The informational physical model: detection of dark matter particles

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Abstract In the paper dark matter particles detection problem is considered in framework of the Planck scale informational physical model. It is shown that the detection practically for sure is impossible.

Key words: Planck scale physics; cosmology; quantum mechanics; particles; antiparticles; fundamental Nature forces; Gravity; dark matter; dark matter particles detection; cosmological inflation

1. Introduction

Attempts to detect dark matter [DM] particles were, and are, rather numerous (see, e.g. [1], and references therein), however till now only some limits for the corresponding cross-sections are obtained. At that in the attempts it is assumed that DM particles interact by fundamental Nature Weak force, despite that till now only gravitational interaction of DM and ordinary matter is observed.

This problem is really fundamental one, so it looks as it is worthwhile to be considered in framework of the Planck scale physical model [2], [3], where, first of all, initial Planck scale model of particles [mostly [2], and fundamental Nature, including Gravity, forces are developed [3].

In the model, in accordance with some of really utmost fundamental in XX century von Weizsäcker [4], [5] and Fredkin-Toffoli [6] findings, it is postulated that Matter is based on a binary reversible logics, and so the ultimate and utmost universal base of Matter is [5]4D dense lattice of primary elementary logical structures – binary reversible fundamental logical elements [FLE] that have [5]4 utmost universal – "kinematical" - degreases of freedom at changing its state – "FLE binary flip"

The lattice is placed in the corresponding Matter's utmost universal fundamentally absolute, fundamentally flat, fundamentally continuous, and fundamentally "Cartesian", [5]4D spacetime with metrics ($c\tau,X,Y,Z,ct$), where $c\tau,X,Y,Z,$ are 4 space dimensions, ct is the time dimension. FLE "size" and "FLE binary flip time" are Planck length, l_P, and Planck time, t_P.

Besides the utmost universal "kinematical" space dimensions above, the space contains also at least 4 dimensions that relate to 4 specific FLE degreases of freedom to change its state [to be "charged" by a Force] that relate to the at least 4 known now fundamental Nature Gravity, Weak, Electric, and Nuclear/Strong forces [more see [3], section 6. "Mediation of the fundamental forces in complex systems"], so FLE has (at least) 4+4+1 degreases of freedom, and so whole Matter's spacetime fundamentally absolute, fundamentally flat, fundamentally continuous, and fundamentally "Cartesian", spacetime that has metrics (at least) [4+4+1]4D ($c\tau,X,Y,Z, g,w,e,s,ct$).

At that everything in Matter, including particles, is/are some specific disturbances in the lattice. Particles are specific cyclic disturbances/cyclic algorithms that run on FLE hardware that are created if a lattice FLE is impacted with transmission to it some at least 4D ($c\tau,X,Y,Z,ct$), momentum $\boldsymbol{P}$, what cause in the lattice – and so in the spacetime - a FLE-by-FLE flipping sequence, which cannot proceed in lattice along a straight line, so FLEs in the sequence are precessing, the FLE flip-point starts to move cyclically along some 4D helix with a frequency ω, having momentum $\boldsymbol{P}=m\boldsymbol{c}$ [***bold*** means 4D vector] , $c=l_P/t_P$ and energy $E=Pc=mc^2=\hbar\omega$, $\hbar$ is Planck constant.

Particles can be charged by the Forces [more see [3], section 6.] as that some FLEs in the algorithms are "marked" by a Force mark, which at their flipping radiate the Forces mediators. A mediators, at least of Gravity, Electric, and Nuclear, Forces, , if specifically hits into "irradiated" particle, transmits to the particle specific momentum $p=\frac{\hbar}{r}$ that releases [if Force is attractive one] in this particle corresponding portion of the particle's own energy, transforming the portion into the particle's kinetic energy.

All having rest mass particles are created by momentums $\boldsymbol{P}$ that are directed along the $c\tau$-axis [in general – by the momentums' $c\tau$-components]. Particles are created if the momentum's $c\tau$-component is directed in positive the axis direction. Antiparticles are the same algorithms as the particles, which run in opposite command order, and so are created by negatively directed momentums. Since in official physics Matter' spacetime has 4D metrics (ct,X,Y,Z), where really spatial $c\tau$-dimension is postulated as is the time dimension, in QFTs - really ad hoc, but so adequately to the reality - it is postulated that "antiparticles move back in time".

Returning to this article problem more concretely so note a couple of essential in this case points: first of all that in the experimental fact that dark matter particles quite evidently interact with ordinary matter seems only gravitationally there is nothing surprising, nothing in physics prohibits existence of particles that have only Gravity Force charge; and, at that,

- since Gravity - in contrast to other Forces - is completely symmetric Force, so the DM particles that have only Gravity charges are symmetric algorithms as well, So, while at interactions of ordinary particles new particles are always created as particle-antiparticle pairs, that fo DM particles logically is senseless, and so it is possible to assume – as that is assumed in the model [more see [3] section Cosmology"] that at Matter's creation just such particles were created just after inflation epoch, when the first FLE lattice version was formed, and in the lattice a huge portion of energy was uniformly globally pumped, by momentums that were directed only in positive $c\tau$-axis direction, Further at interactions of these primary particles, or at their decays, if some particles were unstable, by the angular momentum conservation only particles were created. Some part of the primary particles so can exist till now, composing observable dark matter cosmological objects.

Corresponding first approximation estimation of probability DM and ordinary particles interactions is given below.

2. Gravitational interactions of DM and ordinary particles.

At least in a first approximation of what happens at particles gravitational interaction let's consider gravitational interactions of two protons.

At statics the specific momentum p above releases energy E $E=\frac{p^2}{2m}=\frac{\hbar^2}{2mr^2}$, so for given E

$$r=(\frac{\hbar^2}{2mE})^{1/2}$$

Let E is a detector threshold, say, 1eV, then from the above and for m=1.67x10^{-27} kg; E=1.6x10^{-19}J; p=2.3x10^{-23}kgm/s, we obtain r^2=2.07x10^{-23}m, r=4.6x10^{-12}m.

Correspondingly first approximation gravitational cross-section, s, estimation is

s=6.5x10^{-23}m^2=6.5x10^{-19}cm^2 . That is rather large cross-section value in particle physics, however here is a nuance. As that is shown in the model the gravitational force, F,

$F=\frac{G\mu m}{r^2}=\frac{dP}{dt}=Np$, where μ is mass of radiating DM particle N is number of impacting on the irradiated particle momentums in 1 second. If large masses interact N is extremely large, and so, despite that the interactions are random, it practically exactly is equal to the average $N=F/p$ value.

However in this case, i.e. when $\mu=m$, and so Newtonian force, F, is equal F=9x10^{-42} Newtons, the average number of the momentums in a second is N= 3.9x10^{-19}, i.e. two having ~1GeV/c^2 masses particles in average interact 1 time in time intervals 2.5x10^{18} seconds or in ~10^{10}years.

If a detector has the volume 1m^3, and detecting material density, say, is a bit more 1 g-mole, i.e. 10^{24} particles/cm^3, the distances between the particles, d, is ~10^{-10}m. So effective volume where detections can happen is ~$(r/d)^3$ ~10^{-4}. of the detector volume.

Ordinary matter density in Milky Way is ~ 6 nucleons/m^3, and, if DM particles have ~1GeV/c^2 masses, in the 1m^3 detector there would be constantly ~20 ones, what decreases the time interval ~10^{10}years above quite inessentially.

In Newton Gravity interaction of ~ 1GeV/c^{2}particles with 1 eV energy are impossible at all, at interaction of, say, two protons corresponding distance between the particles $r=\frac{Gmm}{E=1eV}$ is ~ 10^{-45} m, what is evidently unreal. However in Planck scale physics interactions are possible – see above, and can happen in any second with probability, q, q= 3.9x10^{-19} - or there can be no interactions in 10^{10} years time interval with probability Q, $Q=(1-q)^{\frac{1}{q}}=e^{-1}$

Increasing of both, μ and m, masses increases the interactions probability, but really that is inessential in the ordinary matter case, say, if instead protons here would be some heavy nuclei. Increasing of μ can be more effective, however that is possible only provided that in Space the DM particles density correspondingly decreases.

Say, in the model it is suggested that the DM particles are Planck mass ones, which have mass ~10^{19} GeV/c^2 , and so in they interact with protons on the distance *r* above with ~5 times/s rate, however in this case the particles density is ~$20\text{x}100^{-19}$.

3. Conclusion

From the above it follows that experimental observation of DM particles interactions with ordinary matter is unreal.

References

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[i] in the paper section 2.9 “Mediation of the forces in complex systems” can be passed since this is more comprehensively given in section 6.“Mediation of the fundamental forces in complex systems” in [3]