NOT from $mc^2$ □ [6,7]

***Gravitational deflection*** $\Delta\Phi \propto 1/v^2$

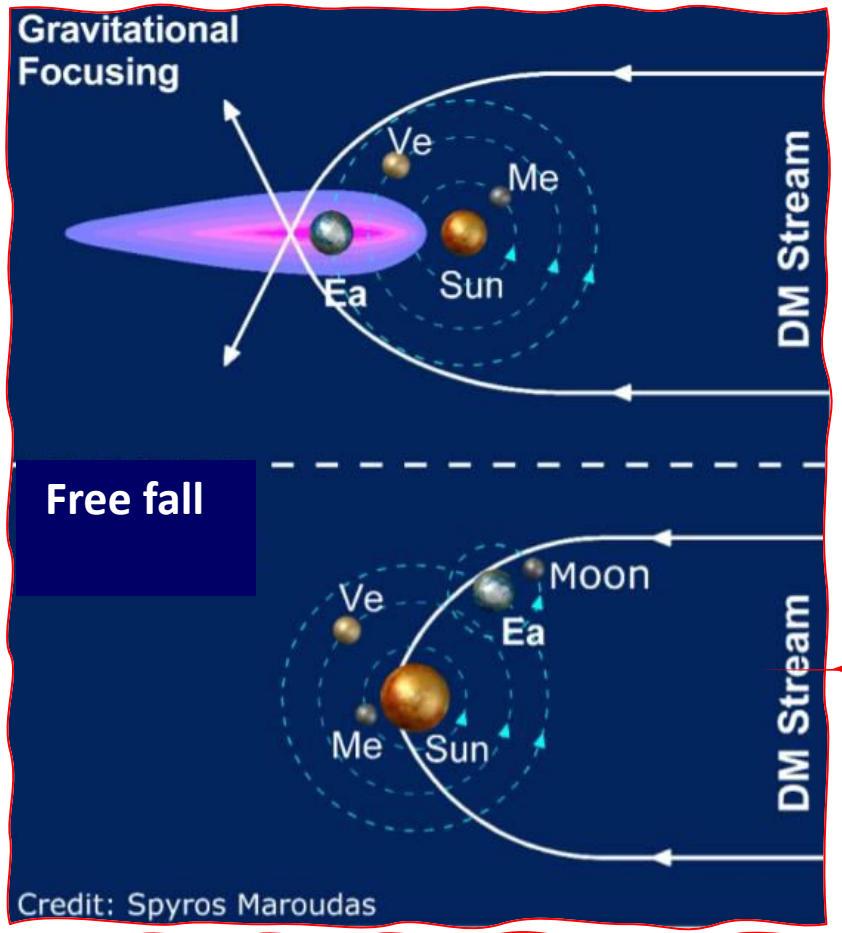
- Deflection (v~1‰ c) □ $10^6\times$ Deflection (v=c)
- planetary lensing within inner solar system ✔
  + Moon => Earth!

[6,7,10]

□ 2003
2014
□ 2017

# Gravitational focusing by the solar system!

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




❶

❷

**Cartoonillustrationofgravitational focusingof low speed streams.**

[10,19]

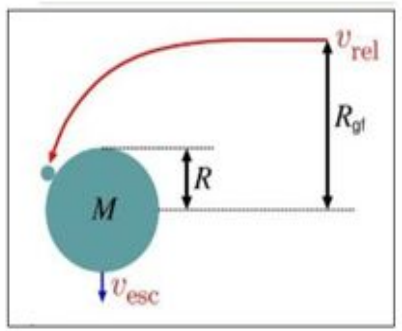
**Gal.center**

~18th December

Coincides with **ionospheric anomaly**

+

**planetary dependence** ✔




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

SUN: $v_{esc}$=612 km/s

☐ **exo-solar** ✔

2 peaks 180$^o$ apart

**[Adrien Leleu]**

Modern Physics Letters A
Vol. 29, No. 37 (2014) 1440008 (7 pages)

DOI: 10.1142/S0217732314400082

World Scientific
www.worldscientific.com



**2014** → https://arxiv.org/abs/1309.4021
arXives

# The 11 years solar cycle as the manifestation of the dark Universe

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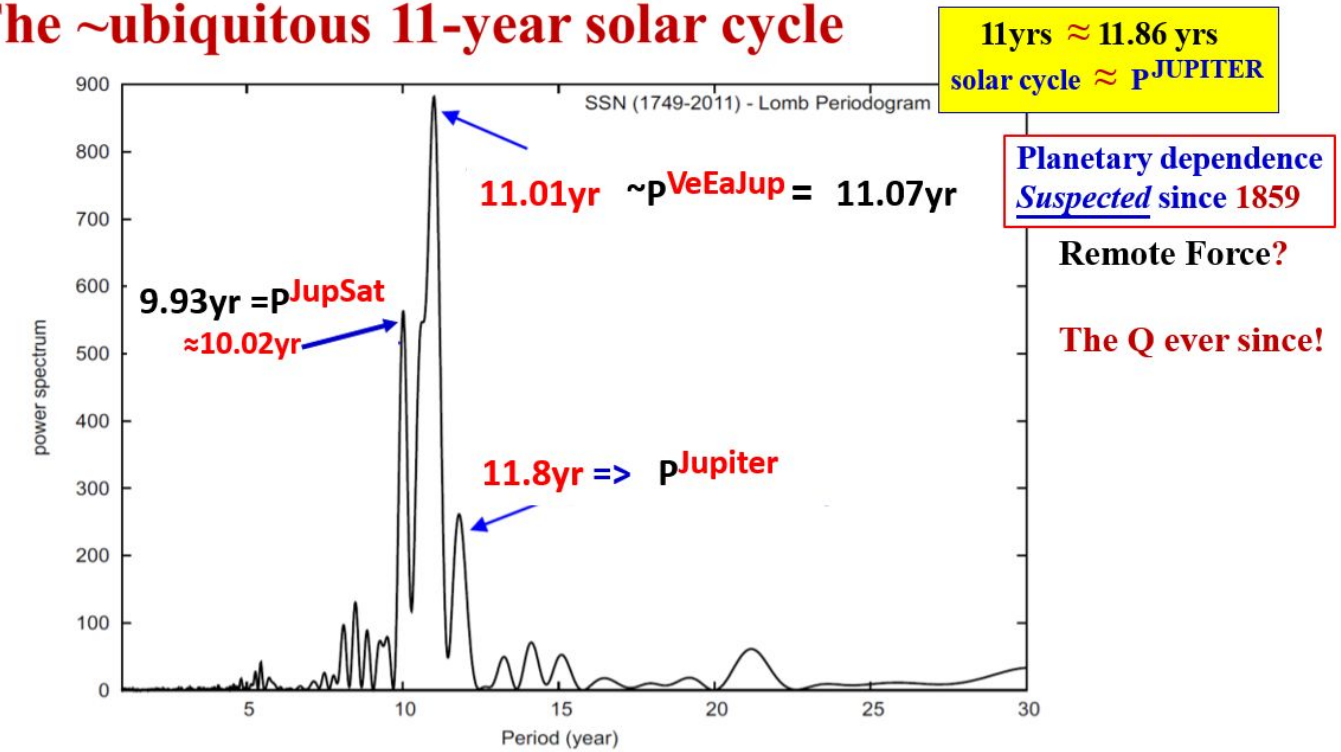
Received 29 January 2014
Accepted 18 September 2014
Published 26 November 2014

Sun's luminosity in the visible changes at the $10^{-3}$ level, following the 11 years period. This variation increases with energy, and in X-rays, which should not even be there, the amplitude varies up to $\sim 10^5$ times stronger, making their mysterious origin since the discovery in 1938 even more puzzling, and inspiring. We suggest that the multi-faceted mysterious solar cycle is due to some kind of dark matter streams hitting the Sun. Planetary gravitational lensing enhances (occasionally) slow moving flows of dark constituents toward the Sun, giving rise to the periodic behavior. Jupiter provides the driving oscillatory force, though its 11.8 years orbital period appears slightly decreased, just as 11 years, if the lensing impact of other planets is included. Then, the 11 years solar clock may help to decipher (overlooked) signatures from the dark sector in laboratory experiments or observations in space.

*Keywords*: 11 years solar cycle; dark matter; gravitational lensing.



## The ~ubiquitous 11-year solar cycle




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

11.01yr ~$P^{VeEaJup}$ = 11.07yr

9.93yr =$P^{JupSat}$
≈10.02yr

11.8yr => $P^{Jupiter}$

Planetary dependence
*Suspected* since 1859

Remote Force?

The Q ever since!

**THANKS** to Maxim Khlopov
J. Editor then!

DM STREAMS >>

YES, we suspected, NOT invented to complete the scenario

 NO conspiracy approach.

# Fine-Grained Streams from Cosmological Simulations

The cold nature of dark matter yields particles with nearly zero dispersions
( **~$10^{-10}$ c** for WIMPs and **$10^{-17}$ c** for Axions) at the last scattering

=> 3x $10^{-7}$ cm/s = *m*-μm/s = 30Angstrom/s ⇔ 300 km/s

**Mark Vogelsberger** and Simon D. M. White used N-body equations of motion:

The DM distribution at a typical point in the halo is described as
a superposition of many ***fine-grained streams*** with discrete
velocity distributions, each of which has a very small velocity dispersion.

**Mark Vogelsberger** and Simon D. M. White,
Mon. Not. R. Astron. Soc. 413 (**2011**) 1419

arXiv:2108.11647 [pdf]

## The Dark Universe is not invisible

K. Zioutas, V. Anastassopoulos, A. Argiriou, G. Cantatore, S.A. Cetin, A. Gardikiotis, D.H.H. Hoffmann, S. Hofmann, M. Karuza,
A. Kryemadhi, M. Maroudas; E.L. Matteson, K. Ozbozduman,;T. Papaevangelou, M. Perryman, Y.K. Semertzidis, I. Tsagris,
M. Tsagri, G. Tsiledakis, D. Utz, E.L. Valachovic

Phys. Sci. Forum 2021, 2(1), 10

Febr. 2021

## Trillions of DM particles may lurk in Earth's crust

https://doi-org.ezproxy.cern.ch/10.1016/S0262-4079(22)01808-5

Oct. 2022

## *Dunkle Materie weniger dunkel?*

***Translated:*** **Is DM less dark?**

https://www.scinexx.de/news/kosmos/dunkle-materie-wer-enigdunkel/ Febr. 2023

## Semi-Visible Dark Photons

**Seminar at CERN 28/3/2023,** M. Hostert.

https://arxiv.org/abs/2302.05410 Febr. 2023

**NEWSCIENTIST** https://doi.org/10.1016/S0262-4079(22)01808-5
Volume 256, Issue 3407 8 October 2022, Page 17

***DARK matter can be trapped inside massive objects, and much of it may be closer to the surface of stars and planets than we realised.*** **On Earth, there may be more than 10 trillion dark matter particles in each cubic centimetre of the planet's crust.**

# Trillions of dark matter particles may lurk in Earth's crust

DARK matter can be trapped inside massive objects, and much of it may be closer to the surface of stars and planets than we realised. On Earth, there may be more than 10 trillion dark matter particles in each cubic centimetre of the planet's crust.

Dark matter is a hypothetical form of matter that isn't visible because it doesn't seem to interact with light. However, it does interact with regular, or baryonic, matter via gravity, and particles of dark matter may occasionally smash into particles of baryonic matter.

Rebecca Leane at Stanford University in California and Juri Smirnov at the University of Liverpool in the UK calculated how these collisions would affect the distribution of dark matter inside celestial bodies. Our galaxy and most others are in huge clouds of dark matter, so a constant stream of these particles is probably entering every planet and star in the galaxy.

Leane and Smirnov found that this dark matter doesn't simply sink to the centres of planets and stars as some past research has assumed. "If you're a dark matter particle, you have gravity pulling you towards the centre of the star or the planet, but as you head down you're bouncing off of all the matter on the way to the core," says Leane. "It turns out that even if you give the dark matter as much time as it likes, some of it still ends up near the surface because of all this bouncing."

They calculated that, in the sun, this would result in 100 trillion particles of dark matter or more in each cubic centimetre of the surface.

"If there's a bunch of dark matter at the surface of the Earth, that could make it easier to detect"

While current detectors aren't built to search for this trapped dark matter – it is expected to move slower than dark matter hurtling in from space, so it would carry less energy and be harder to detect – a high concentration near the surface could help future experiments.

"If there's a bunch of dark matter just sitting at the surface of the Earth, that could make it easier to detect," says Leane. ▮

Leah Crane

# Floating DM in celestial bodies

Rebecca K. **Leane** + Juri **Smirnov** https://iopscience.iop.org/article/10.1088/1475-7516/2023/10/057

...we show that a significant DM population can thermalize **and sit towards the celestial-body surface.** This surface-enhanced DM distribution allows for new phenomenology for DM searches in a wide range of celestial bodies, including the Sun, Earth, Jupiter, Brown Dwarfs, and Exoplanets. ... In reality**, a constant stream of DM particles are colliding with stars and planets** at every moment, some of which are not yet in their equilibrium position. The fact that an additional non-equilibrium DM component can exist was considered for the Earth in [89],+extended for Earth further in [90–95].

R. K. Leane and J. Smirnov, "Floating dark matter in celestial bodies," JCAP 10 (2023) 057, arXiv:2209.09834 [hep-ph].

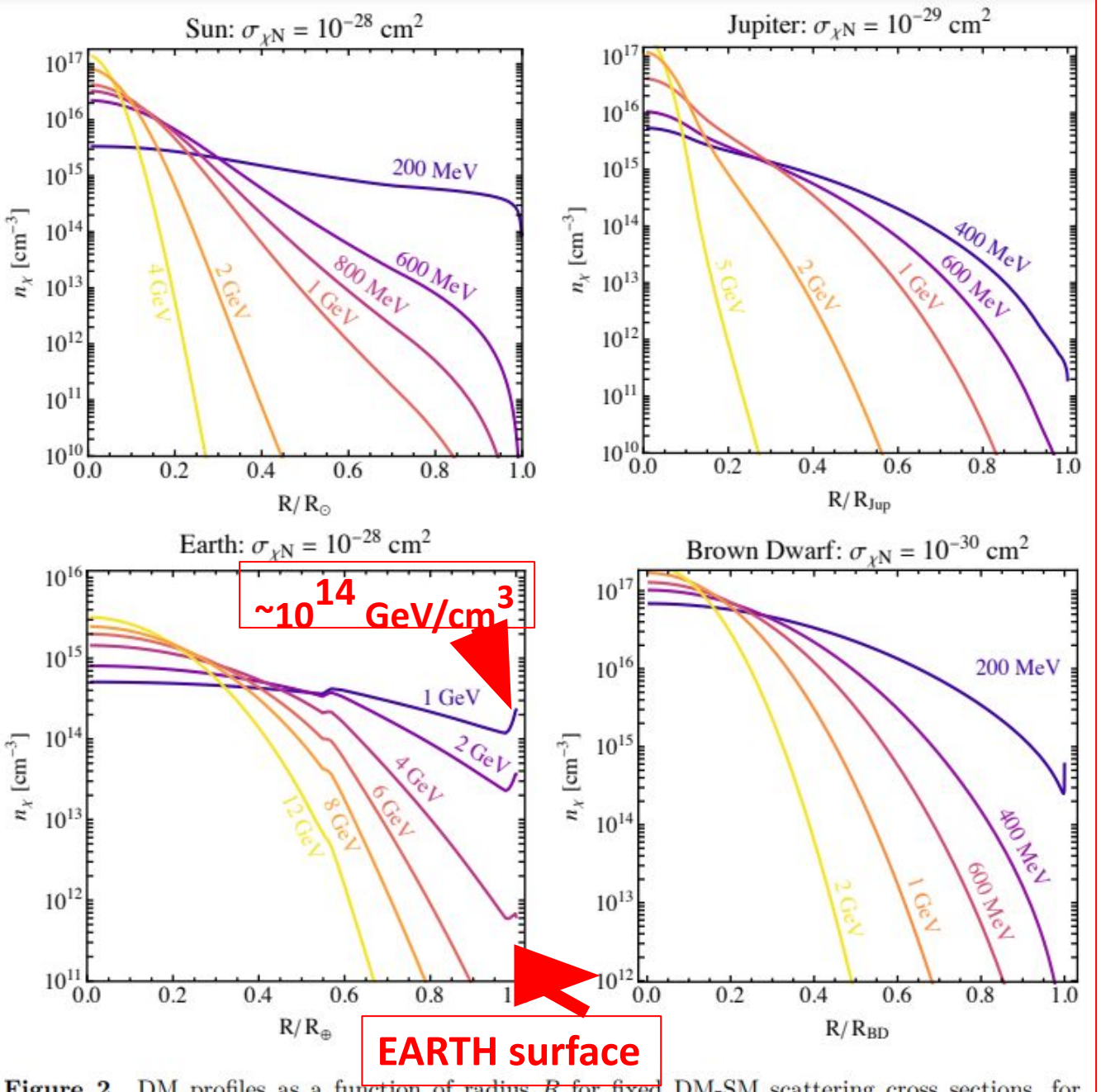



**Figure 2.** DM profiles as a function of radius $R$ for fixed DM-SM scattering cross sections, for different celestial bodies. The y-axis corresponds to the DM density within the object, the lines correspond to varied DM masses as labeled.

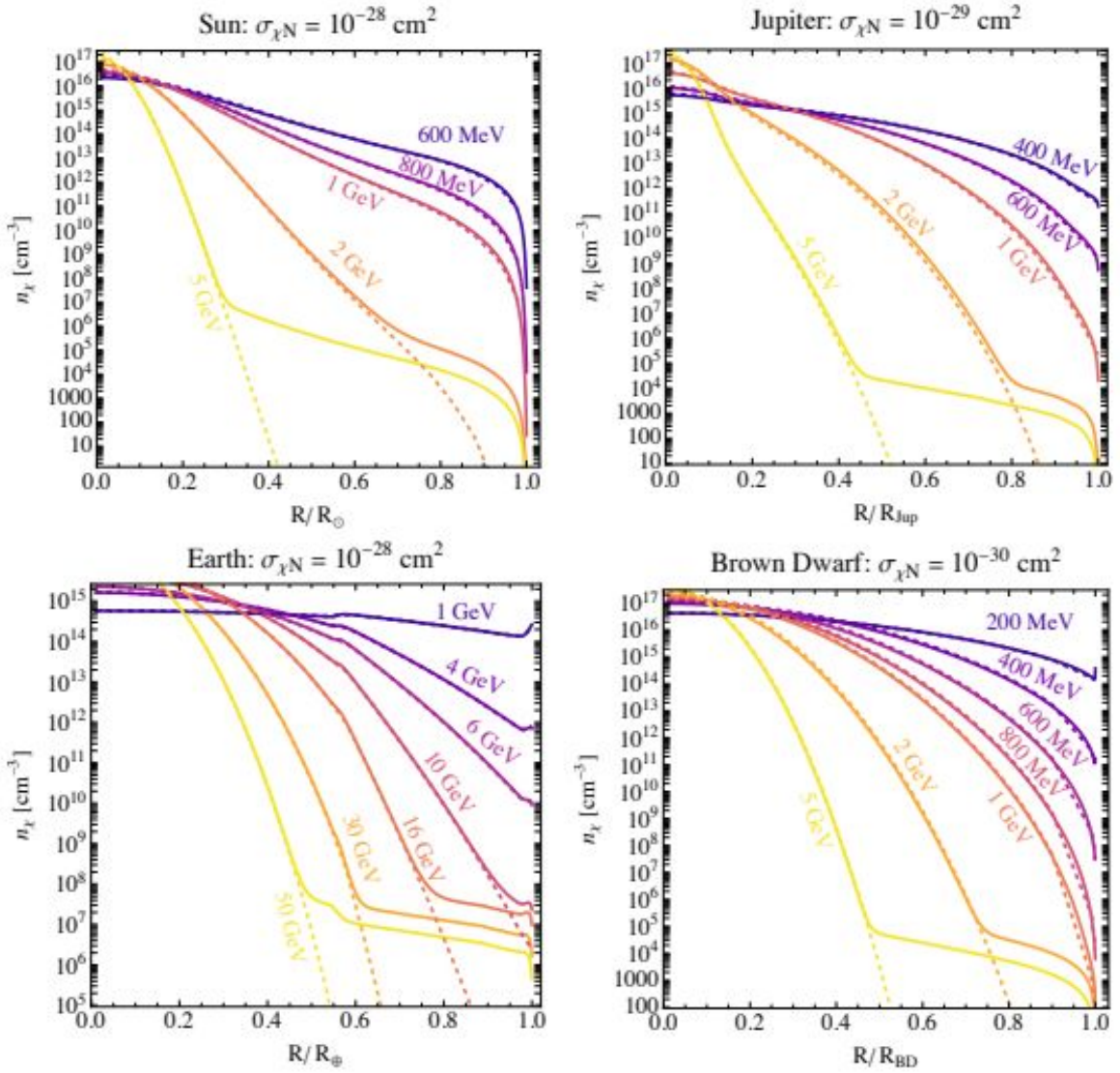



**Figure 3.** Comparison of our DM distribution framework results (solid) against the equilibrium DM distribution framework of ref. [87] (dashed) which was applied to the Sun in ref. [87]. For each celestial body we show DM distributions as a function of radius for fixed cross section, and varying DM masses as labeled. The y-axis corresponds to the DM number density at the given radius. Note the extreme zoomed out log y-axis range compared to figure 2; even with the extreme axis it is clear our framework gives results that can differ by several orders of magnitude.

**[6,7] & solar cycle suggestive for planetary Gravitational focusing of streaming DM [8].**

## Working hypothesis:

Streaming invisible matter

⊗

Gravitational lensing

⊗

Large σ **έστω**

**As suspected:**

**Pretend remote interaction!**

## So far:

***Various solar / terrestrial obs'sshow planetary relationship.***

See https://arxiv.org/abs/2108.11647 and below

## Rule of thumb:

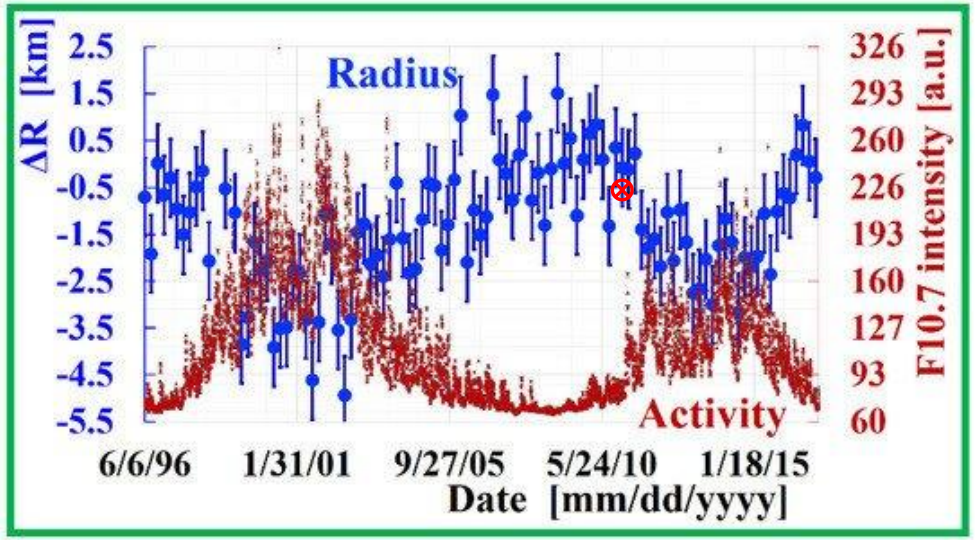
An obs'with 11yrs rhythm implies planetary dependence

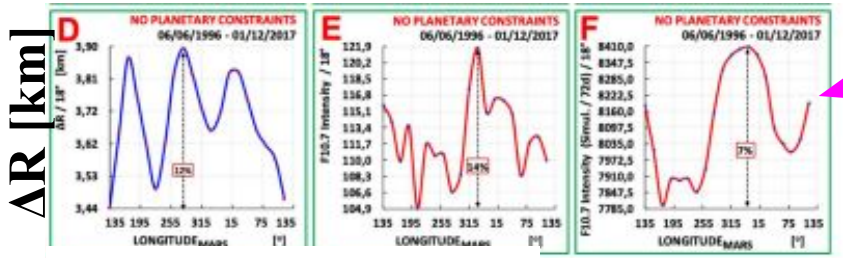
## Note:

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

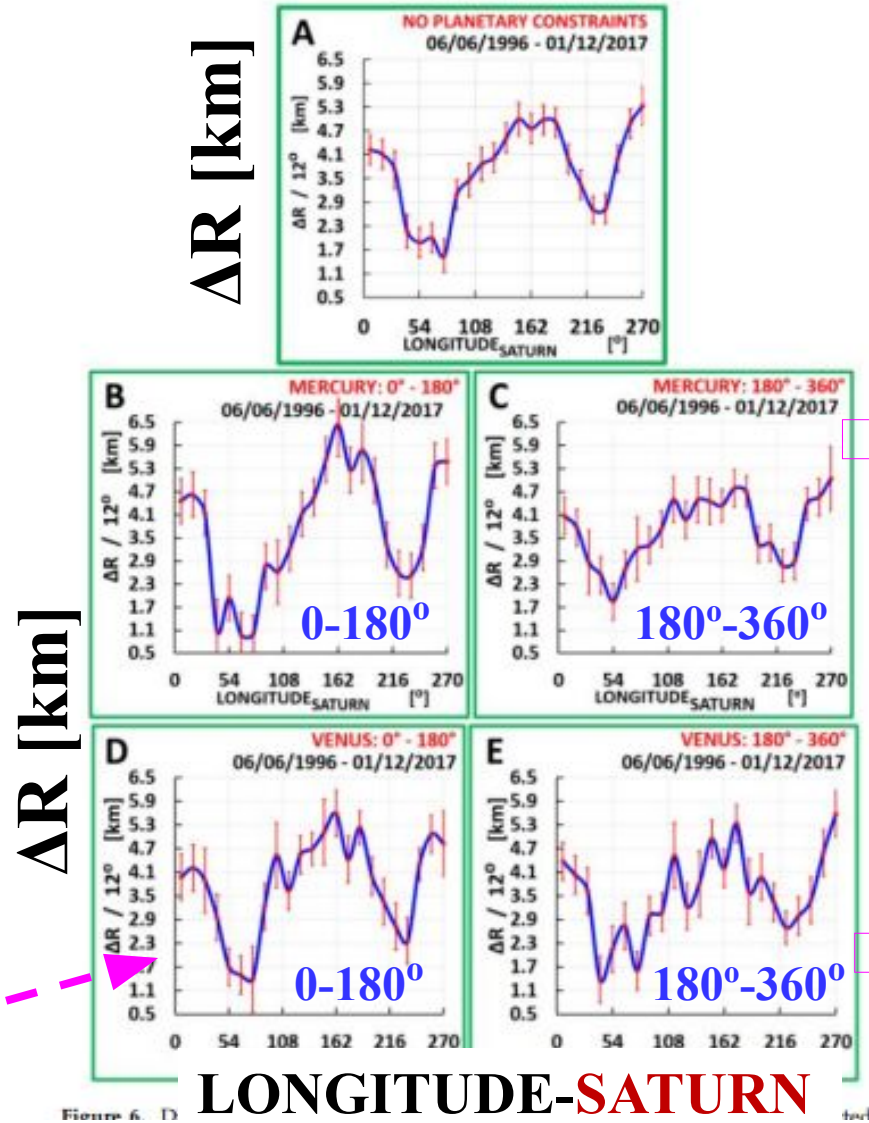
# Solar radius variation:

- from helioseismology
  - minimum BIN=72 days
- **Planetary relationship** ✔




LONGITUDE-MARS




⊗ Mercury

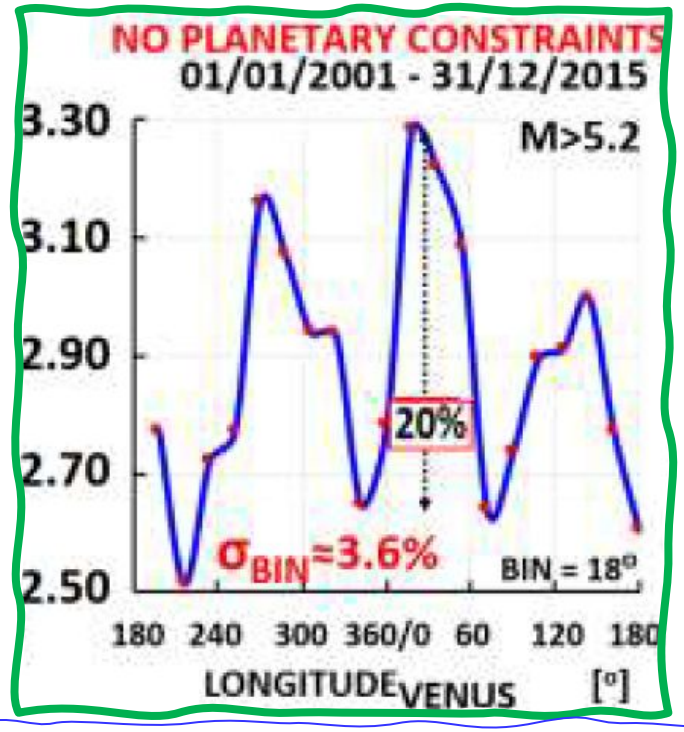
**OR**

Venus

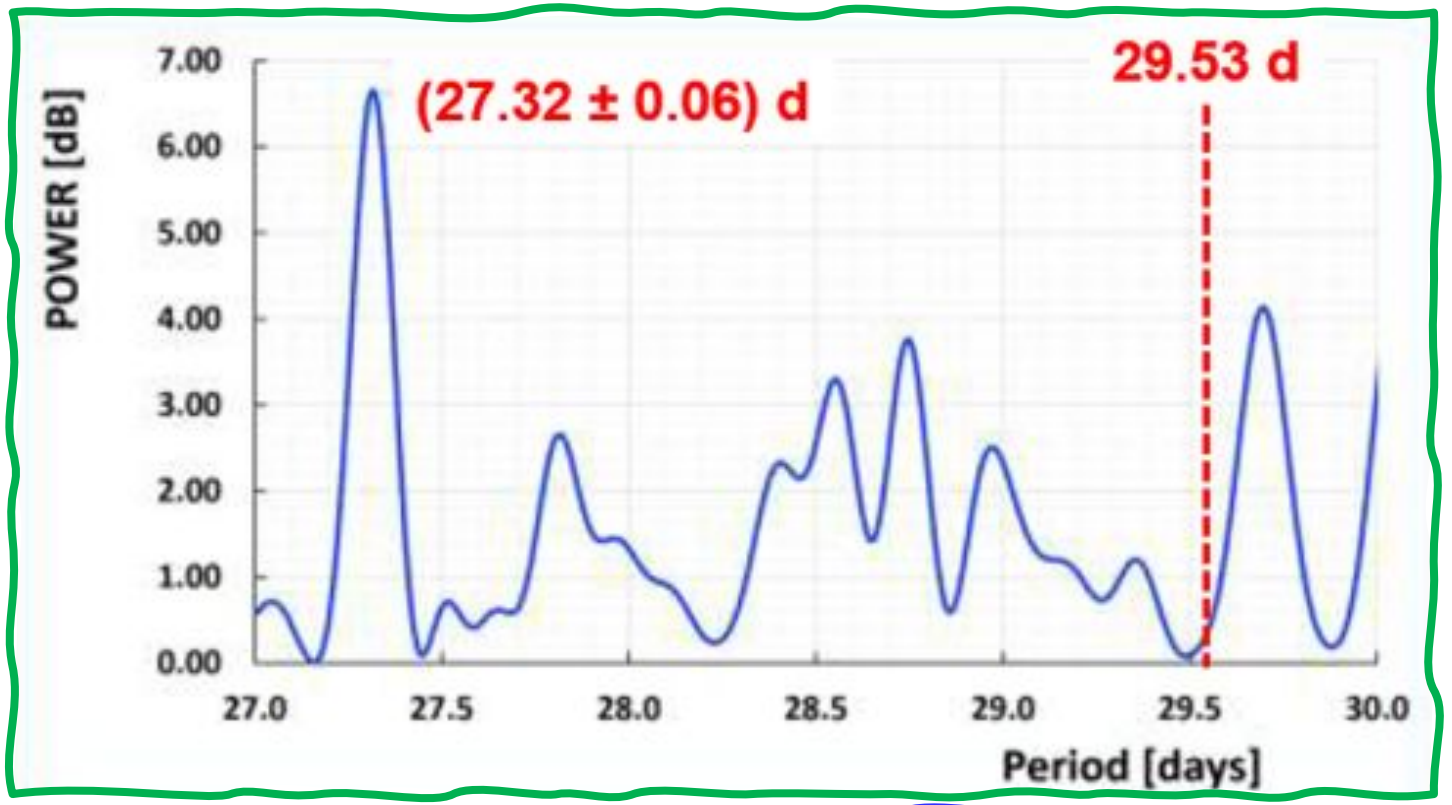
LONGITUDE-SATURN

**Lift 1km photosphere by 1km: required ~ $10^{30}$ erg.**

# EARTHquakes




Planetary relationships for EQs with Magnitude M > 5.2 **(> 5σ)**. Total number of EQs =15696, and it is normalized to daily rates compensating for eccentricity related effects




Fourier periodogram on the number of EARTHQUAKES (EQs) with M > 5.2 and by selecting only days with maximum 25 EQs / day (1/1/2001 to 31/12/2015). Total Nr. of EQs = 15696 with M > 5.2 and maximum 25 EQs/day worldwide. Of note, the appearance only of the sidereal lunar periodicity at (27.32 ± 0.06) days, while the synodic one at 29.53 days is absent.

**[ M. Maroudas, PhD thesis, University of Patras 2022 ]**

V. Marchitelli, P. Harabaglia, C. Troise, G. De Natale,

**On the correlation between solar activity and large earthquakes worldwide**

Scientific Reports 10 (**2020**) 11495;
https://doi.org/10.1038/s41598-020-67860-3 .

**In tension with this work, M>5.2**

**Abstract**

Large earthquakes occurring worldwide have long been recognized to be non Poisson distributed, so involving some large scale correlation mechanism, which could be internal or external to the Earth. Till now, no statistically significant correlation of the global seismicity with one of the possible mechanisms has been demonstrated yet. In this paper, we analyze 20 years of proton density and velocity data, as recorded by the SOHO satellite, and the worldwide seismicity in the corresponding period, as reported by the ISC-GEM catalogue. We found clear correlation between proton density and the occurrence of large earthquakes (***M* > 5.6**), with a time shift of one day. The significance of such correlation is very high, with probability to be wrong lower than $10^{-5}$. The correlation increases with the magnitude threshold of the seismic catalogue. A tentative model explaining such a correlation is also proposed, in terms of the reverse piezoelectric effect induced by the applied electric field related to the proton density. This result opens new perspectives in seismological interpretations, as well as in earthquake forecast.

# Similar relationships in exoplanetary systems?

[M. Perryman]

FocusingofDMstreamscouldalsooccurthere,experiencing streamingDMthesamewayaswithoursolarsystem.

Planetaryfocusinginthosesystemscouldbeinitially investigatedbysearchingfortheassociatedstellaractivityas afunctionoftheexoplanetaryorbitalphases(~Longitude).

TBDone

# Stratosphere: temperature anomalies as imprints from the dark Universe

.. similarly for the ionosphere!

□ planetary relationships ✔

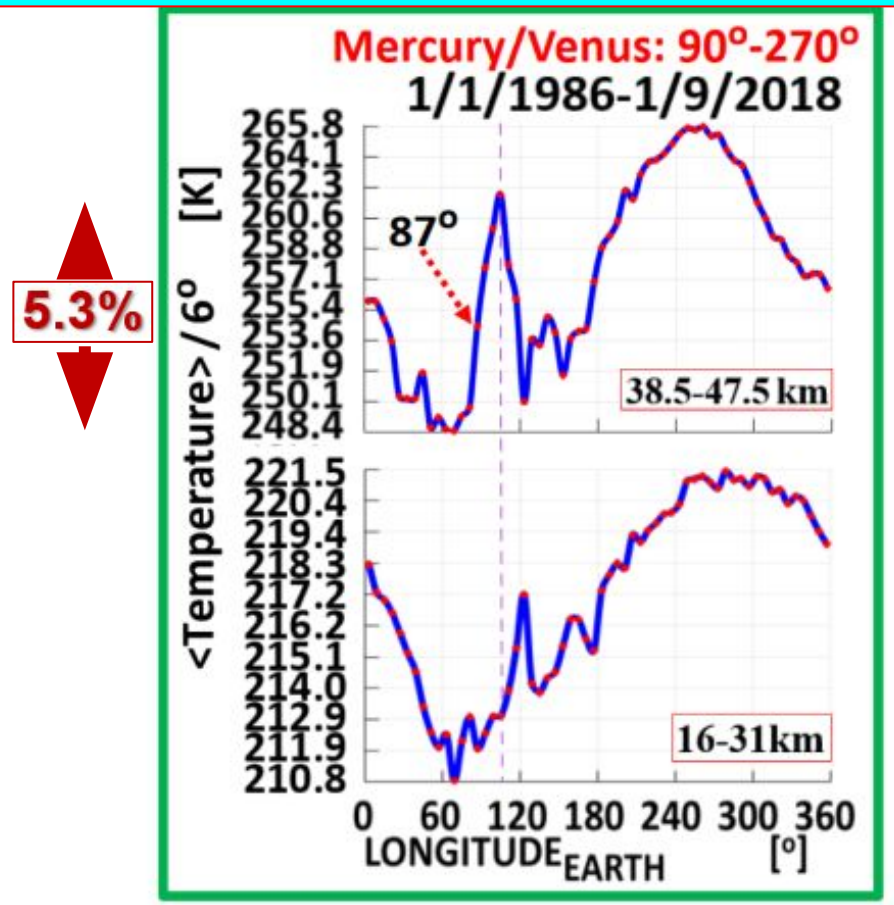



**Fig. 8.** A comparison between the mean temperature spectra of the upper stratosphere (top) and the lower stratosphere (bottom). The lower stratosphere (16–31 km) is the main Ozone layer, which is strongly affected by the solar UV. The striking difference between both spectra implies that the upper 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.

## Energy deposition:

$\sim W/m^2$

Energy

$\sim 10^6$ GeV/cm$^2$/s/

**In the Ionosphere above, too!?**



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

# *More…*

***…planetary relationships within the solar system***

**+**

*in exoplanetary systems*?

M. Perrymann

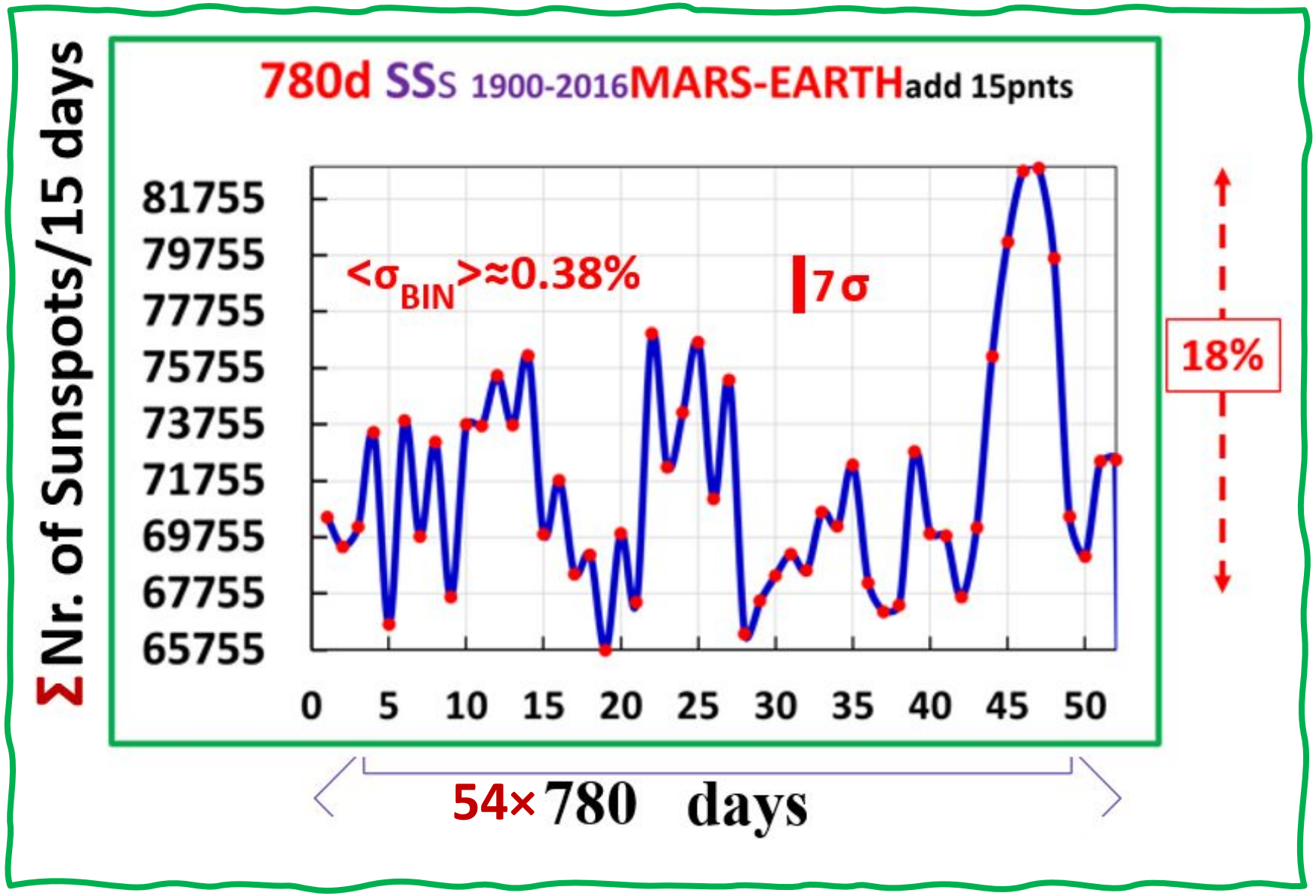
# “Solar composition problem”

**The mystery of the sun’s missing**


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

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

# Sunspots1900-2016>>MARS-EARTH synod = 54×780 days = substructure!




>

*Combined planetary relationshi*

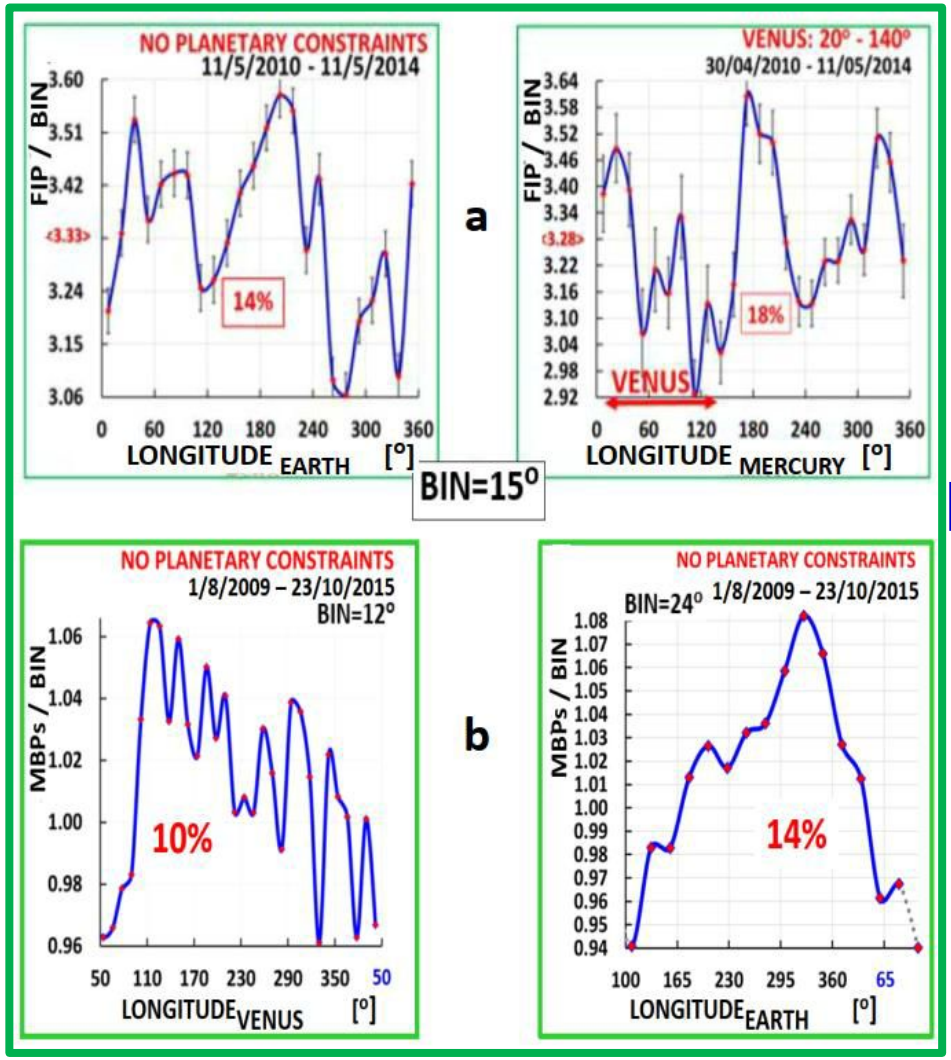
*p*

*Synod*

**Simplest FOURIER analysis with more information.**

**Elemental Composition** →

**Magneti Bright points** →




**Planetary relations:** how to reconcile w. conventional picture?

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

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

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

# AntiQuarkNuggets (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
   - Pearls (??)
2. Magnetic monopoles
3. Dark photons

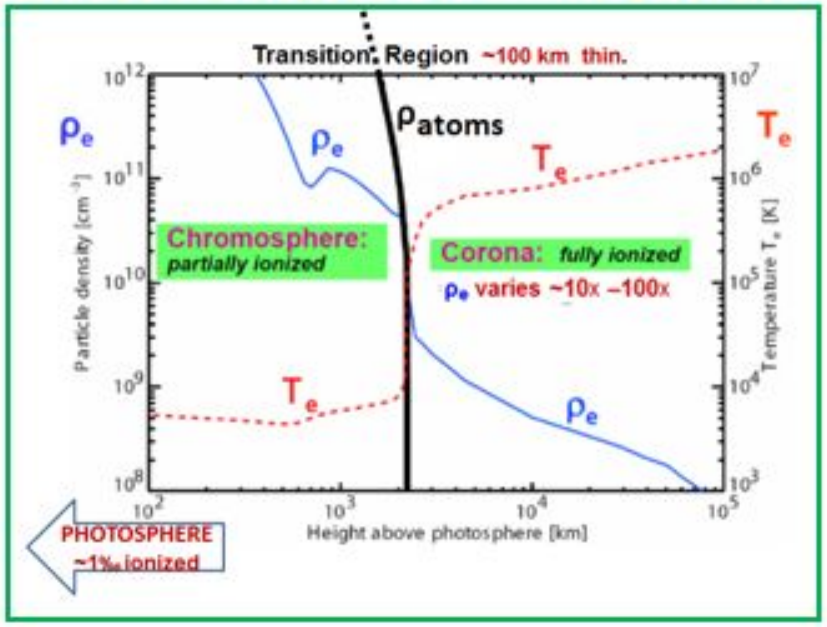
***Or, a combination from + more?***

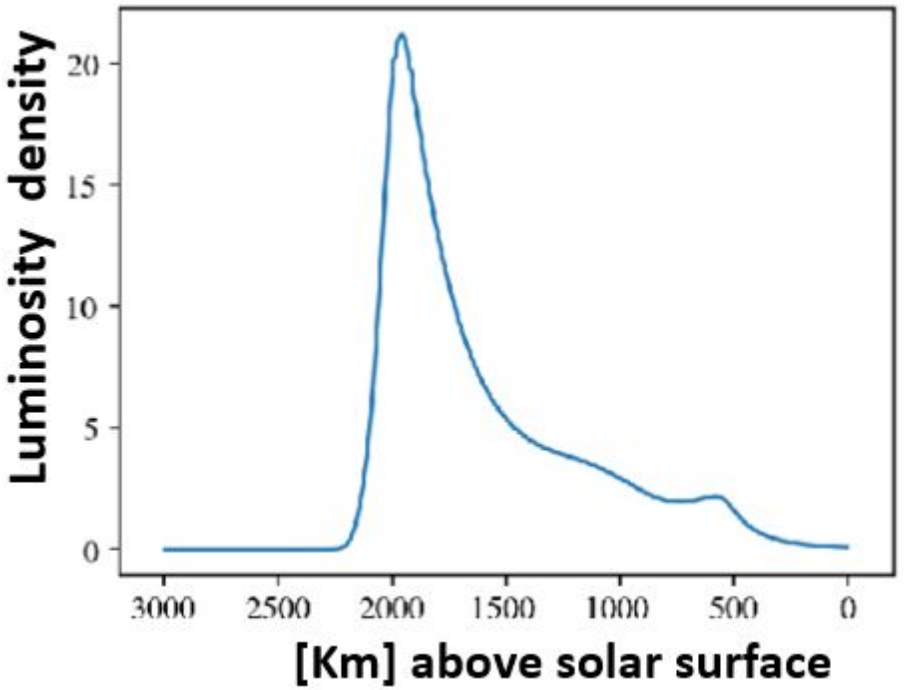
**Pearls?**

>> see Holger B. Nielsen & Colin D. Froggatt NOT worked out whether fit-in here . <<

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

# Chromosphere ⇔ Corona




**AQNs:** ▯ ***the only solar atmospheric model reproducing 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**)

Inexplicable sounds heard in the stratosphere

**Cosmos Magazine**
**https://cosmosmagazine.com › Physics**

2 days ago — US **scientists** have been sending home-made balloons with ... unknown," says **Daniel Bowman**, a researcher at Sandia National Laboratories, US.

# Balloons detect mysterious sounds in Earth's stratosphere

**Washington Post**
**https://www.washingtonpost.com › 2023/05/11 › ballo...**

4 days ago — **Scientists** sent balloons into the **stratosphere** — and found a mystery ... Sandia National Laboratories geophysicists **Daniel Bowman** and Sarah Albert...

# Seismo ionospheric anomalies

before the 2007 M7.7 Chile earthquake from GPS TEC and DEMETER
2019, Journal of Geodynamics

Fluctuations in the ionosphere related to Honshu Twin Large Earthquakes of September 2004 observed by the DEMETER and CHAMP satellites
2014, Journal of Atmospheric and Solar-Terrestrial Physics

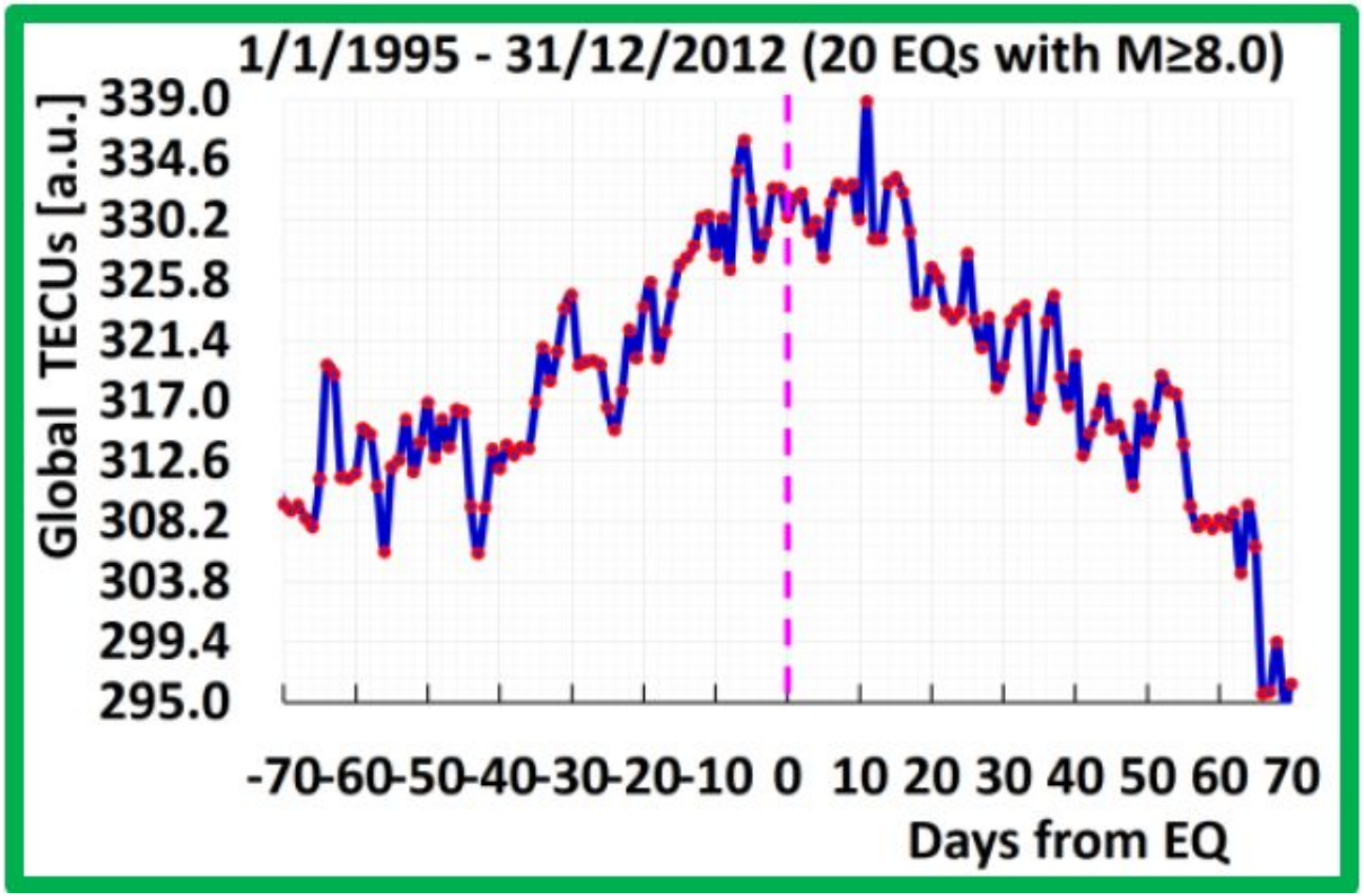
Detection and monitoring of earthquake precursors: TwinSat, a Russia-UK satellite project
2013, Advances in Space Research

Study of the lower hybrid resonance frequency over the regions of gathering earthquakes using DEMETER data
2013, Journal of Atmospheric and Solar-Terrestrial Physics

Pre-Earthquake Ionospheric Anomalies of the Wenchuan Earthquake Studied with DEMETER Satellite
2023, Wuhan University Journal of Natural Sciences

# Ionospheric anomalies detected by ground-based GPS before the Mw7.9 Wenchuan earthquake of May 12, 2008, China

https://www.sciencedirect.com/science/article/pii/S1364682609000807




GPS:
EQ precursor!

The global degree of ionization of the entire ionosphere with reference to the observed 20 Earthquakes (EQs) of magnitude M ≥ 8. [ PhD thesis, Maroudas M., 2021].

To access long-term archieved timeseries of the scintillation indices or related raw data samples please contact the IMPC User Helpdesk.<< impc-uhd@dlr.de **NOT contacted yet. k.z.**

# (wo)man made mini ionosphere

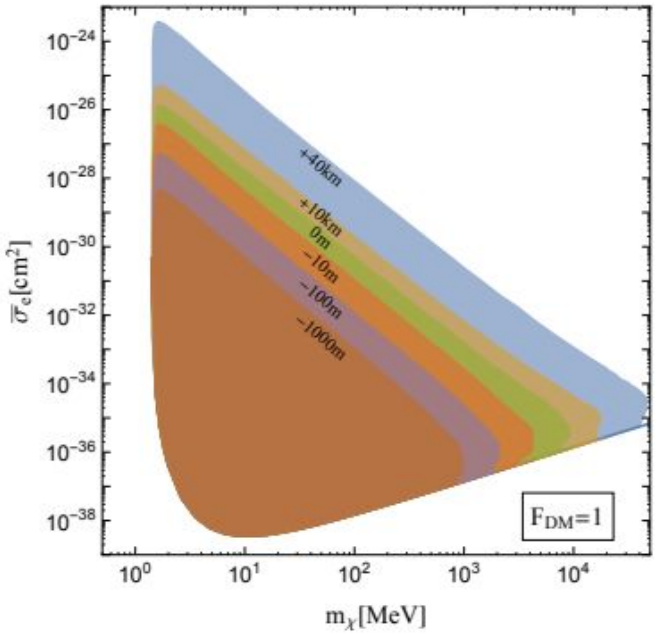
**Artist's impression of the uncrewed Orion capsule re-entering Earth's atmosphere. The real thing returned safely to Earth in 2022 NASA**

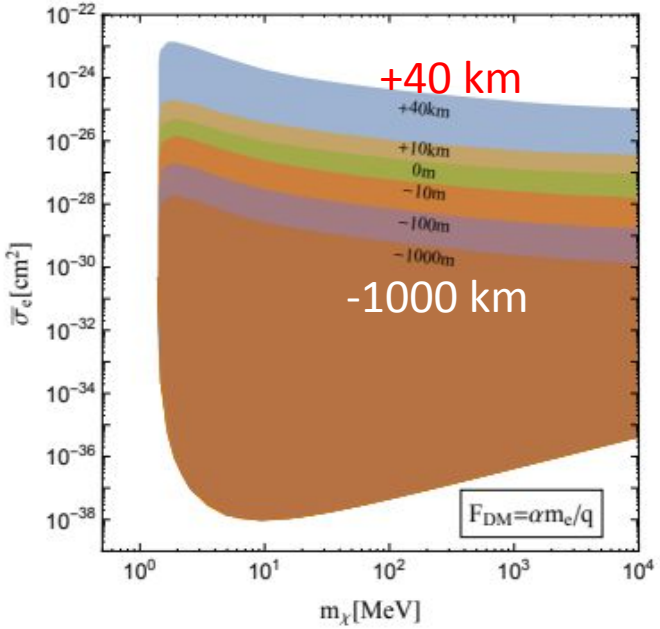
In the GHz range

for some minutes

**$\geq\approx$ μeV**

SpaceX aims to let astronauts **avoid a radio blackout during re-entry** | New Scientist



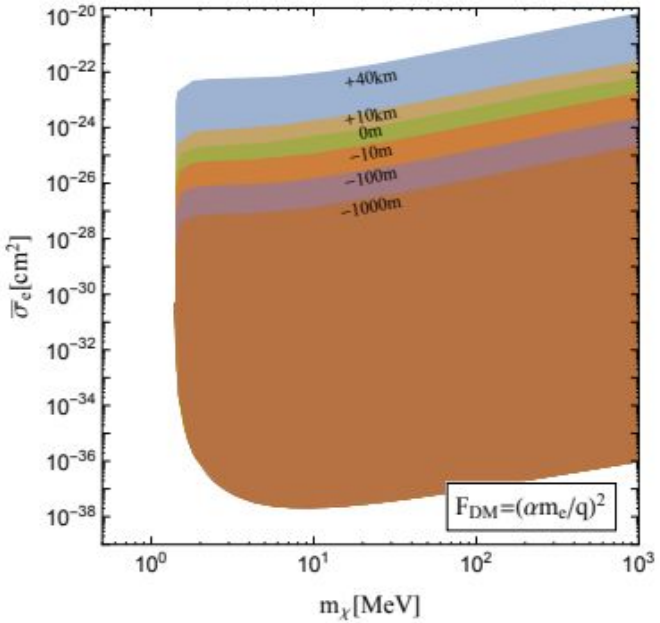




**Figure 7**: Projected sensitivity at 95% CL on the DM-electron scattering cross section versus DM mass for experiments located at several underground depths and above-ground altitudes. We assume a silicon target, zero background events, a detector threshold of two electron-hole pairs, and an exposure of 1 gram-year.

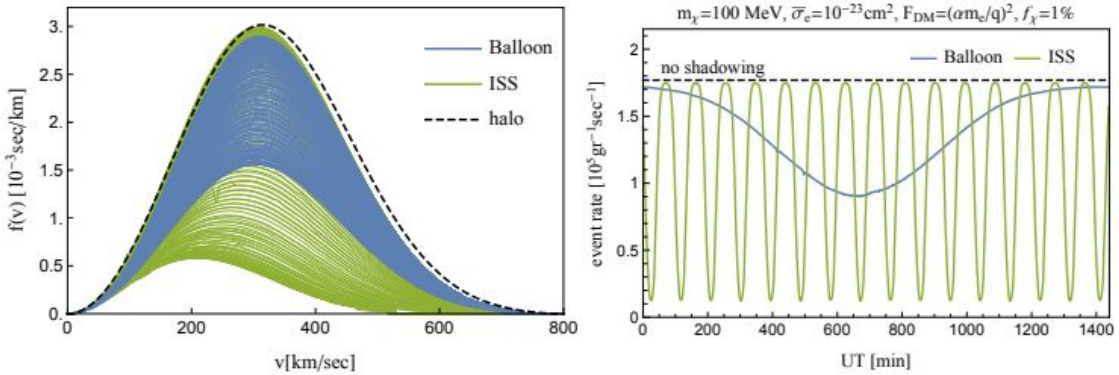



**Figure 9**: Orbital modulation of strongly interacting DM at balloon and ISS borne semiconductor experiments during one day. The signal rate on the right corresponds to the parameters $m_\chi = 100$ MeV, and $\overline{\sigma}_e = 10^{-23}$ cm$^2$, an ultralight mediator, and a DM abundance of $f_\chi = 1\%$.

s://arxiv.org/ct?url=https%3A%2F%2Fdx.doi.org%2F10.108
F1475-7516%2F2019%2F09%2F070&v=3059ad50

https://arxiv.org/pdf/1905.06348.pdf **See section 4.2.4 !!**

**1 example …**

**… outside physics**

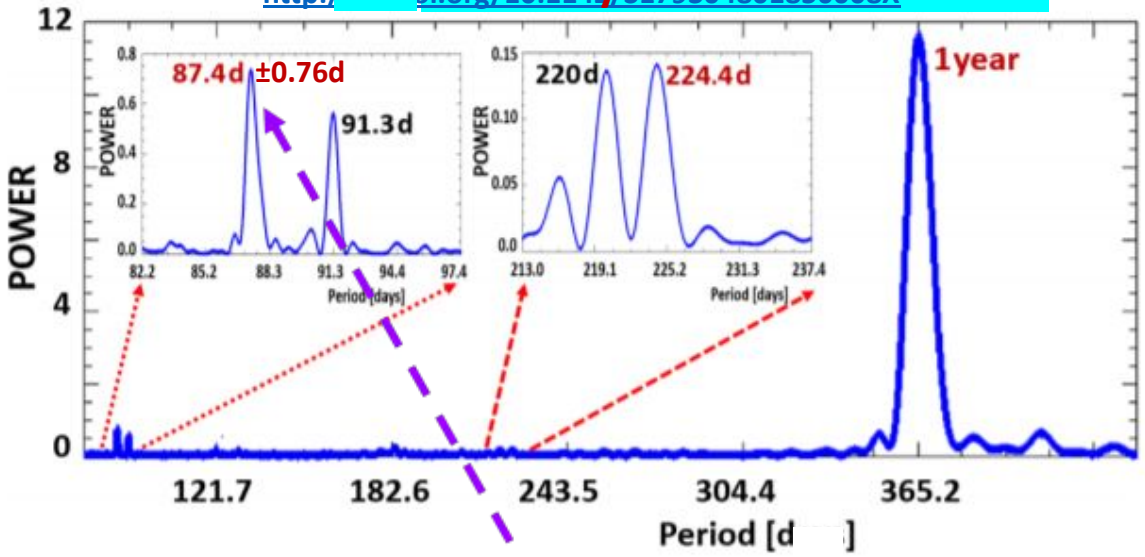
# 2018□ □ 2020 *Melanoma*

..a 27 Days Periodicity in Melanoma Diagnosis

**Planetary Dependence of Melanoma**

http://doi.org/10.1142/S1793048043500067

**USA <monthly> data 1973-2011**

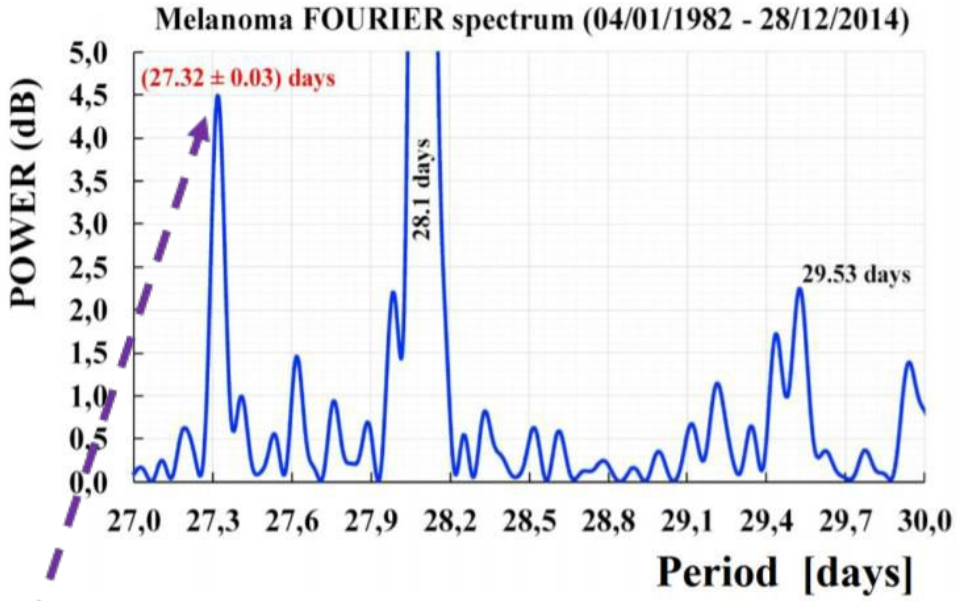



87.97 days

**@Mercury'sorbit**

https://doi.org/10.1142/S1793048020500083

**AUSTRALIA daily data 1982-2015**




**@Moon'sorbit** 27.32 days (sidereal)

=>fixed to remote stars

***Origin: exo-solar!***

***Confirmed independently***

□ ***overlooked***!

*https://doi.org/10.1142/S1793048019200029*

Next plot again

# 2018□ □ 2020 *Melanoma*

**Planetary Dependence of Melanoma**

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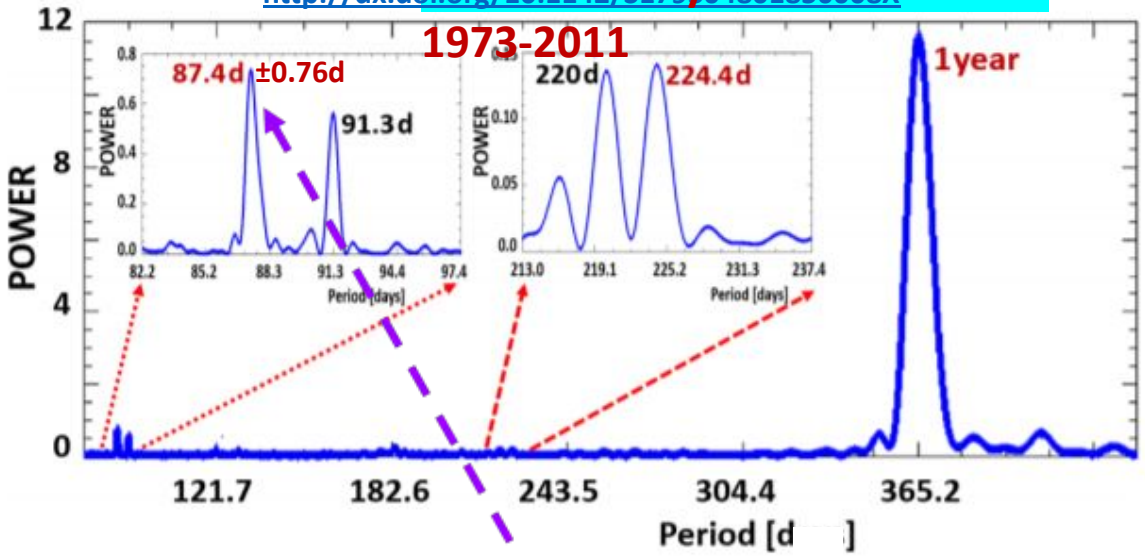
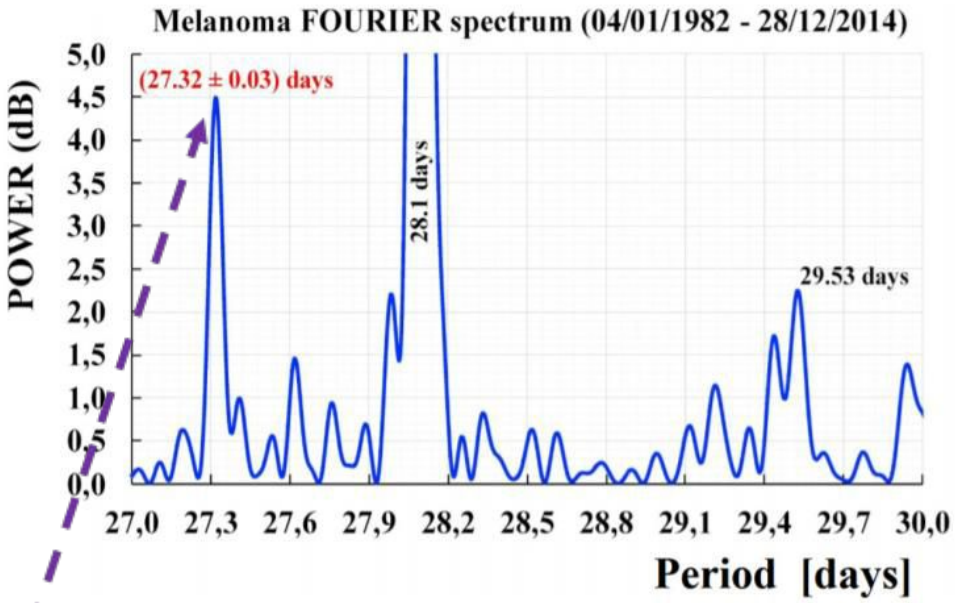
https://doi.org/10.1142/S1793048020500083

**USA <monthly> data 1973-2011** ⟷ **AUSTRALIA daily data 1982-2015**




87.97 days **@Mercury'sorbit**

**@Moon'sorbit** 27.32 days (sidereal)

=>fixed to remote stars

***Origin: exo-solar!***

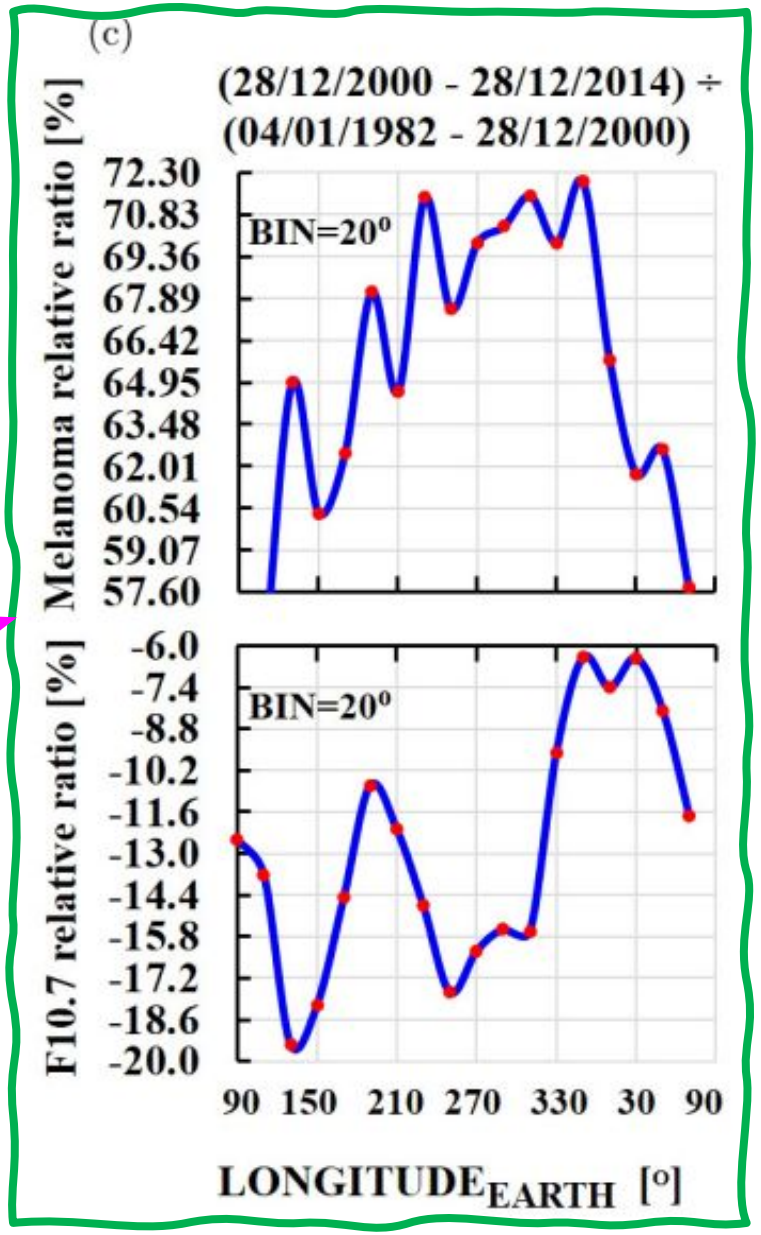
***Confirmed independently***

□ ***overlooked***!

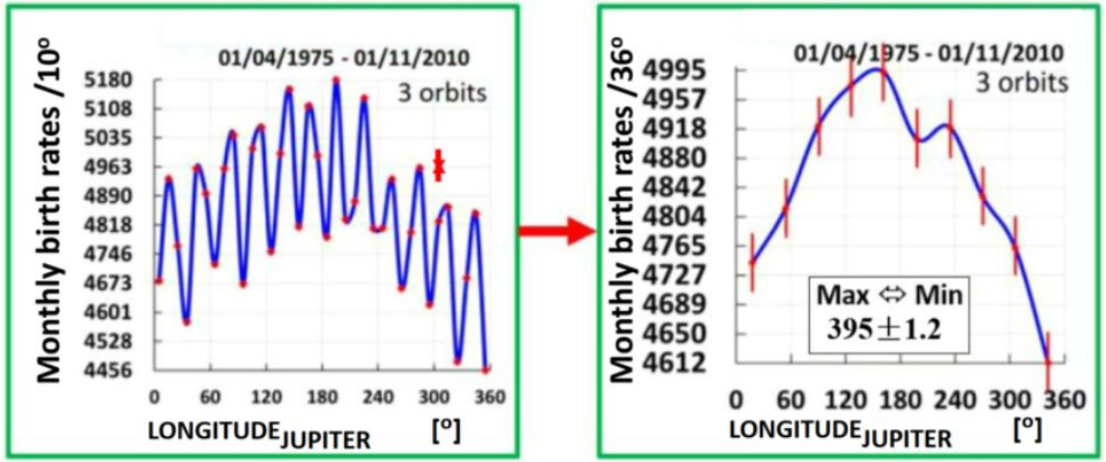
*https://doi.org/10.1142/S1793048019200029*

# The origin of the 27.3 d line:

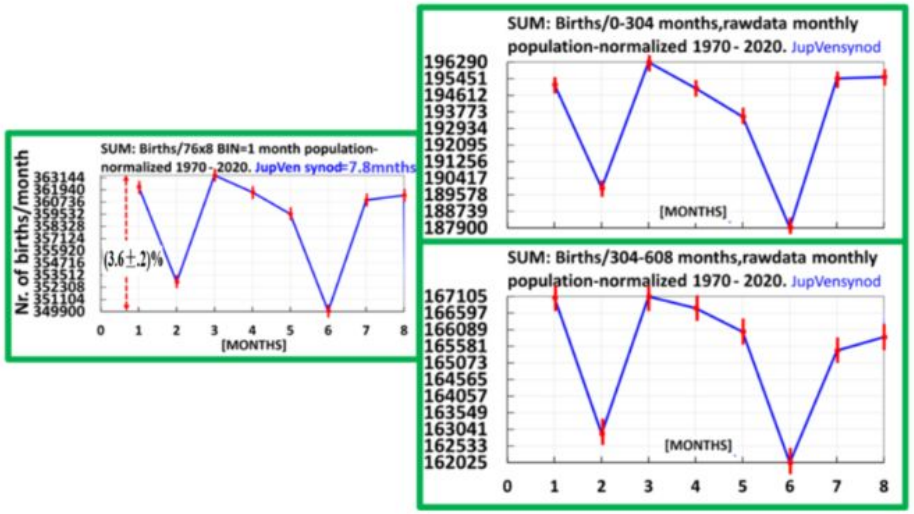
**NOT SOLAR**



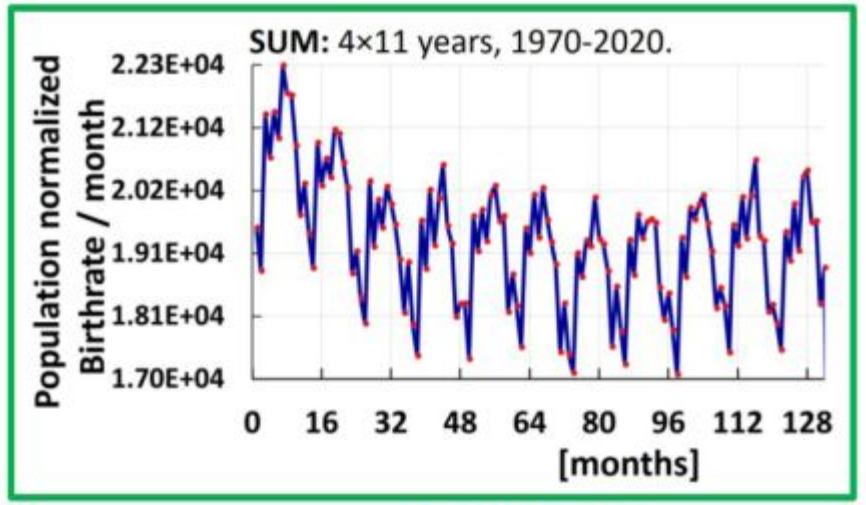

p.t.o.

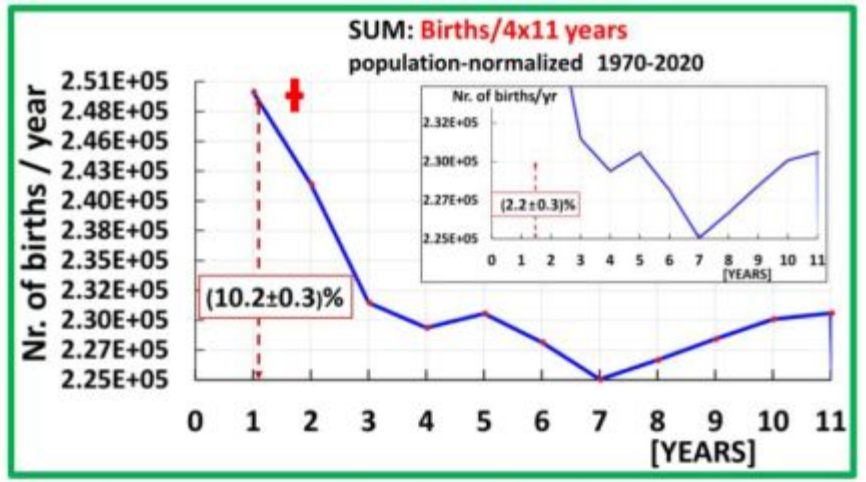



Population normalized birth rates for 3 complete Jupiter orbits, 1975-2010, without planetary constraints. (a) For BIN=10 o , the reproduced 12 annual oscillations during the ~12-year orbital period of Jupiter support the credibility of the applied analysis. The distribution has a maximum around the heliocentric longitude of ~180 o . The error bar (in red) is equal to ±2σ. (b) Using BIN=36 o , the associated averaging gives a much smoother distribution than the left plot. The estimated relative difference maximum-minimum of ~ (7.9±0.3) % is based only on the corresponding two extreme count rates; assuming Poisson distribution, it yields a statistical significance for the amplitude far above 5σ (=7.9/0.3 => 26 σ). The error bars (in red) are equal to ±3.8σ. The underlying number of births (about 250000 / BIN). To exclude possible artifacts, the 3 selected consecutive Jupiter orbits start at zero heliocentric longitude.




The 237 days Jupiter-Venus synod (= 7.8 months). Left: The complete time interval 1970-2020. The statistical significance only for the dip at 6 months, assuming Poisson distribution, is far above 5σ. Right: The spectral shape remains the same when using 2× half the time interval, or 2×304 months. The striking similarity between the two halves and that of the total distribution on the left excludes systematics. The monthly birth rates used are population normalized. The standard deviation for each of the 8 points is ~1.7‰ (left plot) and ~2.4‰ (right plots).




Upper panel: The summing-up of four times 132 consecutive monthly birth rates (=4× the 11 years solar cycle) starting January 1970. The maximum-minimum difference is 23.4%. Assuming Poisson statistics, the mean standard deviation is σ≈0.7%. The apparent annual modulation repeats 11 times being also supportive of the present analysis. Lower panel: The same distribution is shown with a much larger integrating time interval (BIN=1 year). The amplitude is (10.2 ± 0.3) % with a large statistical significance (>30σ). The error bar (in red) is equal to ±3σ. The region around the minimum at year 7 is shown expanded in the insert: comparing the dip in year 7 to the next two points on either side has a significance of above 5σ. The sum of the monthly birth rates is population-normalized.

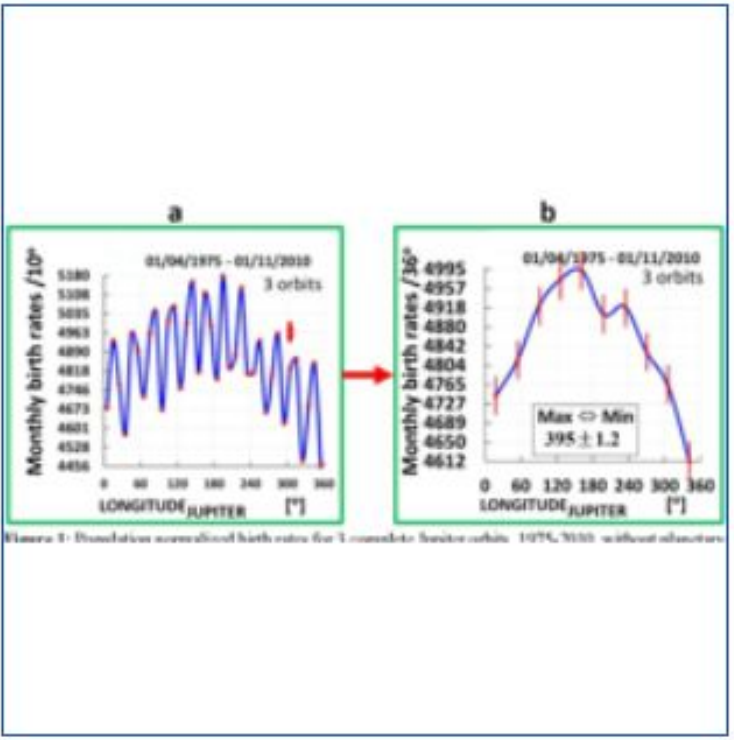



Figure 1

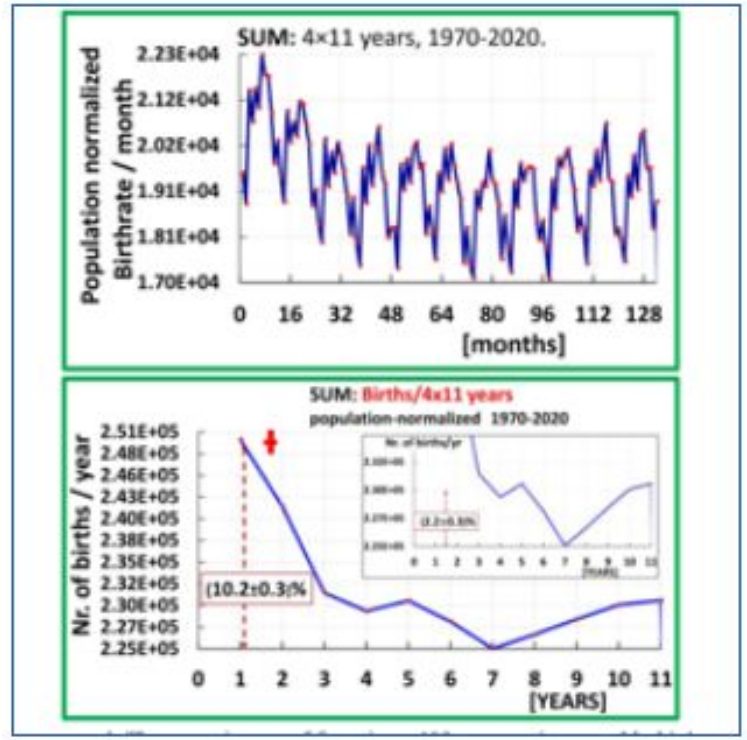



Figure 2

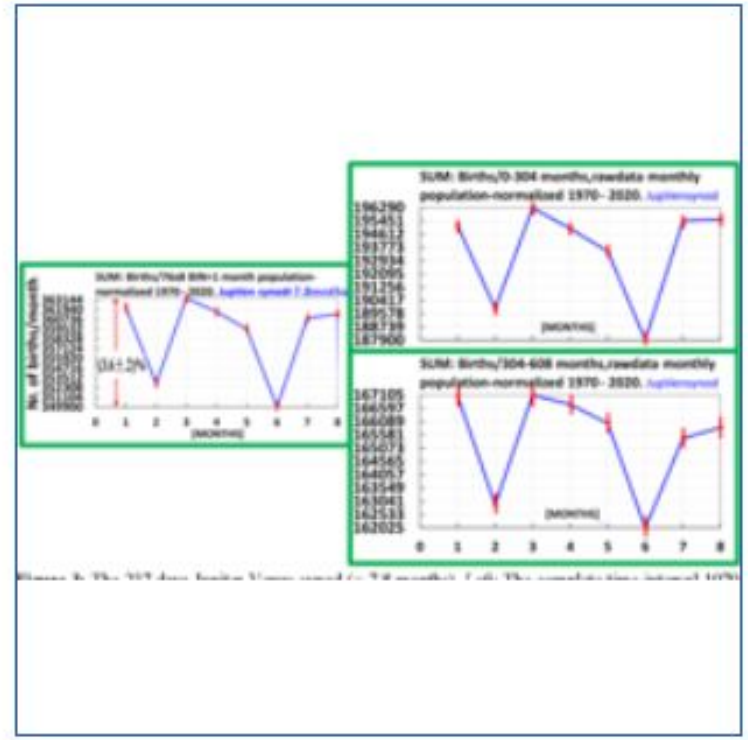


Figure 3

**TheDarkWorldisnotdark!**

THANK

YOU