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Correspondence:

nicola.scafetta@gmai.com

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The Giant Solar Flare Event of January 7, 2014 in Light of the Planetary Theory of Solar Variability[1]

Nicola Scafetta[a,b] and Nils-Axel Mörner[c]

[a]Active Cavity Radiometer Irradiance Monitor (ACRIM) Lab, Coronado, CA 92118, USA

[b]Duke University, Durham, NC 27708, USA

[c]Paleogeophysics & Geodynamics, Stockholm, Sweden

Abstract

On 7 January, 2014 at 18:32 GMT, the Sun unleashed a massive X1.2-class solar flare, seven times the size of the Earth (NASA News, 2014b). At the occasion there was a strict triple inferior conjunction of Jupiter, Earth and Venus with respect to the Sun. The strength of the tidal planetary forcing on the Sun proposed by Scafetta (2012) was at its maximum. Numerous major solar flare eruptions occurred when one or more tide-producing planets (Mercury, Venus, Earth, and Jupiter) were either nearly above the event positions or at the opposing side of the Sun (Hung, 2007). The finding is taken as a strong observational argument in favor of the planetary theory of solar variation introduced in 1856 by Wolf (1856), and recently discussed in the works of the Special Issue in PRP: Pattern in solar variability, their planetary origin and terrestrial impacts (Mörner et al., 2013).

Keywords: Giant solar flare; planetary forcing; planetary theory of solar variations

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1. The solar flare event on January 7, 2014

On 7 January 2014, the Sun unleashed a massive X1.2- class solar flare (Figure 1a) from sunspot active region AR1944 (peaking at 18:32GMT) that was also associated with a coronal mass ejection (CME) (NASA News, 2014a,b; Phys.org News, 2014a). X-class denotes the most intense flares, with this particular flare estimated to be seven times the size of Earth (Zolfagharifard, 2014). Large solar flares send out giant bursts of light and radiation due to the release of magnetic energy. Coronal mass ejections send huge clouds of solar material out into space. Both phenomena are known to impact Earth and are closely monitored. See NOAA's Space Weather Prediction Center (http://spaceweather.gov).

The giant solar flare of 7 January 2014 coincided with a strict rare triple inferior alignment of Venus, Earth and Jupiter with respect to the Sun (Figure 1b).

Figure 1c shows that the tidal planetary index on the Sun, as proposed by Scafetta (2012), was at its maximum during this flare event. The result is consistent with Scafetta and Willson (2013a,b), who showed that during solar maxima (currently the Sun is in the maximum of sunspot cycle 24) solar activity can be enhanced during Earth–Jupiter inferior conjunctions (occurring once every ~1.09 yr) and other planetary conjunctions. Both gravitational and/or electromagnetic

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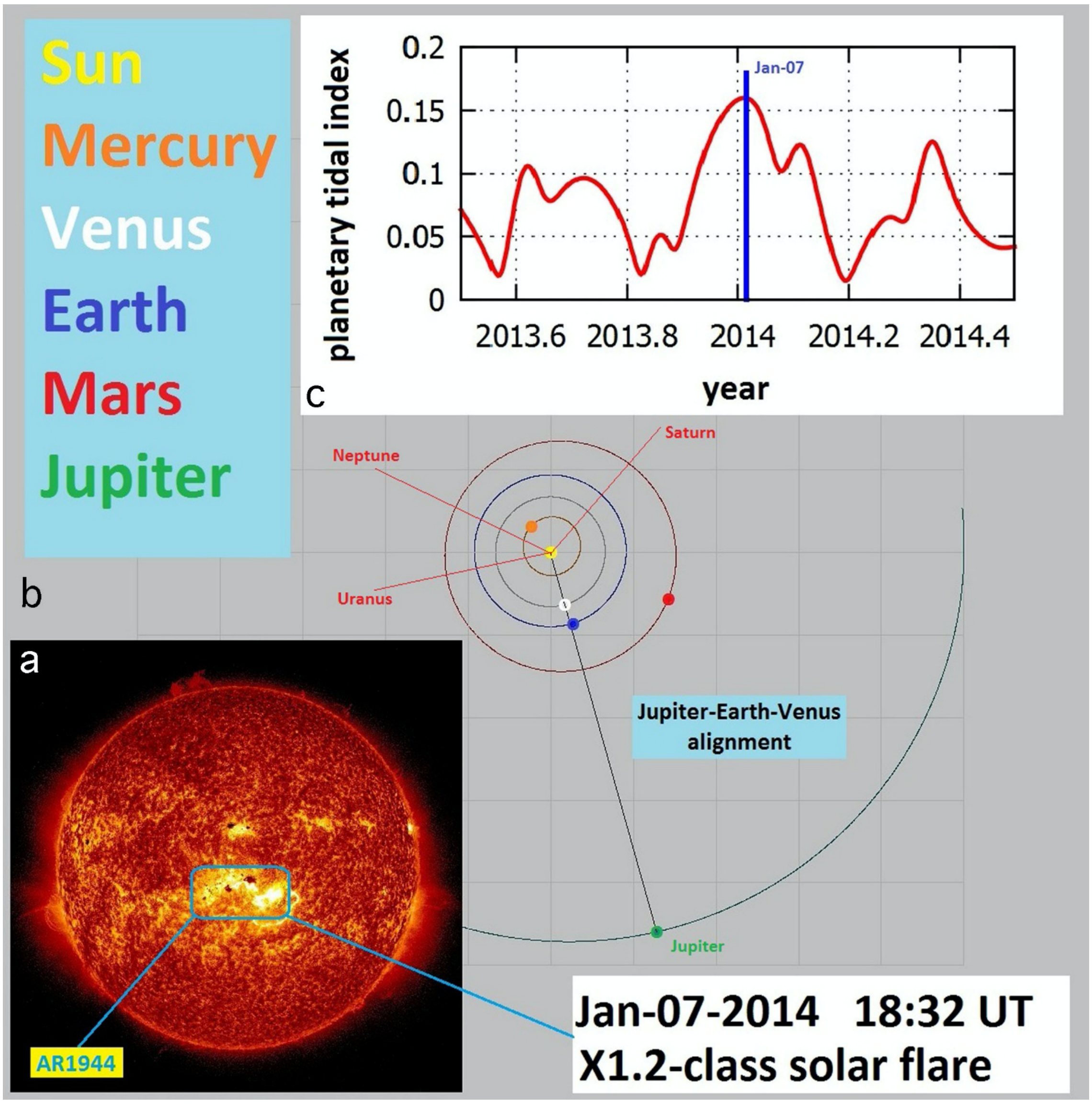

Figure 1: Sequence of events in early January, 2014. (a) On January 7, a giant solar flare of class X1.2 was emitted from the giant sunspot active region AR1944 (NASA News, 2014a,b). The solar flare pointed directly toward Earth. (b) at the same time, Venus, Earth and Jupiter lined up in a triple conjunction. (c) the planetary tidal index peaked during the same period as predicted in Scafetta (2012).

mechanisms may be involved in explaining a planetary–solar physical coupling (e.g., Scafetta, 2012; Scafetta and Willson, 2013a).

During the same period the Sun's distance from the solar system's centre of mass (CM) was about 0.5 SR (solar radius) and this was a local minimum (see figure 3C in Scafetta, 2014): thus, the Sun's CM radial acceleration was at a maximum value (ar ≈ 0.9 km/day^2).

The planetary configuration from 31 December 2013 to 11 January 2014 was peculiarly noteworthy because multiple planetary conjunctions with respect to the Sun took place within a few days of each other between the four major tidal rising planets. These are Mercury, Venus, Earth and Jupiter. During planetary conjunctions spring tides and other possible electromagnetic mechanisms focus on specific solar regions and their effect on the Sun could be greatly enhanced.

Let us summarize the sequence of events.

(a) On 31 December, 2013 there was a superior conjunction between Mercury and Jupiter:

the Mercury–Jupiter angular separation was ∼174.3°, the Venus–Jupiter angular separation was ∼11.5° and the Earth–Jupiter angular separation was ~4.9°. Significantly, late on 1 January 2014 an enormous sunspot, labeled AR1944, was observed over the Sun's left horizon (Phys.org News, 2014b), and a strong M9.9 solar flare erupted from sunspot AR1936 (The Watchers, 2014).

(b) On 5 January, 2014 there was a close inferior conjunction between Earth and Jupiter: the Earth–Jupiter angular separation was ~0.11°, the Mercury–Jupiter angular separation was ∼163.7°, the Venus–Jupiter angular separation was ~3.7°.

(c) On 7–8 January, 2014 there was a close inferior conjunction between Venus and Jupiter: the Venus–Jupiter angular separation was ∼1.5°, the Earth–Jupiter angular separation was ~2.0∘and the Mercury–Jupiter angular separation was ∼157.2°.

(d) On 10–11 January 2014 there was a close inferior conjunction between Venus and Earth that was also briefly discussed by Scafetta (2014): the Venus–Earth angular separation was ∼1.9°. The angular separation of Jupiter from Saturn, Uranus and Neptune was ~120.5°, ~94.1° and ~130.9°, respectively, and the CM was almost aligned with the Venus– Earth–Jupiter line (Fig. 1).

Interestingly, high solar flare activity was registered throughout the period between 31 December 2013 and 11 January 2014 during Mercury, Venus, Earth and Jupiter conjunctions.

2. Discussion and conclusions

The observed phenomenon is likely not a coincidence. In fact, at least twenty-five of a list of thirty-eight largest known solar flares were observed to start when one or more tide-producing planets (Mercury, Venus, Earth, and Jupiter) were either nearly above the event positions (less than 10° longitude) or at the opposing side of the Sun (Hung, 2007). Hung (2007) also estimated that the probability for this to happen at random is 0.039%, and concluded that *"the force or momentum balance (between the solar atmospheric pressure, the gravity field, and magnetic field) on plasma in the looping magnetic field lines in solar corona could be disturbed by tides, resulting in magnetic field reconnection, solar flares, and solar storms.*"

Although the timing of X-class solar flare events are also characterized by a stochastic nature (e.g. Grigolini et al., 2002) and significant flare activity can also occur at times when there are no planetary conjunctions, a general planetary modulation of solar activity also at short timescales is likely plausible according to detailed high-frequency spectral analysis results of several solar indexes (e.g., Bigg, 1967; Scafetta and Willson, 2013a,b; Shirley et al., 1990; Tan and Cheng, 2013; Wood, 1972).

In 1856, Wolf was the first to propose that the planets of the solar system could modulate solar activity. In particular, a correlation between the combined tidal index of Venus, Earth and Jupiter (period ∼11.07 yr) and the ∼11-year sunspot cycles has been known since the middle of the 20th century (Bendandi, 1931; Hung, 2007; Scafetta, 2012; Wilson, 2013).

The observed occurrence of significant solar flare activity concomitant with multiple close conjunctions among Mercury, Venus, Earth, and Jupiter is taken herein as a nice confirmation of the planetary theory of solar variation. Consequently, our result should be taken as a further step towards a new scientific paradigm stressing a physical coupling between the planet movement and the Sun (Mörner et al., 2013). Both gravitational and/or electromagnetic mechanisms may be involved in explaining this phenomenon.

The interaction between planetary beats and changes in solar activity has recently been addressed in a multi-authored volume (Mörner et al., 2013). In particular: Scafetta (2014) presented a general review of the scientific hypotheses about the complex planetary synchronization structure of the solar system since the seminal works of Copernicus and Kepler; Wilson (2013) presented a Venus–Earth– Jupiter spin–orbit coupling theory; Salvador (2013) used this model as a base for a mathematical model of the variations of the sunspot cycle over the past millennium.

In light of the present finding and of the referenced scientific literature, we agree with Charbonneau (2013) that the planetary hypothesis of solar variation needs to be reconsidered and properly developed.

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References

Bendandi, R. 1931: *Un Principio Fondamentale dell'Universo*. (S.T.E., Faenza, Italy).

Bigg, E. K. 1967: *Influence of the planet Mercury on sunspots*. Astronomical Journal 72, 463–466, doi:10.1086/110250.

Charbonneau, P. 2013: *Solar physics: the planetary hypothesis revived*. Nature 493, 613–614, doi:10.1038/493613a.

Grigolini P., Leddon, D. and Scafetta, N. 2002: *The Diffusion entropy and waiting time statistics of hard x-ray solar flare*s. Physical Review E 65, 046203, doi:10.1103/PhysRevE.65.046203.

Hung, C.-C. 2007: *Apparent Relations Between Solar Activity and Solar Tides Caused by the Planet*s. NASA report/TM- 2007214817, available at: http://ntrs.nasa.gov/search.jsp?R=20070025111.

Mörner, N.-A., Tattersall, R., and Solheim, J.-E.: *Preface: Pattern in solar variability, their planetary origin and terrestrial impacts.* Pattern Recogn. Phys., 1, 203–204, doi:10.5194/prp-1-203-2013, 2013. Republished in Science of Climate Change, Vol 5.2, https://doi.org/10.53234/scc202504/07. Individual papers of this Special Issue of Pattern Recognition in Physics are available in the same Vol.

NASA News: 2014a: *Sun unleashes first X-class flare of 2014*. Jan. 7, 2014a. Available at: http://svs.gsfc.nasa.gov/vis/a010000/a011100/a011136/

NASA News 2014b: *CME Accompanies X-class Flare*. Jan. 8, 2014. Available at: http://www.nasa.gov/content/goddard/sununleashes-first-x-class-flare-of-2014/#.UtAXiZ6J98E

Phys.org News 2014a: *Sun unleashes first X-class flare of 2014. Jan.7*. Available at: http://phys.org/news/2014-01-sununleashes-x-class-flare.html

Phys.org News: 2014 NASA's *SDO sees giant January sunspots.* Jan. 1, 2014. Available at: http://phys.org/news/2014-01nasa-sdo-giant-january-sunspots.html

Salvador, R. J. 2013: *A mathematical model of the sunspot cycle for the past 1000 yr*. Pattern Recogn. Phys., 1, 117–122, doi:10.5194/prp-1-117-2013.

Scafetta, N. 2012: *Does the Sun work as a nuclear fusion amplifier of planetary tidal forcing? A proposal for a physical mechanism based on the mass-luminosity relation*. J. Atmos. Sol.Terr. Phy., 81–82, 27–40, doi:10.1016/j.jastp.2012.04.002.

Scafetta, N. 2014*: The complex planetary synchronization structure of the solar system.* Pattern Recogn. Phys., 2, 1-19, doi:10.5194/prp-2-1-2014, https://doi.org/10.53234/scc202504/08

Scafetta, N. and Willson, R. C. 2013a: *Empirical evidences for a planetary modulation of total solar irradiance and the TSI signature of the 1.09 yr Earth-Jupiter conjunction cycle*. Astrophys. Space Sci., 348, 25–39, doi:10.1007/s10509013-1558-3.

Scafetta, N. and Willson, R. C. 2013b: *Multiscale comparative spectral analysis of satellite total solar irradiance measurements from 2003 to 2013 reveals a planetary modulation of solar activity and its nonlinear dependence on the 11 yr solar cycle*. Pattern Recogn. Phys., 1, 123–133, doi:10.5194/prp1-123-2013. https://doi.org/10.53234/scc202504/17

Shirley, J. H., Sperber, K. R., and Fairbridge, R. W. 1990: *Sun's internal motion and luminosity.* Solar Physics 127, 379–392, doi:10.1007/BF00152175.

Tan, B. and Cheng, Z. 2013: The mid-term and long-term solar quasiperiodic cycles and the possible relationship with planetary motions. Astrophys. Space Sci., 343, 511–521, doi:10.1007/s10509-012-1272-6 2013.

Tattersall, R. 2013: *Apparent relations between planetary spin, orbit, and solar differential rotation*. Pattern Recogn. Phys., 1, 199-202, doi:10.5194/prp-1-199-2013. https://doi.org/10.53234/scc202504/09

The Watchers 2014: *Strong M9.9 solar flare erupted from AR 1936*. Jan. 1, 2014. Available at: http://thewatchers.adorraeli.com/2014/01/01/strongm9-9-solar-flare-erupted-from-ar-1936/

Wilson, I. R. G. 2013: *The Venus–Earth–Jupiter spin–orbit coupling model*. Pattern Recogn. Phys., 1, 147–158, doi:10.5194/prp-1- 147-2013. https://doi.org/10.53234/scc202504/14

Wolf, R. 1859: *Extract of a letter to Mr. Carrington*, Mon. Not. R. Astron. Soc., 19, 85–86, 1859.

Wood, K. D. 1972: *Sunspots and planets*. Nature 240, 91–93, doi:10.1038/240091a0.

Zolfagharifard, E. 2014: *Sun unleashes massive solar flare seven times the size of the Earth – and it is so strong it's delayed an ISS rocket delivery*. MailOnline, Jan. 8. Available at: http://www.dailymail.co.uk/sciencetech/article2535952/Sun-unleashes-massive-solar-flare-SEVENtimes-size-Earth-strong-delayed-ISS-rocket-delivery.html