

# The Three Dark-Matter Objects

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**Abstract:** This is a review article. We have described the properties of three dark-matter (DM) objects that result from the phase transitions of the Scale-Symmetric-Theory (SST) inflation field.

## 1. The initial conditions in the Scale-Symmetric Theory (SST) [1], [2], [3]

The SST starts from 16 initial conditions: 7 parameters, 5 symmetries and 4 very simple equations. The number of parameters in SST is 4 or more times smaller than in the Standard Model (SM). Contrary to SM, the SST includes gravity and gives much better results. The most important is the symmetry that defines the saturation of interactions via the SST tachyons – it says that when the smallest object built of the SST tachyons contains  $N = 0.6235764 \cdot 10^{20}$  tachyons then next bigger one contains  $N^2$  of tachyons, the next bigger one contains  $N^4$  of tachyons, and so on. Such symmetry leads to the fundamental phase transitions of the SST inflation field – there appear the superluminal binary systems of closed strings (the entanglons) which are responsible for the superluminal quantum entanglement of neutrinos, there appear neutrinos and neutrino-antineutrino pairs, the core of baryons, and the core of the Protoworld which evolution started the expansion of the Universe. The postulate about the duplication of shapes on different levels of Nature and the symmetry related to the saturation of interactions enforce the existence of three DM objects.

## 2. The difference between photons and elementary dark-matter (DM) objects

According to SST, due to the very strong short-distance quantum entanglement, the carriers of elementary photons (i.e. the spin-1 neutrino-antineutrino pairs) are the rigid objects so there do not appear any changes in distance between the two neutrinos in a pair. On the other hand, the speed  $c \approx 3 \cdot 10^8$  m/s is the natural speed of the photons in the two-component spacetime (there is the SST Higgs field and the SST Einstein spacetime). The unitary spins of the carriers of elementary photons can rotate – such rotational energy is the pure energy (i.e. the massless energy) of the carriers of elementary photons. The elementary photons can be entangled so they are the composite photons that we will call just photons.

There are two different arrangements of the unitary spins of the carriers of elementary photons i.e. of the neutrino-antineutrino pairs.

- A) Spin of each pair can be perpendicular to direction of its motion. Then spin can rotate around the direction of motion. Such scenario is characteristic for electric charges and electromagnetic interactions.
- B) Spin of each neutrino-antineutrino pair can be tangent to direction of its motion. Then spin cannot rotate around the direction of motion i.e. then the pairs cannot interact electromagnetically. Such scenario is characteristic for dark matter (DM) structures. Dark matter structures should not increase dynamic pressure of spacetime so the fundamental DM structure should be a circle-like loop composed of neutrinos (more precisely: of the neutrino-antineutrino pairs) with spins tangent to the DM loop.

### 3. The three dark-matter objects

SST shows that Nature is trying to duplicate the shapes on larger and larger scales [1].

#### 3.1 The fundamental DM loop

In SST, there appears the fundamental closed string built of  $N$  tachyons – interactions of such strings with the SST Higgs field lead to the electric charge [1] so we can assume that a fundamental DM structure (i.e. DM loop) should consist of the entangled  $N$  lightest neutrinos. Mass of all such DM loops is *invariant* and is

$$M_{\text{DM-loop}} = N m_{\text{Neutrino}} = 2.0796 \cdot 10^{-47} \text{ kg} \approx 1.2 \cdot 10^{-11} \text{ eV} , \quad (1)$$

where  $m_{\text{Neutrino}} = 3.3349306 \cdot 10^{-67} \text{ kg}$  is the gravitational-inertial mass of the non-rotating-spin lightest neutrino [1].

Such DM loops can increase or decrease their angular momentum so they can have different radii but emphasize once more that their mass is invariant. The smallest radius of DM loop is  $R_{\text{DM-loop,lower-limit}} = 0.23248 \text{ fm}$  and follows from the shortest-distance quantum entanglement of neutrinos [1].

The DM loops can interact gravitationally so there appears the gravitational lensing caused by distributions of the DM loops (very often they have cosmic sizes). The DM loops can interact with charged leptons and hadrons via the virtual electron-positron pairs – it leads to the correct orbital speeds of stars in halos of spiral galaxies [4].

Experiments aimed at detecting the DM loops should be based on changes in their angular momentum. We should concentrate on the angular-momentum transfer between the spinning plasma and the DM loops (the direct observation of the DM loops is very difficult) – we should observe a disappearance of some part of angular momentum of the spinning plasma.

#### 3.2 The DM tori/particles

SST shows that due to the fundamental phase transitions there appear the fundamental tori – they are the kernel of such theory because tori are the simplest objects that can have internal helicity – it leads to symmetry breaking in the weak interactions.

The postulate about the duplication of shapes on different levels of Nature and the symmetry related to the saturation of interactions enforce the existence of a DM torus/particle made of  $N$  entangled DM loops. Mass of such DM torus/loop should be [3]

$$M_{\text{DM-torus/particle}} = N M_{\text{DM-loop}} = 1.2968 \cdot 10^{-27} \text{ kg} \approx 727.43 \text{ MeV} . \quad (2)$$

The equatorial radius of such DM torus/particle is  $A = 0.6974425 \text{ fm}$ . The DM loops are entangled on the equator. From the short-distance quantum entanglement, which is quantized,

results that then the equatorial radius is equal to  $A$ . The DM torus/particle is the spin-0 particle but it has a distinguished direction because the poloidal speed of the torus is equal to  $c$  – it causes that the DM torus/particle produces a half-jet in the SST Einstein spacetime. The DM torus/particle behaves as a monopole. But abundance of such DM tori/particles in the observed Universe is practically equal to zero – see Paragraph 3.3.

### 3.3 The DM core of the Protoworld

The mass and radius of the DM torus/particle are appropriate to form the stable DM core of the Protoworld, the evolution of which led to the expansion of the Universe [3], [1]. Mass of the DM core of the Protoworld was [3]

$$M_{\text{DM-core-of-Protoworld}} = N^4 M_{\text{DM-torus/particle}} = 1.9608 \cdot 10^{52} \text{ kg} . \quad (3)$$

The equatorial radius of such DM core of the Protoworld was  $R_{\text{Core-Protoworld}} \approx 0.287 \text{ Gly}$  [3].

The DM tori/particles in the DM core of the Protoworld were entangled. The total energy of the entanglement of the DM tori/particles and the DM loops in the DM tori/particles was equal to the non-gravitating energy frozen in each lightest neutrino [3]. We can see that creation of a new neutrino caused that the DM core of the Protoworld decayed into the DM loops – it is the reason that abundance of the DM tori/particles (magnetic monopoles) is in the Universe practically equal to zero.

Our Universe is one of many in the inner Cosmos [5]. The radius of our Universe is  $\sim 21 \text{ Gly}$  [5] and it is the cyclic universe. This means that the dark matter in the form of the DM loops cyclically condenses in the centre of our Universe. The weak interactions of such DM condensate with a lightest neutrino (via the virtual electron-positron pairs) causes that such a system transforms into the DM core of the Protoworld.

Emphasize that the non-gravitating energy frozen inside each neutrino is  $\sim 0.6 \cdot 10^{119}$  times higher than its gravitational-inertial mass [1] and such non-gravitating energy is equivalent to the gravitational mass of the DM core of the Protoworld! It is this equivalence that is the trigger for the formation of the DM core of the Protoworld, and after some time on the cosmic scale, it is the trigger for its decay into the DM loops.

## 4. Summary

Here we described properties of the three DM structures: the DM loops, the DM tori/particles (magnetic monopoles), and the DM core of the Protoworld.

Due to the evolution of the DM core of the Protoworld, today we can experimentally investigate (directly and indirectly) only the DM loops.

## References

- [1] Sylwester Kornowski (25 September 2020). “Foundations of the Scale-Symmetric Physics (Main Article No 1: Particle Physics)”  
<http://vixra.org/abs/1511.0188>
- [2] Sylwester Kornowski (29 May 2017). “Initial Conditions for Theory of Everything”  
<http://vixra.org/abs/1705.0176>
- [3] Sylwester Kornowski (14 February 2019). “Foundations of the Scale-Symmetric Physics (Main Article No 2: Cosmology)”  
<http://vixra.org/abs/1511.0223>
- [4] Sylwester Kornowski (18 June 2016). “The Dark-Matter Mechanism and Orbital Speeds of Stars in Galaxies”  
<http://vixra.org/abs/1410.0031>

- [5] Sylwester Kornowski (22 March 2020). "Cosmology in Crisis"  
<http://vixra.org/abs/2003.0287>