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Preface: Pattern in solar variability, their planetary origin and terrestrial impacts

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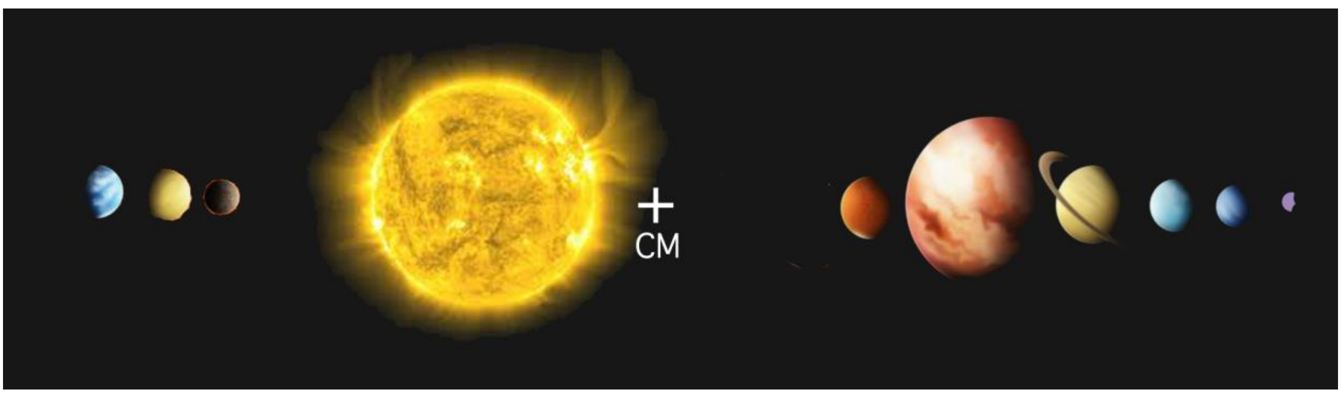

The idea that planetary effects may modulate or even control solar variability is old which was investigated by Rudolf Wolf from 1859 until his death in 1893. Many further efforts to measure and explain the possible mechanisms for planetary solar effects have been made by researchers at frequent intervals over the years. Despite this it has remained a hypothesis which is favoured by some and neglected or rebutted by others.

Today we are in a stronger position to address the question, with accurate data, computer aided methods and new insights. Therefore, we think the time is right for a broader and more extensive investigation into the question of "the possible planetary modulation of solar variability".

In this special issue of *Pattern Recognition in Physics*, we present a new, multi-component input to the question, with the aim of elevating the hypothesis to the status of a theory. We hope this work will lead to better understanding and prediction of solar and terrestrial variation, strengthening the scientific value and policy relevance of a promising new paradigm.

We consolidate this process with a collection of 12 independent papers:

1. "The complex planetary synchronization structure of the solar system"

   In this paper Nicola Scafetta reviews the "harmony" of the solar system from Kepler's basic concepts forward through time. It serves as an ideal introduction to the special issue. He ends by reviewing his own contribution to this question.

2. "The Hum: log-normal distribution of planetary–solar resonance"

   Roger Tattersall describes "the Hum" or the celestial sounds of orbital resonance. He demonstrates "the existence of strong correlations between orbital dynamics and solar variation" due to interactions between the power-law-based forces of gravity and magnetism and the interactions between both the Sun and planets as well as between the planets themselves.

3. “Energy transfer in the solar system”

   In this paper, Hans Jelbring addresses the energy transfer in the solar system. He notes that “the reversible transfer of energy between the orbit of Moon and Earth’s rotational energy is crucial to the creation of the 13.6-day and 27.3-day periods in both solar variables and Earth bound climate variables”.

4. “Planetary beat and solar–terrestrial responses”

   Nils-Axel Mörner reviews the planetary–solar interaction, the dual responses in solar activity (irradiance and solar wind), the multiple terrestrial changes induced, and the likelihood that we will soon be facing a new grand solar minimum with Little Ice Age climatic conditions.

5. “Signals from the planets, via the Sun to the Earth”

   By analysing terrestrial climatic and climatic-related variables, Jan-Erik Solheim is able to show that the observed variations must lead their origin in solar variations driven by the “stable periodic oscillations” of the planetary motions.

6. “Apparent relations between planetary spin, orbit, and solar differential rotation”

   In this paper, Roger Tattersall analyses the relations between changes in the Earth’s rate of rotation (LOD) and the spatio-temporal disposition of the planetary masses in the solar system, indicating an underlying physical coupling between the celestial bodies.

7. “Venus–Earth–Jupiter spin–orbit coupling model”

   Ian Wilson presents a spin–orbital coupling model and demonstrates that it “produces net tangential torques that act upon the outer convective layers of the Sun with periodicities that match many of the long-term cycles” observed in terrestrial records of cosmogenic nuclides.

8. “Celestial commensurabilities: some special cases”

   Hans Jelbring shows that planetary commensurability implies that “all celestial bodies in our solar system interact energetically”. Therefore, there must exist a physical process capable of transferring energy between celestial bodies (orbital energy) as well as between orbital energy and rotational energy.

9. “Responses of the basic cycle of 178.7 and 2402 yr in solar–terrestrial phenomena during Holocene”

   Ivanka Charvatova and Pavel Hejda address the solar inertial motions (SIM). They demonstrate that it is “a very noticeable” phenomenon, and identify it throughout the Holocene, well manifested in the well-known 179 yr cycle and a long-term regular cycle of 2402 years. They report a close correlation between SIM and solar–terrestrial interaction and changes in terrestrial climate.

10. “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”

    Nicola Scafetta and Richard Willson use a multiscale dynamical spectral analysis technique to study different solar irradiance data. “The observed periodicities are found highly coherent with the spring, orbital and synodic periods of Mercury, Venus, Earth and Jupiter”, indicating a planetary forcing on the Sun.

11. “The sunspot cycle length modulated by planets?”

    Jan-Erik Solheim addresses the relation between sunspot cycle length variations, climate and solar variability. The solar cycle length decreased during deep solar minima of the past millennium, and this is “expected to re-occur in the first part of this century”. In conclusion, he finds “a strong argument for an external forcing” upon the Sun by Venus, Earth, Jupiter and Saturn.

12. “A mathematical model of the sunspot cycle for the past 1000 yr”

    Rick Salvador formulates a mathematical model of the sunspot cycles and applies it on the records of the last millennium. The model can be used “to forecast future solar cycles quantitatively for 30 yr and directionally for 100 yr”, indicating “a solar minimum and quiet Sun for the next 30 to 100 yr”.

We end this Special Issue of PRP with a collective paper, co-authored by 19 persons:

13. “General conclusions regarding the planetary–solar–terrestrial interaction”

    Here all authors plus nine other prominent scientists join in the general conclusion that, indeed, the planetary beat affects the Sun and, by that, a number of terrestrial variables. This implies that the old hypothesis is now elevated to a firm theory, maybe even a new paradigm. A second implication of the material presented is that we are facing a new grand solar minimum, around 2030–2040, with severe climatic conditions as were the case during previous solar minima.

We hope you enjoy our efforts

Stockholm, Leeds and Baerum in October 2013