Simulation Hypothesis and Dark Matter

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Abstract

Dark Matter is presented as a consequence of the hypothesis of simulation, in particular of augmented reality (AR). A mathematical confirmation is given.

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Because dark matter has not yet been observed directly, it must barely interact with ordinary baryonic matter and radiation, except through gravity, if it exists. Most dark matter is thought to be non-baryonic; it may be composed of some not yet discovered subatomic particles. The primary candidate for dark matter is some new kind of elementary particles that have not yet been discovered, in particular weakly interacting massive particles (WIMPs). Many experiments to directly detect and study dark matter particles are being actively undertaken, but none have yet succeeded.

Elon Musk, a highly authoritative figure, talks on YouTube that most likely our world is an intelligent simulation. He has mentioned the idea that part of our world is simulated (part A), and part is not (part B): it is like "augmented reality" (check this term in Wikipedia), made by highly advanced beings. I argue that part B is a galaxy, but part A is the Dark Matter surrounding that galaxy. Hereby, I am calling Dark Matter being the virtual reality, the virtual matter.

Indeed, the failure of direct detection of Dark Matter tells at least to me that Dark Matter passes through our reality as being free from interaction with it. Gravity is not the direct-contact interaction, as is known. This is just like the augmented reality of the Pokémon Go game; the virtual monster Pokémon is being placed into our reality without direct interaction with it. [2]

It is understandable why underground detectors for particles of Dark Matter have caught absolutely nothing for so many years of work. Usually, particles have a pretty strong effect on our world. But such small corpuscles as neutrinos have the weakest effect on ordinary matter. I give convincing arguments that Dark Matter acts so weakly on our world that its direct-contact action is equal to zero. That is why Dark Matter passes through the devices that are built for its capture completely without noticing them, completely without labor and friction with these devices. Such Dark Matter is a representative of the "invisible" world, i.e. the detectors trying to detect it locally are "blind", they see nothing. They fall into the third category of matter,

1. Living visible matter - people, animals, artificial animals (latter is Artificial Intellect).

2. Living visible matter - stones, rocks, ice.

3. Non-living invisible matter - dark matter.

4. Living invisible matter - the prediction of my classification of matter.

I. EQUATIONS OF GEODETIC MOTION

Consider Reissner-Nordström black hole. From the rest state at $r = R$, let us release a small, electrically neutral test body.

The metric is t-independent, so the test-body has a velocity component $u_t = -E = \text{const}$. The falling is radial, so $u^\theta = u^\phi = \text{const} = 0$. Using normalized velocity vector with $u_\nu\, u^\nu = g^{tt}\, u_t\, u_t + g_{rr}\, u^r\, u^r = E^2/(-A) + (u^r)^2/A = -1$, for the radial component of velocity one has

$$(u^r)^2 = E^2 - A\,. \tag{1}$$

Starting at $r = R$ with radial velocity $u^r = 0$, one has

$$E^2 = 1 - 2M/R + Q^2/R^2\,, \tag{2}$$

and

$$(u^r)^2 = Q^2(1/R^2 - 1/r^2) + 2M\,(1/r - 1/R) = (1/r - 1/R)(2M - Q^2\,[1/R + 1/r])\,. \tag{3}$$

Note that if

$$2M - Q^2(1/R + 1/r) < 0 \quad \Leftrightarrow \quad 2M/Q^2 - 1/R < 1/r \tag{4}$$

during the falling $r < R$, one has $(u^r)^2 < 0$, but because of $2M/Q^2 - 1/R > 0$, one obtains $r < 1/(2M/Q^2 - 1/R)$. Thus, the test-body has not reached the singularity at $r = 0$.

II. VANISHING SIZE

Further research has shown that the proper size of the body shrinks to zero at $r = r_m = 1/(2M/Q^2 - 1/R)$.

Consider a drop of "perfect fluid" falling into a Black Hole. Because the drop is small, the velocity of every part of it is the velocity of the fall. The equation of matter is $T^{\mu\nu}_{;\nu} = 0$, thus $u_\mu\, T^{\mu\nu}_{;\nu} = 0$, where

$$T^{\mu\nu} = (\rho + p)u^\mu u^\nu + p\, g^{\mu\nu}\,, \tag{5}$$

where pressure p and density ρ are the inner characteristics of the drop. Thus,

$$-(\rho + p)_{,\nu}\, u^\nu - (\rho + p)\, u^\nu_{;\nu} + (\rho + p)\, u^\nu\, u^\mu_{;\nu} u_\mu + p_{,\nu}\, u^\nu = 0\,, \tag{6}$$

where $u^\mu_{;\nu} u_\mu = 0$, because $(u^\mu u_\mu)_{;\nu} = (-1)_{;\nu} = 0$. As $u^\nu = dx^\nu/ds$, one has

$$-\frac{d(\rho+p)}{ds} - (\rho+p)\, u^\nu_{;\nu} + \frac{dp}{ds} = 0\,. \tag{7}$$

Here and in the following, the index with semicolon means the covariant derivative uses Christoffel symbols, while the index with comma means the ordinary derivative with respect to the spacetime coordinate.

This differential equation has no solution, unless the fluid is compressible. Let the equation of state be $p = p(\rho)$. Then

$$\frac{d\rho}{ds} = -(\rho + p(\rho))\, u^\nu_{;\nu}\,. \tag{8}$$

Now the rate (and sign) of the change of the density depends on $D := u^\nu_{;\nu}$, and the formula coincides with the one given in Ref. [1], pages 226–227.

If one inserts the above velocity u^ν into the divergence, one gets to know that $u^\mu_{;\mu} \sim 1/u^r \to -\infty$ at $r = r_m$. The idea of the paper is proven now because the position of the latter special point r_m coincides with the special point r_m in the previous chapter, derived by the first method.

It is interesting to note that for a Schwarzschild Black Hole ($M \neq 0$, $Q = 0$) one has

$$D := M\, \frac{4\,r - 3\,R}{\sqrt{2\,M\,R\,r^3\,(R-r)}} \tag{9}$$

With the zero at $r = 3R/4$ being the starting point for the compression. Notably, this happens at an infinite distance from the Black Hole, if R is infinite. Such an unexpected result hardly can be found in Newton's age, even while we still have a weak field at $r = (3/4)R \gg 2M$. The deadly ripping with $D \gg 1$ never begins, but the deadly compression with $D \ll -1$ happens at the singularity $r = 0$. This has been shown by several methods, including the study of the geodetics deviation equation. [3]

The drop's density at $r \to r_m$ diverges because of

$$\frac{d\rho}{\rho} = \left(-D - D\frac{p(\rho)}{\rho}\right) ds\,. \tag{10}$$

Integration of both sides produces

$$\ln(C\,\rho) = \int \left(-D - D\frac{p(\rho)}{\rho}\right) ds = \int \left(\frac{D}{u^r} + \frac{D}{u^r}\,\frac{p(\rho)}{\rho}\right) dr = \infty\,,$$

where C is a constant of integration.

III. SOLUTION TO THE CONTRACTION

Because the contraction seems to go beyond the energy-momentum conservation law and General Relativity, I have endured the known law $T^{\nu\mu}_{;\nu} = 0$ with the tensor of invisible Virtual Matter $X^{\nu\mu}$,

$$(T^{\nu\mu} + X^{\nu\mu})_{;\nu} = 0\,. \tag{11}$$

I call the Virtual Matter "invisible" because it should go through underground "detectors of Dark Matter" without the slightest effort. Why? Because being just a mathematical fix to the contraction of the test body, Virtual Matter is not a new kind of matter; hence, it does not interact with the visible matter even via the weak interaction. To my understanding, Virtual Matter with $X^{\nu\mu}_{;\nu} = 0$ is called Dark Matter, and Dark Matter with $X^{\nu\mu} = -\Lambda\, g^{\nu\mu}$, where Λ is the cosmological constant, is called Dark Energy.

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[1] A. P. Lightman, W. H. Press, R. H. Price, S. A. Teukolsky, "Problem Book in Relativity and Gravitation," Princeton University Press, Princeton, 1975.

[2] Pokémon Go is a 2016 augmented reality (AR) mobile game developed and published by Niantic in collaboration with Nintendo and The Pokémon Company for iOS and Android devices. The game uses mobile devices with GPS to locate, capture, train, and battle virtual creatures, called Pokémons, which appear as if they are in the player's real-world location.

[3] Dmitri Martila, new results, 2020, to be published