# The Titius-Bode Law Once More

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**Abstract:** We do not reject the mainstream theory of the creation of the Solar System saying that its formation was due to the gravitational collapse of a region within a large molecular cloud about 4.6 Gyr ago. Indeed, the Sun and the outer shells of planets appeared due to such processes. But applying the Scale-Symmetric Theory (SST), we show that initially there was a modified black hole composed of neutron black holes that due to the inflows of the dark energy, via a supernova (there appeared other stars as well), transformed into the large molecular cloud and next into the Sun and outer shells of planets and dwarf planets. Moreover, we showed that the initial modified black hole created the planetary rings defined by the Titius-Bode Law (TBL) for the gravitational interactions - they transformed into the seeds of planets – this happened in the a few Gyr old Universe. The TBL for the gravitational interactions cannot be discredited due to the fact that it does not predict the Neptune orbit. The complete TBL for the nuclear strong interactions described within SST (SST shows that the core of baryons is a modified black hole in respect of the strong interactions), which is an analog to the TBL for the gravitational interactions, leads to an orbit that corresponds to the orbit of the planet Neptune. Both TBLs follow from the virtual processes near modified black holes of the same strength - it is because involved masses in gravitational TBL are about 61 powers of ten times higher than in nuclear-strong TBL. Deviations from predicted semi-major axes are from -5.6% for Mercury up to +5.3% for Neptune. According to gravitational TBL derived within SST, there are following planets or (dwarf planets): Mercury, Venus, Earth, Mars, (Ceres), Jupiter, Saturn, Uranus, Neptune and (Pluto) (theory of prime numbers leads to 10 planets/dwarf-planets defined by TBL). Because of high probability of destruction of the Titius-Bode orbits during the evolution of the modified black holes, the Solar System is unique in the Universe. Here we calculated the semi-major axes of listed planets/dwarf-planets from the initial conditions (for Earth we obtain 0.971 AU).

## 1. Introduction

Here, applying the Scale-Symmetric Theory (SST) [1], we described the mechanism of creation of the Solar System.

The SST shows that the succeeding phase transitions of the superluminal non-gravitating Higgs field during its inflation (the initial big bang) lead to the different scales of sizes/energies [1A]. Due to a few new symmetries, there consequently appear the

superluminal binary systems of closed strings (entanglons) responsible for the quantum entanglement (it is the quantum-entanglement scale), stable neutrinos and luminal neutrino-antineutrino pairs which are the components of the luminal gravitating Einstein spacetime (it is the Planck scale), cores of baryons (it is the electric-charge scale), and the cosmic-structures/protoworlds (it is the cosmological scale) that evolution leads to the dark matter, dark energy and expanding universes (the "soft" big bangs) [1A], [1B]. The electric-charge scale leads to the atom-like structure of baryons [1A].

According to SST, the General-Relativity (GR) black holes with singularity in their centres are not in existence [2], [1B]. But there are in existence the modified black holes composed of neutron black holes which contain orbit with spin speed equal to the speed of light in "vacuum" $c$ [2], [1B].

Among a thousand of calculated quantities within SST, which are consistent with experimental data, we calculated mass of neutron black hole ($m_{NBH}$ = 24.81 solar masses), the ratio $A_S$ / $B_S \approx 1.3898$ for the Titius-Bode Law for the nuclear strong interactions (TBLS) which is valid inside the baryons (SST shows that the core of baryons is a modified black hole in respect of the strong interactions) [1A]

$$R_S = A_S + d\, B_S\,, \tag{1}$$

where $d$ = 0, 1, 2, 4 and we showed that due to the four-neutrino symmetry, astronomical bodies can be entangled and number of entangled objects in a system is quantized [1B]

$$D_n = 4^{\mathrm{d}} \text{ (for single objects) or } = 2\cdot 4^{\mathrm{d}} \text{ (for binary systems)}, \tag{2}$$

where $d$ = 0, 1, 2, 4, 8,… = 0, $2^{\mathrm{n}}$, where n = 0, 1, 2, 3, 4, 5,…

**2. The upper limit for number of planets/dwarf-planets defined by TBL**

**Table 1** *Gravitational Titius-Bode Law within SST*

| Planet or (dwarf-planet) | Actual semi-major axis [AU] [3] | Gravitational TBL [AU] SST | Deviation [%] |
|---|---|---|---|
| **Mercury** | **0.387** | **0.410** | **–5.6** |
| **Venus** | **0.723** | **0.705** | **+2.6** |
| **Earth** | **1.000** | **1.000** | **±0.0** |
| **Mars** | **1.527** | **1.590** | **–4.0** |
| **(Ceres)** | **2.766** | **2.770** | **–0.1** |
| **Jupiter** | **5.203** | **5.130** | **+1.4** |
| **Saturn** | **9.539** | **9.850** | **–3.2** |
| **Uranus** | **19.191** | **19.290** | **–0.5** |
| **Neptune** | **30.061** | **28.535*** | **+5.3** |
| **(Pluto)** | **39.529** | **38.170** | **+3.6** |

*It follows from other interaction

The Titius-Bode Law for the gravitational interactions (TBLG) near the modified black holes should look similar to the TBLS but involved mass should be much bigger and the upper limit for the $d$ numbers can be different

$$R_G = A_G + d\, B_G\,, \tag{3}$$

where $d = 0, 1, 2, 4, 8, \ldots \equiv 0, 2^n$, where $n = 0, 1, 2, 3, 4, 5, \ldots$ and $A_G / B_G \approx 1.3898$ because strength of the fields near the core of baryons and modified gravitational black hole is the same. The best fit to the observational data we obtain for $A_G = 0.410$ AU and $B_G = 0.295$ AU (see Table 1).

The theory of prime numbers shows that the most numerous series of prime numbers that looks as an analog to the TBLG we can write as follows (physical laws are unique as the prime numbers so there should be some relations between them)

$$N = 5 + d\, 6\,, \tag{4}$$

where $d = 0, 1, 2, 4, 8, 16, 32, 64, 128 \equiv 0, 2^n$, where $n = 0, 1, 2, 3, 4, 5, 6, 7$. We obtain: $N = 5, 11, 17, 29, 53, 101, 197, 389$ and $773$ (9 prime numbers). So when we prove that there should be as well the Neptune orbit then we obtain 10 planets/dwarf-planets defined by the TBLG. The Neptune orbit can correspond to $N_{Neptune} = 577$ (it is the closest prime number to the mean $(389 + 773) / 2 = 581$) – it leads to:
$d_{Neptune} = [577 / \{(389 + 773) / 2\}] \cdot \{(64 + 128) / 2\} = 95.34$. We can see that upper limit for the $d$ numbers in formula (3) is $d_{Upper\text{-}limit} = 128$ – it corresponds to the dwarf planet Pluto.

**3. A nuclear analog to the Neptune orbit**

The dynamics in surrounding of modified gravitational black hole is similar to the dynamics for interior of baryons described within SST [1A]. On the orbit with spin speed equal to the $c$, there are created virtual bosons in baryons or virtual masses in modified gravitational black holes. The virtual masses are the objects composed of spheres with shifted mass density of the Einstein spacetime. Number of entangled spheres is defined by formula (2). They are embedded in bigger regions of Einstein spacetime with lowered mass density [4]. Ranges of virtual objects are inversely proportional to their masses so the symmetrical decays of the virtual masses in very high temperatures (it concerns the atomic nuclei as well) lead to the Titius-Bode Law for nuclear strong and gravitational interactions. Decays of the virtual masses at the Titius-Bode (TB) distances produce the TB orbits/tunnels in the grainy Einstein spacetime (i.e. produce tunnels with lower mass density than the mean value for the Einstein spacetime). It means that dust and gas, first of all, collect in such tunnels. Then such rings of gas and dust can transform into the seeds of planets/dwarf-planets.

Inflows of the dark energy into the modified black holes (MBH) [1A] caused their explosions along the polar jets. From ejected mass, among other things, were created stars. Finally, in centre of the MBH appeared a supernova and after its explosion the Sun. But we can see that the TB planet/dwarf-planet orbits were created much earlier in the early Universe. The explosions of MBHs were in direction perpendicular to the disc containing the TB orbits so some of the TB orbits could survive.

In the protons there can take place following phenomenon. In the $d = 1$ state (its radius is $A_S + B_S$), there are created the virtual bosons as a loops with a mass of $M_{S(+,-),d=1} \approx 423.04$ MeV [1A]. It means that in the $d = 1$ state there can appear the virtual nuclear weak mass of such boson: $M_{Weak} = \alpha_{w(proton)}\, M_{S(+,-),d=1} = 7.9205$ MeV, where $\alpha_{w(proton)} = 0.0187229$ (SST shows that a boson with a mass of $750.28$ MeV has a range $B_S$ i.e. $750.28 / 7.9205 = 94.73$) [1A]. The virtual weak mass creates a tunnel/loop in the Einstein spacetime with a

radius of $A_S + B_S + 94.73B_S = A + 95.73B$ i.e. $d = 95.73$ (it is outside the nuclear strong field of a proton) – this value is close to $d_{Neptune} = 95.34$ obtained within the theory of prime numbers. Notice that the mass $M_{Weak}$ is broadened so the tunnel/loop is broadened as well so we can assume that the SST leads to $d_{Neptune} = 95.34$ i.e. semi-major axis of Neptune should be close to $28.535$ AU.

**4. Cosmogony of the Solar System**

By studying the four-neutrino symmetry, we can see that a virtual pion can interact at maximum with $2 \cdot 4^{32}$ neutrinos (this is because of the long-distance quantum entanglement of the weak charges of neutrinos) each placed in another neutron black hole (NBH) [1B], [1A]. Firstly, we can say that our early Universe contained two loops each composed of $2 \cdot 4^{32}$ the NBHs [1B] and secondly that smaller structures in the Universe were the binary systems of protogalaxies which were composed of $2 \cdot 4^{16}$ the NBHs and having two cores – see formula (2) (for example M31 was created in such a manner).

Assume that a progenitor of the Solar System was a modified black hole composed of $4^4$ NBHs.

Using the formula for angular momentum we know that if the mass of the initial TB rings/orbits have changed very slowly over time then the evaporation of the progenitor of the Solar System (due to the inflows of the dark energy) caused the semi-major axes to increase inversely in proportion to the mass of the progenitor: $m_{ring}\, v_{ring}\, r_{ring} = const.$, since $m_{ring} = const.$ and $v_{ring} = (G\, M_{Progenitor} / r_{ring})^{1/2}$ then $M_{Progenitor}\, r_{ring} = const.$

$$M_{Progenitor\text{-}beginning} = 4^4\, m_{NBH} = 4^4 \cdot 4.935 \cdot 10^{31} \text{ kg} = 1.263 \cdot 10^{34} \text{ kg}, \tag{5}$$

whereas

$$M_{Progenitor\text{-}now} = M_{Sun} = 1.989 \cdot 10^{30} \text{ kg}. \tag{6}$$

The semi-major axes of the rings increased

$$f = M_{Progenitor\text{-}beginning} / M_{Sun} = 6350 \text{ times}. \tag{7}$$

At the beginning, the radius of the Mercury-ring, $R_{G,Mercury\text{-}beginning} = A_{G\text{-}beginning}$, was equal to

$$A_{G\text{-}beginning} = G\, M_{Progenitor\text{-}beginning} / c^2 = 9.379 \cdot 10^6 \text{ m}, \tag{8}$$

where $G = 6.67400 \cdot 10^{-11}$ m$^3$ kg$^{-1}$ s$^{-2}$ [1A], whereas now should be

$$A_{G\text{-}now} = f\, A_{G\text{-}beginning} = 5.956 \cdot 10^{10} \text{ m} = 0.398 \text{ AU}. \tag{9}$$

This value is very close to the actual semi-major axis of Mercury $0.387$ AU. For the semi-major axis of Earth is $R_{Earth\text{-}now} = A_{G\text{-}now} + 2\, B_{G\text{-}now} = 0.971$ AU, where $A_{G\text{-}now} / B_{G\text{-}now} = 1.3898$. We can see that deviation for the calculated value for Earth is $-2.9\%$ only.

Kuiper's belt is remnant of a supernova.

The Oort's cloud is remnant of the era of inflows of the dark energy into the NBHs (the era of big stars [1B]).

Following the era of the big stars, a supernova arose in the centre of the Solar System. After its explosion about 5 Gyr ago, the Sun was created. During the explosion of the supernova, the following transformations took place

Ni-56 → Co-56 → Fe-56.

Firstly, nickel-56 appeared because this nucleus is the proton-neutron symmetrical nucleus. Due to the neutron-proton pairing, such symmetry is always preferred during a very high temperature.

Because symmetrical decays (symmetrical fission) prefer very high temperatures then the following elements should be produced

Fe-56 → Si-28 → N-14 or C-14 → Li-7.

Formula (2) leads to nuclei containing 64 nucleons so their symmetrical decay lead to the development of the following nuclei

Ni-64 → S-32 → O-16 → Li-8 → He-4 → D-2 → H-1.

Because the half-period for C-14 is approximately six thousand years, today we should detect many C-12 atoms.

In regions having a high density of muons, symmetrical fusion of three nuclei was possible. This is possible because the condensate in centre of muon consists of three identical weak energies i.e. there are two neutrinos and a condensate that have the same energies [1A]. Because nucleons and He-4 were (and are) the most abundant of all, the probability of the production of T-3 and C-12 was very high.

Symmetrical fusion of two nuclei was also preferred because the neutral pions consist of two entangled photon loops that have the same energy [1A]. This leads, for example, to the following fusions

C-12 + C-12 → Mg-24.

We can say that muons and neutral pions are the catalysts for symmetrical fusions.

**5. Summary**

The Scale-Symmetric Theory shows that the Titius-Bode law for the Solar System is not a coincidence.

We showed that initially there was a modified black hole composed of neutron black holes that due to the inflows of the dark energy, via a supernova (there appeared other stars as well), transformed into the large molecular cloud and next into the Sun and outer shells of planets and dwarf planets.

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strong interactions), which is an analog to the TBL for the gravitational interactions, leads to an orbit that corresponds to the orbit of the planet Neptune.

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According to gravitational TBL derived within SST, there are following planets or (dwarf planets): Mercury, Venus, Earth, Mars, (Ceres), Jupiter, Saturn, Uranus, Neptune and (Pluto).

Because of high probability of destruction of the Titius-Bode orbits during the evolution of the modified black holes, the Solar System is unique in the Universe.

Obtained results are close to the observational data.

**References**

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