

Architecture of the Solar System and Earth placement into liveable zone around its Star

(by P.A.Semi, 2011)

● Stabilization of Earth Orbit

Orbit of planet Earth is stabilized by the resonance with planet Venus - they are of similar size and are in **dynamic stability**¹ around resonance frequency 13:8² [image 1, image 2]. If there is any instability in Planet's orbits (which really occur frequently due to tugs by outer planets, mostly by Jupiter), the planet gets too soon or late into the meeting-point and is attracted there (or bracketed from getting out of there sooner) by it's peer to "meet in time". Since orbital time determines orbital distance (due to Kepler laws), the fact, that the planets are forced to be "in time" forces them on a specific orbit. Also the "Day" (Spin) of Venus is locked into this cosmic "clock" - 12 Venus Days occur in 13 Venus Years, and every time both planets meet (in resonance stabilization points) the planet Venus shows (almost) the same face toward the planet Earth (I hereby conjecture, that this side of Venus is heavier than the other one). Same as with Moon (also tidally locked with planet Earth), there is some "wobble" (vibration) around the local minimum. Since orbit times may be altered much more easily than Planet spin time, the spin/orbit synchronization of the planet Venus stabilizes the planet Earth into the "livable" zone around the Sun. Without this stabilization, the Earth would follow the fate of Phaeton and Mars, which are (or have been) out-spiralling into the Jupiter-Saturn mill: Every time the Mars and Jupiter meet near, the Jupiter is attracting Mars "outside" toward it more strongly, than if they are on opposite sides of Sun, when Jupiter attracts Mars "inside" more weakly. Indeed, the Mars trajectory is one of the most chaotic ones in Solar system, only comparable with Pluto, which is influenced highly by its resonance with Neptune. For a magnetic planet, the Solar wind also repels ("blows out") planets toward outer orbits - on a billion-year scales this effect may not be negligible. Mars is orbiting very closely below the periodic trajectory of Jupiter-Saturn barycenter [image 3, image 4]. The Asteroid Belt is at the place, which is frequently swept by the J-S barycenter - hence a "Jupiter-Saturn Mill". Within some near time (probably of few (hundred) million years?) the Mars planet will out-spiral into this "Zone" and disintegrate like the previous small planets from this area, which now fill the Asteroid belt.

This way, the Planet Earth is also "protected" from outside - Jupiter and other large planets, and also the Asteroid Belt, catch many cometes and asteroids, which would otherwise be cycling Solar system that long time, until they get crashed into some planet - which would be Earth, if there were no more probable targets.

The Outer Planet System (J,S,U,N planets) is also in a resonant stabilization (5:2, 7:1, 14:1, 20:7, 40:7, 2:1) - being of comparable weight and attracting toward resonance meet points, so that they do not inspiral.

Although this double resonance of Earth and Venus looks very artificially, if it could happen randomly and is essential for an evolution of Life on the Planet (long-time stability of orbit), it largely diminishes the n_e parameter³ of Drake equation - function of probability, that there is another civilization in the galaxy, if they were random. [ref. Wiki-Drake]

● Solar activity cycles - magnetic linking with planet Earth

The planet Earth does not orbit on an ellipse, but rather an elliptic "tilde" trajectory - pulsing by Moon counterweight in and out - in the frequency, that is in a resonance with that level (latitude) of Sun, in which the Solar Magnetic Activity Cycle (Sunspot cycle) starts, which is then continuing for half of the cycle time toward the Solar equator. The Cycle comprises of two parts, one when Earth accelerates and other when it Decelerates. Opposite phenomena involve activity in both parts of the Cycle [image 9, 10]. The Sun does not rotate uniformly, but rather spins fast at equator (25 days) and slow at poles (36 days). The zone, that spins 29.5 days (392 nHz) [image 5] is in the middle latitudes - precisely where the Sunspot belt starts in a new Cycle [image 6]. The slowing of Solar poles is caused by magnetic bracketing by the largest structure in the Solar system - the Solar Wind. Unlike with the commonly used parable with the garden streamer, parts of the Solar wind do not travel directly out from the Sun in the direction at which they started (as do the water droplets in garden streamer), but the Solar wind is deflected in the direction of Solar Spin. Shortly behind Earth Orbit the angle gets more than 45° and the Voyager travelled into the region, where the outward velocity component completely disappeared and the Solar wind is moving only perpendicularly to the Sun... This encloses the Heliospheric Bubble. This Solar wind deflection is performed by polar magnetic field lines, which thereby slow down polar rotation rate, and they also mediate planetary magnetic influence (bracketing) to the Sun through Polar regions and SunSpots, rather than through the Equatorial belt...)

Why the planet Earth and not Jupiter? Most of all,

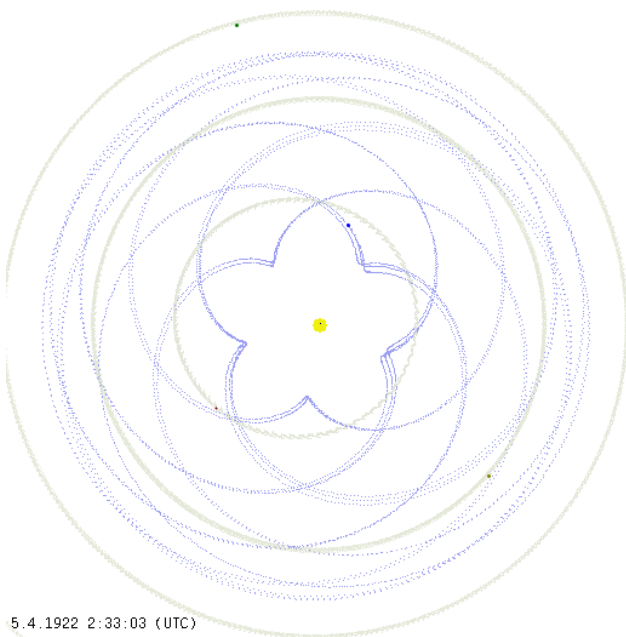
The Vibration of Planet Earth in resonant frequency with the Solar Spin by the counterweight of Moon, tuned to the Solar Spin, is re-charging the Earth's Magnetosphere...

Also due to the "cube-of-distance law", the force by the strong Jupiter onto Sun in vacuum would be about 100x stronger than the magnetic power of planet Earth - weaker but more near. But as the planets are moving in an interplanetary magnetic field (IMF) which is a conductor plasma, we measure approximately 100x stronger the magnetic field of Sun than it should be, if we have been orbiting in vacuum [ref. wiki]. That way, the magnetic force of Earth onto Sun is also 100x bigger than it would be in vacuum. This effect holds same for Jupiter, it would have also stronger influence than it had in a vacuum, but as it is more far and IMF is probably weaker conductor at those far reaches, and inflected into much steeper angle, this effect may be smaller than the Earth's... But mainly - there is a frequency issue: The "Jupiter Pulse" onto Sun is 12-year slow and stable growing and diminishing (as a Tide). Nothing near the frequency, in which the Sun spins. The Earth planet, on the other hand, is in resonant vibration with the Solar surface layers of middle latitudes. (A parable - waves resonant with the boat size may be much more influent than a slow tide.) The 22-year Solar Magnetic Cycle is in best resonance with the 22-year (also irregular) cycle in changes in Earth's orbital Angular momentum patterns (similar cycle exists in changes of Venus's orbital Angular momentum, but since Venus is magnetless and almost vibration-less (Venus with its conjectured mass assymetry radiates the Gravity vibration, which may resonate with the Jupiter fast pulse?), the planet Earth seems to be the cycle "Cause" instead) [image 7, image 8]. Another proof of this was the "delayed" start of SC24 - since SC23 started quite soon and so the start of SC24 had to wait to be back in sync with the Earth (and Venus?) influence(s). The cycle strength is further modulated by Jupiter Tidal effect by non-constant bracketing of polar-ward (meridian) flows, which influence the next-cycle strength [ref. K.Georgieva et al...]

We show the relation between changes of rate of changing Earth's angular momentum and some (not all) spikes on daily Sunspot numbers [image 9] and also in Solar wind parameters [image 10]. Formula is $Abs(Deriv(Deriv(VAngMoment(Emb))))$. The Sun is "accustomed" to slowly changing (growing or decreasing) influences by planets, but changes in the rate of changing (both starts and ends of accelerations or decelerations of magnetic Earth) cause eddies, which cause Sunspots, and they can be traced directly on Solar wind flow spikes [image 10]. The image also shows influence of Jupiter, Venus and Earth conjunctions and oppositions on the counts of Solar Wind electrons.

Remarks:

- *1 - "Dynamic stability" here means, that something is **vibrating** around some stable point (local minimum), which is in finally more stable than "sitting" in the stable point without moving... Earth is vibrating in Milankovitch cycles around the perfect resonance with Venus...
- *2 - The Earth-Venus resonance of 13:8 is of a best quality in the Solar system (0.6% from perfect), harmonic interval is Sexta minor...
- *3 - n_e = the average number of planets that can potentially support life per star that has planets



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Image 1 - trajectory of Barycenter between Earth and Venus planets, compared with Planet orbits.

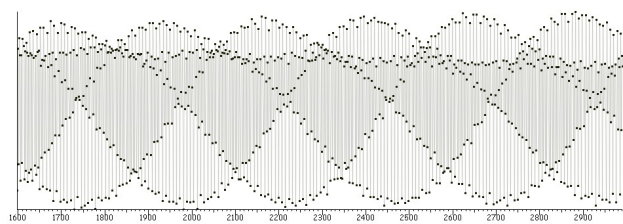


Image 2 - irregularities in the frequency of Earth and Venus meeting at the closest approach (Y axis spans 3.964135 - 3.964352 nHz, difference is 0.2 Earth-days (2919.5d - 2919.7d) and irregularities which are on the range of approximately 0.01 days) show, that there exist irregularities in planet movement, but on long term they are stabilized into a same wave pattern. (Data from DE406 ephemerides)

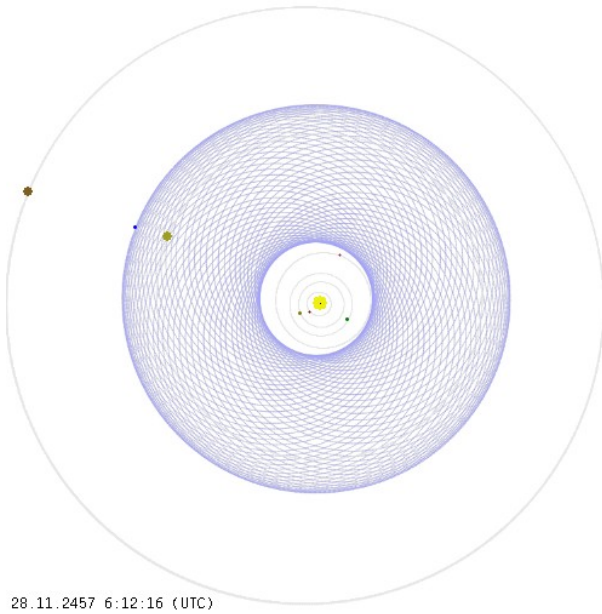


Image 3 - trajectory of Jupiter-Saturn barycenter compared with Planet orbits

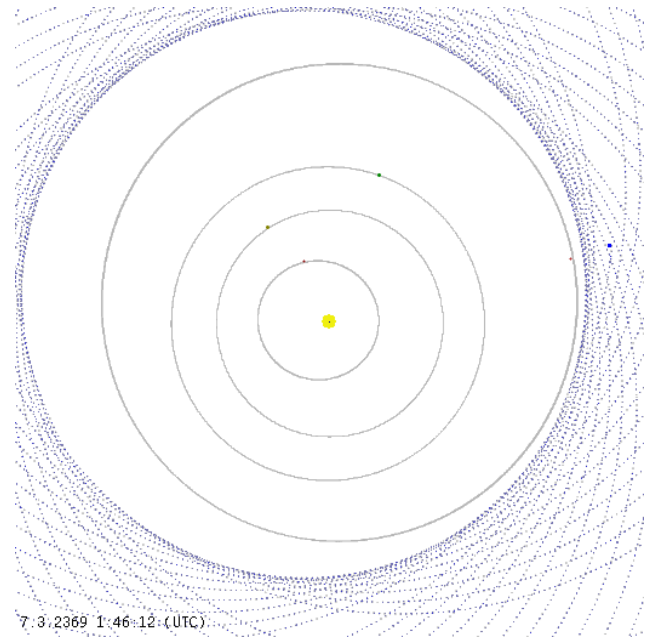


Image 4 - trajectory of Jupiter-Saturn barycenter compared with Planet orbits in detail

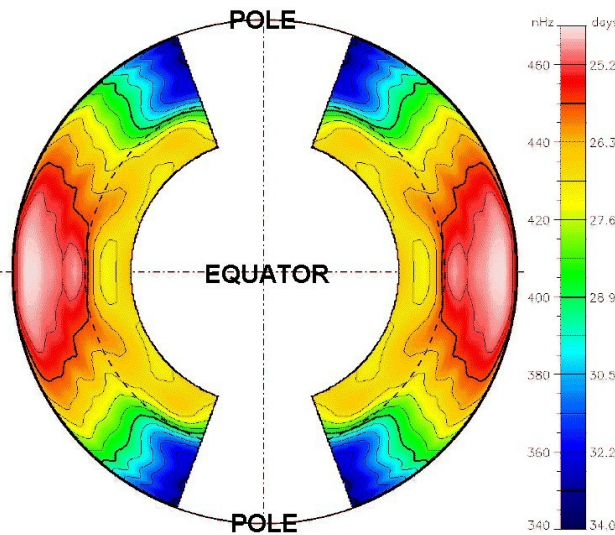


Image 5 - Solar internal rotation profile, image from (Surface Waves and Helioseismology, Solar physics at Marshall Space Flight Center) used without permission... [Ref MSFC.1]
The level, that is synchronized with Earth pulse is in blue-green color (392 nHz, 29.5 days)

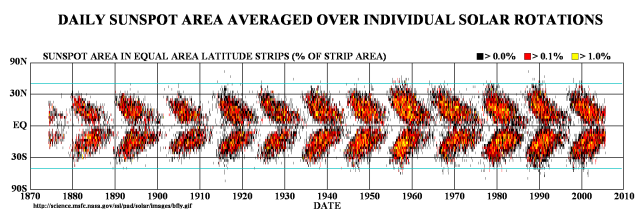


Image 6 - Butterfly diagram with a line, showing resonance zone with Earth pulse. (The image from Dr. David H. Hathaway, NASA/Marshall Space Flight Center, used without permission, with a modification.) [Ref MSFC.2]

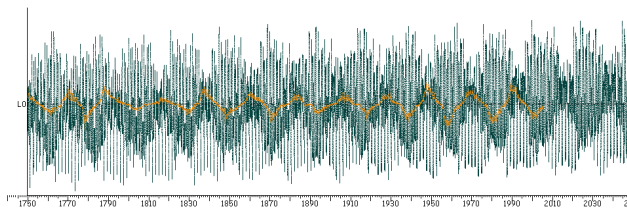


Image 7 - Sunspot cycle (22-year signed) compared with changing pattern of Earth orbital Angular momentum.

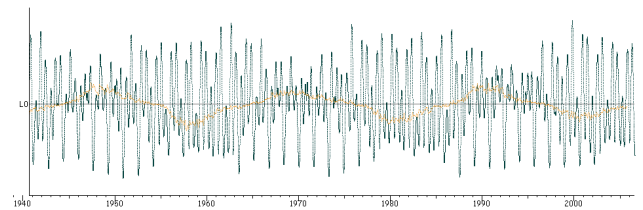


Image 8 - Sunspot cycle (22-year signed) compared with changing pattern in Earth orbital Angular momentum in detail.

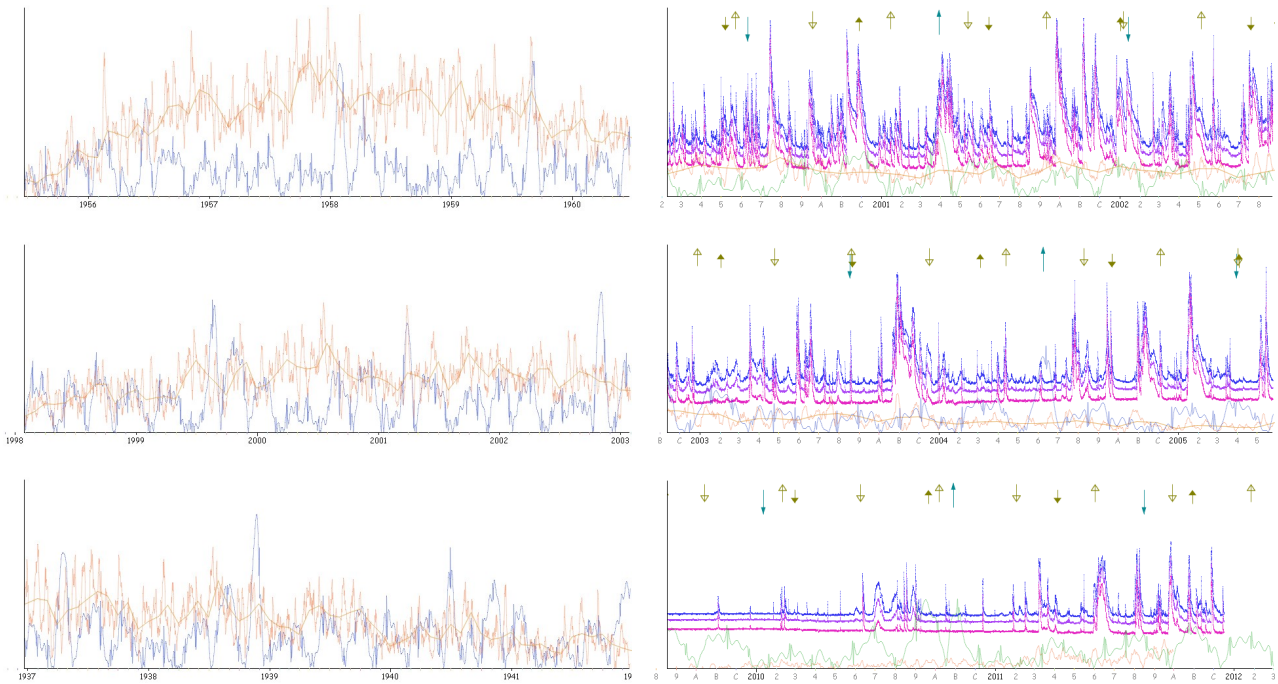


Image 9 - Changes in Earth Angular momentum (absolute value of 2nd derivative) compared with daily Sunspot counts

Image 10 - Planetary events (conjunctions and oppositions) of Earth, Venus, Jupiter, compared with electron counts from ACE mission [Ref. ACE.1] (in libration point outside of magnetosphere...) (using $\ln(\text{Value})$ from 3 of DE30 channels) . Blue or green line are changes in rate of change of Earth's angular momentum.

Wide olive arrows are for Jupiter, filled with Earth and open with Venus, thin green arrows are Earth-Venus. Up pointing arrows are conjunctions and down pointing arrows are oppositions.

References:

[ref. wiki] http://en.wikipedia.org/wiki/Interplanetary_magnetic_field and http://en.wikipedia.org/wiki/Heliospheric_current_sheet

[ref. wiki-Drake] http://en.wikipedia.org/wiki/Drake_equation

[ref. K.Georgieva et al...] PLANETARY TIDAL EFFECTS ON SOLAR ACTIVITY, K. Georgieva et al, 2009

[ref. MSFC 1] <http://solarscience.msfc.nasa.gov/Helioseismology.shtml>

[ref. MSFC 2] <http://solarscience.msfc.nasa.gov/SunspotCycle.shtml>

[ref. ACE 1] http://www.srl.caltech.edu/ACE/ASC/level2/epam_l2desc.html

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