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THE DARK UNIVERSE IS NOT INVISIBLE

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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. Favoured candidates from the dark sector are the highly ionizing anti-quark nuggets, magnetic monopoles, but also particles like dark photons.

Keywords: dark matter; gravitational lensing; sun; Earth; exoplanetary systems

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1. Introduction

The detection of the constituents of dark matter (DM) is one of the central challenges in modern physics. The strongest evidence of DM comes from large scale observations, while direct and indirect searches are followed by a large number of experiments. The study of anomalous phenomena in physics has provided surprises. For example, the observation of an unexpected atmospheric ionization (1912) resulted to the discovery of cosmic rays [1]. The discovery of dark matter (DM) by Zwicky in 1933 [2] was due to gravitational discrepancies observed in large cosmological systems. The search for the direct detection of the putative DM constituents is ongoing since decades though without success. DM became synonymous with something which actually does not interact with ordinary matter, and more specifically that DM does not emit light.

In this work we point out a number of striking observations made in our neighborhood which contradict this picture of DM [3-5]. Relevant observations cover diverse mysterious phenomena, with the mostly striking ones being: the multifaceted solar activity, the dynamic Earth's atmosphere and diseases like melanoma [6]. The common new signature in all these studies is the observation of planetary relationships which are not expected within known physics. We recall that already as early as 1859 WOLF [7] suspected planetary influence at the origin of the otherwise still mysterious 11-year solar cycle, which is present in a plethora of phenomena; one is inclined to accept this as something obvious. However, it was concluded observationally [3-5] that planetary focusing effects by some type of low-speed invisible streaming matter could be behind of some observations. We recall that lensing effects even by the Sun is effective some 545 A.U. downstream.

It is worth mentioning here that planetary gravitational lensing effects by a planet is possible within the solar system by one solar body to another one, and most notably by the Sun itself. The reason is simply the fact that the gravitational deflection goes with $1/(\text{velocity})^2$ and streaming DM constituents with velocities around 10^{-3} c or eventually less, can get strongly influenced over distances typical for the inner solar system including the distance Moon-Earth [8,9]. In between, SOFUE [10] concluded that even the intrinsic Earth can gravitationally strongly enhance the flux of incident streams downstream on Earth's opposite surface; and this, in a velocity range up to about 400 km/s covering a large fraction of the expected one for DM. The work of ref. [10] expands the DM scenarios of planetary lensing effects [8,9] between solar system bodies including the Moon-Earth system. The flux enhancement by the Moon towards the Earth is about 10^4 #).

Notably, there is no known force which can explain remote planetary effects except the widely suspected gravitational tidal forces like those acting on Earth by the Moon. However, this tidal force is far too feeble to cause solar phenomena, with a strength weaker by a factor of about 10^{-12} [11]. However, the aforementioned planetary lensing effects of streaming DM constituents result in a seemingly remote interaction within our solar system. Following this mechanism, it is natural to expect planetary dependence of various phenoma which should not occur within conventional physics of forces associated with a solar system body. For this to happen requires streaming DM, which in addition must interact with ordinary matter with a much larger cross-section compared to the limits derived so far for DM axions and WIMPs. Meanwhile, DM particles with similar properties are being discussed in the literature; we mention as possible examples the theoretically motivated anti-quark nuggets (AQNs) [12] or other DM clusters, and eventually also magnetic monopoles. Following various observations, these types of particles, including also the hidden sector dark photons, remain as the favorites. Since 2017 ZHITNITSKY and collaborators have elaborated on the involvement of AQNs which might explain solar phenomena like the mysterious solar corona heating source [13], but also anomalous high energy events and other observations in space.

Thus, the planetary DM scenario is fitting-in already several observations, suggesting independently streaming DM in our neighboorhood. Interestingly, DM streams [14] or clusters [15] are also motivated cosmologically.

The common feature of a number of otherwise unexpected observations is their typical planetary relationship [3-5]; their manifestation is given by periodic rates of certain observables identical

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with fixed planetary orbital or synodic or other combined planetary periodicities. Therefore, to extend this approach in other observations, long time series of some measured observables are required. After several data analyses two developed analysis software codes are reliable, after a number of consistency tests.

Notably, the planetary scenario is totally different from the models based on tidal forces, which have been attempted with very little success since the discovery of the first large flare some 155 years ago [7]. However, it is worth stressing that there is no conventional explanation for a remote planetary interaction with Sun's or Earth's atmosphere, e.g., by gravitational tidal forces, since they are by far too weak [11]. Presently, we are making neither an assumption about the nature of the streaming invisible massive matter nor about its interaction with normal matter e.g., of the Sun or the Earth. Our goal is to find without bias the lensing and the existence of preferred direction(s). If this seminal idea holds, there will be ways to explore it further in the future, due to its apparent implications in ongoing dark matter searches.

In addition, the observation of a peaking planetary relationship excludes of itself any remote tidal forces, since their strength changes smoothly during an orbit [11]. Thus, in order to identify the origin of some signature possibly showing an 11-years rhythm, the search for a planetary relationship is essential. The driving idea behind this study is based on the gravitational focusing by the Sun and its planets of low-speed invisible (streaming) matter. Whatever its ultimate properties, it must interact somehow "strongly" with normal material like that of the upper atmosphere or the Sun's atmosphere in order to be able to cause the observed puzzling behaviour there. Occasionally, we refer to generic dark matter constituents as ''invisible massive matter'', in order to distinguish them from the widely addressed dark matter candidates like axions or WIMPs, which cannot have any noticeable atmospheric effect. Encouragingly, recent work discusses potential constituents from the dark sector [12,13] having a large cross-section with normal matter.

2. Experiments - Observations

A number of terrestrial and celestial observations have been analysed in previous work [3-5], which have shown that at least some solar and terrestrial observations follow planetary relationships. Most of these observations were already considered to be of unknown origin like the flaring Sun, the solar corona paradox or the anomalous annual stratospheric temperature excursions and atmospheric ionization around December. Remarkably, the latter coincides with the annual alignment [4] around 18th December of Earth, Sun and the galactic center, including occasionally also the Moon.

Notably, a planetary relationship has been observed also for melanoma incidence [16] which is a type of cancer of the skin. Interestingly, this first observation has been cross-checked independently (see ref. [17]). In spite of the first unfortunate interpretation, remarkably the Fourier analysis of the same dataset provided a clear peak at the orbital period of Mercury for a number of major cancer types. This is not surprising within the advocated invisible streaming matter scenario, given the inherent sensitivity of living matter to external influence. Moreover, recently, the analysis of a long series of daily melanoma incidence registered in Australia, provided a short periodicity of 27.3 days [6]. This rhythm coincides exactly with the Luna orbital period fixed to remote stars, which implies that its origin, whatever it ultimately is found to be, must be exo-solar in origin. The aforementioned invisible streaming matter scenario fits within this construct, since the Moon can focus DM constituents towards the Eearth with velocities up to about 400 km/s [10]; this covers a large portion of DM's velocity distribution peaking at about 250 km/s.

3. Results

Here we add two more solar observables [18]. The same analysis as before (section 2.) has been applied with daily measurements. The two solar observables are:

a) the elemental composition of Sun's atmosphere [19]. Surprisingly, the elemental composition in the corona and slow solar wind (A_c) is different than in the photosphere (A_P). Hence, the values A_c/A_P, provide the ratio of the coronal abundance to the photospheric abundance (A_p). This composition enhancement process is known as the FIP effect. Low first ionization potential (FIP) elements that are easy to ionize in the chromosphere are preferentially enhanced by factors of 3- to 4-fold, whereas high-FIP elements that remain neutral in the chromosphere retain their photospheric abundances. The variation of coronal composition is highly correlated with solar activity as it is given by the proxy of the solar F10.7 cm radio line [19]. The ratio of coronal to photospheric composition (Ac/Ap) increases from around 2.3 (2010) to close to 4 (2014). Irradiance measurements allowed to compute the daily averaged ratio of coronal to photospheric composition, or FIP bias (A_c/A_p), for the period between April 2010 and May 2014. A_c/A_p increases when solar activity picks up.

The observed solar composition problem becomes more puzzling with Figure 1a, which shows two peaking planetary relationships. Following conventional reasoning, these relationships should not be extant. The day of the elemental abundances (given by FIP/BIN in Figure 1a) is projected on the corresponding Earth's heliocentric orbital position and the other to that of Mercury being constrained by Venus' heliocentric orbital position between 20° and 140°. The observed peaking spectral shapes exclude on their own any long-range force [4,5] like the debated gravitational tidal forces, even though these are extremely feeble [11] and could not cause any visible impact like the present one.

b) the solar magnetic bright points (MBPs) [20]. The Sun shows a global magnetic field changing with the 11-year solar cycle. In addition, our host star also harbours small-scale magnetic fields often seen as strong concentrations of magnetic flux reaching kG field strengths. Figure 1b shows two planetary relationships using a decade long daily relative numbers of solar MBPs at the solar disc centre being projected in the frame of reference of Venus and Earth.

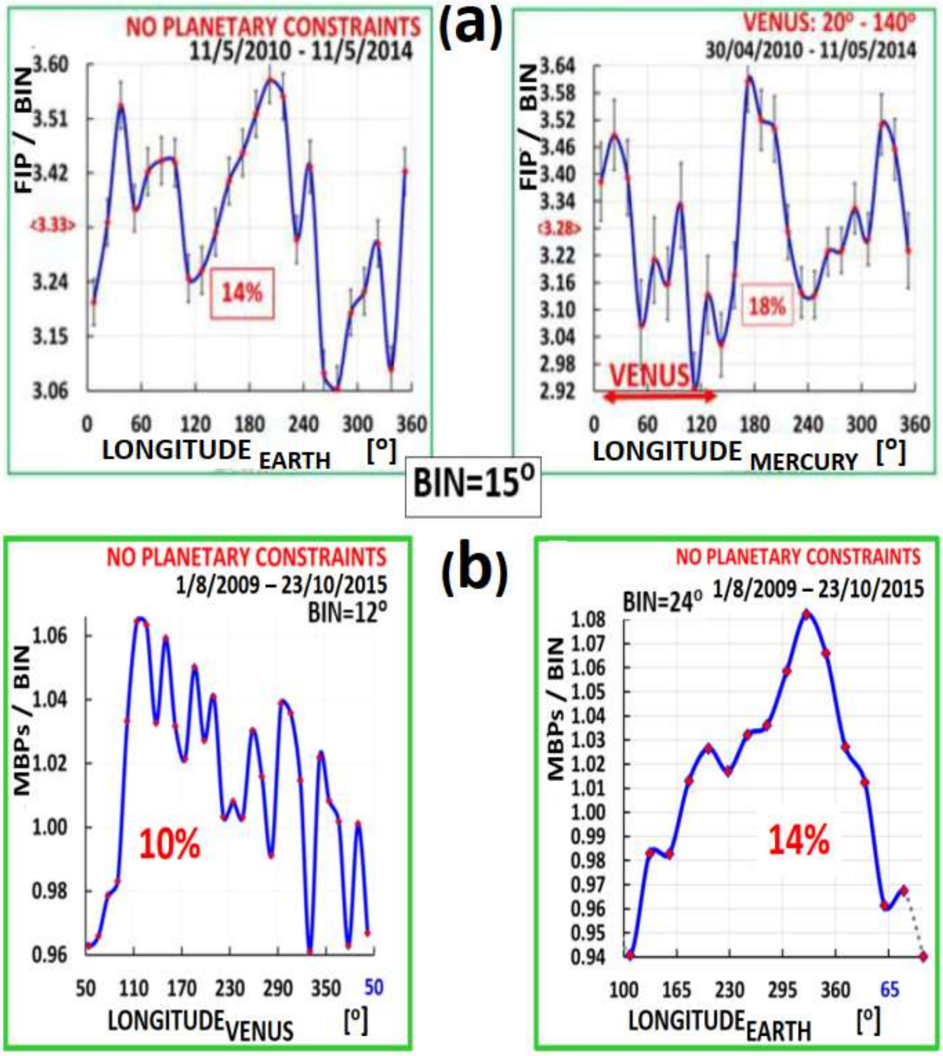

Figure 1. (a) The dependence of the coronal elemental composition [19] to the photospheric one (Ac/Ap), given here by FIP / BIN, is projected on heliocentric longitudes for the Earth (left) and the combined Mercury – Venus dependence (right). The relative min⇔ max amplitude is 14% and 18%, respectively. **(b)** The dependence of the relative Nr. of magnetic bright points (MBPs) [20] projected on heliocentric longitudes of Venus (left) and Earth (right). The estimated error per BIN is about 3.5% . This follows also from the rather smooth shape of the Earth's spectral shape (right). The relative min⇔ max amplitude is 10% and 14%.

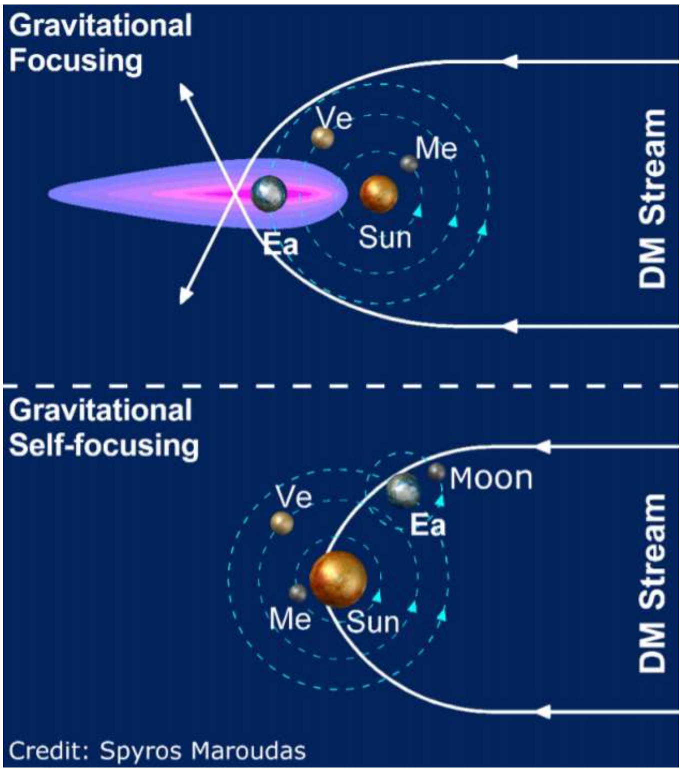

Figure 2. Schematic representation of gravitational (self-)focusing effects of DM streams by the Sun, Earth, Venus, Mercury and/or Moon. (Top) Gravitational focusing effect by the solar system. In this configuration, the galactic center is on the right side and in the opposite direction of the incident DM stream. (Bottom) The self-focusing effect of incident low speed streams reflects the dominating free fall towards the Sun; the flux enhancement increases with $(v_{\text{incident}} / v_{\text{escape}})^2$. The flux towards the Earth can also be gravitationally modulated by the intervening Moon [10].

4. Discussion

The detection of the constituents of dark matter is one of the central challenges in modern physics. The strongest evidence of DM comes from large scale cosmic observations, while direct searches have failed so far to provide convincing evidence of it. The large-scale observations suggest that the ordinary DM halo in the Galaxy is quite isotropic, at least for the size of the solar system; in literature, the co-existence of dark streams or the galactic dark disk hypothesis have also been considered [14,21]. The existence of DM streams could explain the puzzling behavior of the active Sun, where there is not yet a clear picture of its workings, e.g., phenomena like the solar flares and the unnaturally hot Corona (see e.g., [13] and ref [6] therein). In this work we refer occasionally to generic dark candidate constituents as ''invisible massive matter'', in order to distinguish them from ordinary dark matter like the celebrated axions and WIMPs.

Of note, the as yet unanswered intriguing question is as to whether the motor of the active Sun is entirely of an internal nature, or if it is triggered by some external influence. Here we follow the latter scenario, by assuming that the triggering mechanism is *at least partly* due to the planetary focusing of invisible massive matter stream(s) with a large interaction cross section with ordinary matter.

Furthermore, even if only a portion of the observed solar activity arises from the focusing of some DM streams by the outer planets, straightforward tests of this scenario should be possible. First, the direction of the inferred DM stream in the reference frame of our Galaxy could be compared with the stellar halo streams that are now being identified in the Gaia astrometry mission data. These are believed to arise from one or more ancient galaxy mergers with our own Milky Way, and which should carry with them the dark matter halos predicted by current cosmological models [22]. Second, the direction of such a hypothesised DM stream would presumably be fixed, in Galactic coordinates, over at least several tens of parsecs in our solar neighbourhood. Studying the time-dependency of the stellar activity of other exoplanet systems in our solar neighbourhood would then be expected to correlate with similar planetary focusing occurring in those systems also.

5. Conclusions

In this work, we have presented accumulating evidence of small-scale observations which show a planetary relationship. Remote planetary effect impact is extremely feeble and is excluded as the origin behind a plethora of diverse observations. A common viable scenario for such observations is that of the streaming invisible matter which undergoes planetary gravitationally focusing towards the Sun or the Earth, enormously enhancing the local flux of DM. This, combined with possible constituents from the dark sector with large interaction cross-section with ordinary material, can further amplify the impact of focused DM streams.

The suggested scenario follows from the present and previous work. Therefore, it seems reasonable to conclude that DM is occasionally visible, but it has been overlooked to this point, mainly due to the failed dedicated DM searches. Therefore, in future the strategy of direct DM searches should be changed. Of note, the favorite DM candidates are the Anti-Quark Nuggets, magnetic monopoles and dark photons from the hidden sector. Future experiments should turn their sensors towards such DM constituents.

Similarly, in other nearby exoplanetary systems focusing of DM streams could also occur, 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.

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