Interactions of the Dark-Matter Loops with Stars via Leptons Solve the Rotation Braking

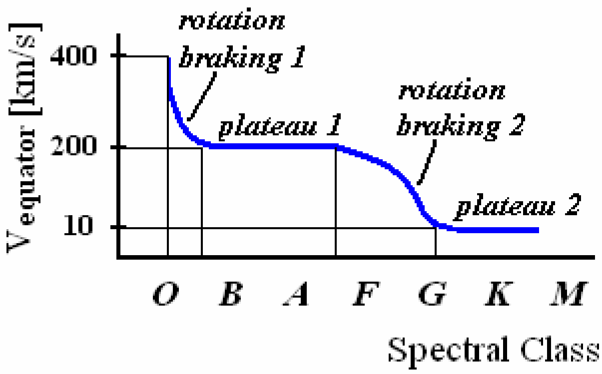
Sylwester Kornowski

Abstract: Here, applying the Scale-Symmetric Theory (SST), we described the origin of the two intervals of the rotation braking and two plateaus in the curve describing rotation velocity of the main-sequence normal stars as a function of the spectral classes. We did it involving the interactions of the dark-matter (DM) loops with the electron and proton vortices in stars. Calculated here the advection velocity of the proton vortex is about 414 km/s, of the electron vortex is about 10 km/s whereas the mean value is about 212 km/s. The threshold rotational velocities follow from the fact that in hottest stars, near equator, there dominate the light ions, next in colder stars there dominate the neutral light atoms, and next in coldest stars there are created heavier neutral atoms so gravity transfers the angular momentum to the cores of stars. We showed as well that the DM structures are perfectly elastic so it is very difficult to detect them. We answered following question: How should we plan an experiment to detect dark matter?

1. Introduction

The distribution of angular momentum among main-sequence normal stars shows that the stars at early spectral type O have rotational velocities higher than about 200 km/s up to about 400 km/s, next there is a plateau about 200 km/s at late O, all B and early A whereas at late A and especially at spectral type F, there is a significant decrease to about 10 km/s at $G0$ and next there appears the second plateau about 10 km/s for colder main-sequence normal stars [1], [2].

In literature, the derived value is given as $v_{equator}\sin i$ (or $vsini$), where $v_{equator}$ is the rotational velocity at the equator and i is the inclination i.e. the axis-of-rotation-of-star inclination to the line-of-sight of an observer on the Earth [3]. It means that if i is not a right angle, then the rotational velocity is greater than $vsini$. $Vsini$ is determined via measurements of widths of spectral lines. Inclination is not always known so $vsini$ gives a minimum value for the rotational velocity. Moreover, many additional phenomena cause that the main picture is distorted, for example, when different parts of a rotating main-sequence normal star move with different rates of rotation or due to transfer of angular momentum to formed planets (as it was in the solar system) or migration of starspots, and so on. Here we neglect the additional phenomena.



Rotational velocities of main-sequence normal stars

Here, applying the Scale-Symmetric Theory (SST) [4], we show that the interactions of the dark-matter (DM) loops with stars via leptons explain the appearance of the two plateaus and two intervals of rotation braking in the curve describing rotational velocities as a function of spectral classes.

The General Relativity leads to the non-gravitating Higgs field composed of tachyons [4A]. On the other hand, the Scale-Symmetric Theory shows that the succeeding phase transitions of such Higgs/inflation field lead to different scales of sizes/energies [4A]. 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) [4A], [4B].

The Scale-Symmetric Theory shows that the components of the Einstein spacetime, dark energy and dark matter are the same – they are the neutrino-antineutrino pairs [5]. The neutrinos in a pair carry opposite weak charges. Spins of neutrinos in a pair are parallel so its carry unitary spin. The pairs can be the carriers of the rotational energies i.e. they are the carriers of photons and gluons (photons behave as gluons in strong fields i.e. in fields with internal helicity) [4A]. The free neutrino-antineutrino pairs interact gravitationally only but they can be entangled and/or confined. But resultant weak charge of a pair is equal to zero whereas gravitational mass is very small (about $6.7 \cdot 10^{-67}$ kg [4A]) so a detection of the neutrino-antineutrino pairs is much difficult than the neutrinos. It is the reason that we still cannot detect them.

The dark-matter (DM) structures, which are composed of entangled non-rotating-spin neutrino-antineutrino pairs (it is the long-distance superluminal quantum entanglement via exchanges of the rotating entanglons/dark-photons [6], [7], [8]; involved energy is inversely proportional to distance of entangled pairs), were/are created due to motions of baryonic plasma [4A], [4B]. For example, rotating stars produce the DM loops/circles that via the weak condensates in centres of charged leptons can interact with protons in the stars.

The DM structures are perfectly elastic. It follows from the fact that according to SST, the neutrino-antineutrino pairs are moving with the speed of light c and their gravitational mass is invariant i.e. there cannot be any changes in their kinetic energy [4A]. But the expanding DM loops increase their angular momentum due to the increase in their size only (*angular momentum = mcr*, where for DM loops/circles is *mc = const.*) so they can decrease rotational velocity of stars interacting with them. We can see that due to the superluminal quantum entanglement of the changing size DM loops with visible matter, we must consider the galaxies or the Universe but even the whole Cosmos ([4B], [4A]) as a single system.

Can we measure the changes in angular momentum transferred to the expanded DM loops i.e. can we measure the disappearing angular momentum of visible matter? We should produce a vortex of plasma. Such vortex produces the DM circles whereas expanding vortex of plasma should transfer some part of angular momentum to the DM circles – their sizes should increase with increasing size of the plasma vortex because the visible vortex and the DM circles are entangled. We should measure the disappearing angular momentum of the visible vortex. Of course, energy of the exchanged entanglons/dark-photons can be tremendous (their energy is inversely proportional to distance of entangled particles) but they do not produce volumetric fields so they are invisible for detectors – it causes that in the quantum mechanics there appears the uncertainty principle [6].

Due to the interactions of the DM loops with electrically charged particles in stars, especially electrons and protons, there appears the advection of the particles. The speed of advection in a vortex we can calculate from formula derived within SST

$$v_{advection} = c\,(2\,\alpha_i\, m / m_o)^{1/2}, \tag{1}$$

where α_i is the coupling constant that represents the interactions of the DM loops with a vortex whereas m / m_o is the ratio of interacting mass to an upper limit for mass. Applying formula (1), we calculated the non-Newtonian orbital speeds of stars in galaxies, [9], the external radii of the accretion discs around the black holes, [10], and the illusory changes in the gravitational constant [11]. Value of α_i depends on type of interaction.

Here it is the coupling constant for the weak interactions via charged leptons. According to SST, such coupling constant is [4A]

$$\alpha_{w(electron-muon)} = 9.511082 \cdot 10^{-7}. \tag{2}$$

2. Calculations

Due to the advection and rotation of stars, near their equators can appear electron vortex or proton vortex or both vortices rotating in the same direction. It leads to conclusion that the m in formula (1) is the mass of electron $m_{electron}$ = 0.5109989 MeV or proton m_{proton} = 938.2725 MeV, [4A], whereas the upper limit m_o is the mass of proton.

The above remarks lead to following values for the stellar equatorial rotational velocities of the vortices caused by the advection

$$v_{advection,electron-vortex} = c\,(2\,\alpha_{w(electron-muon)}\, m_{electron} / m_{proton})^{1/2} = 9.65 \text{ km/s}, \tag{3a}$$

$$v_{advection,proton-vortex} = c\,(2\,\alpha_{w(electron-muon)}\, m_{proton} / m_{proton})^{1/2} = 413.48 \text{ km/s}. \tag{3b}$$

We can see that obtained results are close to the lower and upper limits for equatorial rotational velocities of main-sequence normal stars. Now we must motivate why there appear the two plateaus and two intervals of rotation braking. The explanation is as follows. In the early O (i.e. from $O0$ to $O5$) stars, there dominate the ions so, generally, due to the very high temperature, electrons are separated from protons and it causes that turbulent motions near the equator destroy the electron vortex (it has lower inertia than the proton vortex). It means that there dominates the proton vortex and the proton-vortex advection velocity. This and the below remarks lead to conclusion that for such stars, the rotational velocities should be from about 414 km/s down to 212 km/s – it is the first rotation braking. With decreasing temperature, there is more and more neutral helium so the electron vortex is stronger and stronger – it decreases the mean advection velocity. In the late O, all B, all A and early F main-sequence normal stars, there dominates the neutral helium and next the neutral hydrogen so electrons are not separated from protons so the mean rotational velocity should be close to the mean advection velocity for the electron and proton vortices i.e. should be close to about 212 km/s – it is the first plateau. In the late F, all G and all K main-sequence stars, there appear the neutral metals i.e. the heavier atoms, so due to gravity, the rapid rotation is transferred to the cores of stars (the proton vortex inspirals towards the core) – due to the law of conservation of angular momentum, the rotational velocities near the equators decrease. Due to very high temperature in the cores, there dominate the proton vortices so the inner advection velocities should be close to 414 km/s – it causes that near the equators, the rotational velocities are a few km/s. Such is the origin of the second rotation braking and the second plateau.

But what is the mechanism of creation of the heavier atomic nuclei? Notice that the second plateau starts from $G0$. Mass of such stars is close to the Chandrasekhar limit about 1.4 solar masses. The Scale-Symmetric Theory shows that for such mass, the transfer of energy from the core to surface of star is very efficient because of creation of the condensates that are in the centres of muons [12]. It causes that density of the core can increase so there is created more and more neutrons so more and more the heavier atomic nuclei also.

3. Summary

Here, applying the Scale-Symmetric Theory, we described the origin of the two intervals of the rotation braking and two plateaus in the curve describing rotation velocity of the main-sequence normal stars as a function of the spectral classes. We did it involving the interactions of the dark-matter loops with the electron and proton vortices in stars. Calculated here the advection velocity of the proton vortex is about 414 km/s, of the electron vortex is about 10 km/s whereas the mean value is about 212 km/s. The threshold rotational velocities follow from the fact that in hottest stars, near equator, there dominate the light ions, next in colder stars there dominate the neutral light atoms, and next in coldest stars there are created heavier neutral atoms (for example, metals) so gravity transfers the angular momentum to the cores of stars.

References

[1] McNally D. (1965). "The distribution of angular momentum among main sequence stars"
The Observatory **85**: 166–169

[2] Simone Daflon, *et al.* (October 2007). "The projected rotational velocity distribution of a sample of OB stars from a calibration based on synthetic He I lines"
The Astronomical Journal, **134**:1570–1578

[3] Shajn G., Struve O. (1929). “On the rotation of the stars”
Monthly Notices of the Royal Astronomical Society **89**: 222–239
[4] Sylwester Kornowski (2015). *Scale-Symmetric Theory*
[4A]: http://vixra.org/abs/1511.0188 (Particle Physics)
[4B]: http://vixra.org/abs/1511.0223 (Cosmology)
[5] Sylwester Kornowski (18 January 2016). “The Einstein-Spacetime, Dark-Energy and Dark-Matter Particle and the Higgs Boson”
http://vixra.org/abs/1502.0132
[6] Sylwester Kornowski (15 December 2015). “Quantum Physics in the Lacking Part of Ultimate Theory”
http://vixra.org/abs/1304.0043
[7] Sylwester Kornowski (19 January 2016). “Dark Photons, Information and Thoughts”
http://vixra.org/abs/1502.0250
[8] Sylwester Kornowski (23 January 2016). “The Superluminal Interpretation of Quantum Mechanics”
http://vixra.org/abs/1505.0124
[9] Sylwester Kornowski (11 January 2016). “The Dark-Matter Mechanism and Orbital Speeds of Stars in Galaxies”
http://vixra.org/abs/1410.0031
[10] Sylwester Kornowski (25 January 2016). “The Revised Theory of Black Holes and Accretion Discs”
http://vixra.org/abs/1508.0215
[11] Sylwester Kornowski (21 May 2016). “The Origin of the Illusory Periodic Changes in the Gravitational Constant”
http://vixra.org/abs/1605.0222
[12] Sylwester Kornowski (17 January 2016). “The Tower of the Chandrasekhar Limits and Spin Periods of Pulsars”
http://vixra.org/abs/1501.0213