A note on anisotropic quantum gravity

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Abstract

Anisotropic gravitation is considered, leading to a unique view of dark matter.

1 On the interruption of processes by time dilation

A *process* is a system of mass-energy, along with its internal interactions.

Time dilation is the *interruption* of said process, whether it be kinematic and/or gravitational – both are the result of external interactions. In the case of the gravitational interaction, the process is interrupted by spacetime itself (e.g. gravitons). In the case of the non-gravitational interaction, the process is interrupted by the other force-carrying particles (e.g. photons, etc).

It is the gradient of the gravitational time dilation [1], based on the distance from the gravitating process, that causes acceleration toward the gravitating process. This is encoded in the first term on the right-hand side of the Schwarzschild line element

$$ds^2 = -\left(1 - \frac{R_s}{r}\right) c^2 dt^2 + \frac{dr^2}{\left(1 - \frac{R_s}{r}\right)} + r^2(d\theta^2 + \sin^2\theta d\phi^2). \tag{1}$$

where R_s is the Schwarzschild radius

$$R_s = \frac{2GM}{c^2}, \tag{2}$$

and M is the mass-energy of the gravitating process.

Note that if all of physics is about processes, then it is therefore all about *computation* [2,3] – here we have even adopted the concept of process interruption, which is surely familiar to all assembly programmers [4].

Also note that the densest process for any given amount of mass-energy M is a black hole – contemporary digital or quantum processors are nowhere close to this limit.

Finally note that in Newton and Einstein's theory, all mass-energy gravitates in an *isotropic* (spherical) manner. In this paper, we will consider aspherical – *anisotropic* – gravitating processes.

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2 On the holographic principle

It takes n Boolean degrees of freedom to describe the gravitational field [5, 6] generated by a process of mass-energy M. This is regardless of the radius of the gravitating process, and regardless of how many non-gravitational degrees of freedom exist. Where k_b is the Boltzmann constant, the number of gravitational degrees of freedom is

$$n = \frac{k_b A_s}{4\ell_p^2 \log 2}, \tag{3}$$

where in the case of the Schwarzschild line element

$$A_s = 4\pi R_s^2. \tag{4}$$

Note that in the case where the process is a black hole, this effectively quantizes the event horizon. In the case where the process is not a black hole, the corresponding Schwarzschild radius is where the event horizon would otherwise lie at. The Planck length is

$$\ell_p = \sqrt{\frac{\hbar G}{c^3}}. \tag{5}$$

In the case where the process is a black hole, all of the non-gravitational degrees of freedom have been stripped away as gravitational waves, leaving only the gravitational degrees of freedom. In other words: a black hole is raw spacetime.

3 On dark matter

With regard to the flat rotation curve found in galactic dynamics [7]: if this number n is at least conserved as a gravitationally bound process (e.g. a galaxy) goes from sphere to disk as distance from the process centre increases, then the gravitation becomes anisotropic, strengthening along the orbit plane, weakening elsewhere. In fact, gravitation is anisotropic for all gravitationally bound processes, for there is no such thing as a perfect spherically symmetric, isotropic, homogeneous process (not even a black hole is spherically symmetric, because the event horizon is quantized). This includes galaxies, clusters, walls, and filaments. For instance, for a perfect disk, the interaction strength increases by a factor of c, and for a perfect filament it increases by a factor of c^2. For more details, see [8], where we show that for these perfect shapes that the gravitational field goes from being $(3+1)$-dimensional down to $(2+1)$ or $(1+1)$-dimensional. For example, at a distance of 10 kiloparsecs from the Galactic centre, it is found that the dimension of the gravitational field is roughly $(2.96+1)$.

We have no reason to expect that we will find a WIMP, axion, or similar solution [9–14] to the dark matter problem – if gravitation is quantized, then dark matter is made up of a graviton condensate.

For processes bound by all four forces, such as protoplanetary disks, there is practically no dark matter to be found, because the emission of gravitons is close to isotropic.

4 Conclusion

In this paper we have defined a unique view of dark matter, which forms due to anisotropic gravitation in gravitationally bound processes. Of greatest importance is the fact that there is a finite number of gravitational degrees of freedom for a process of mass-energy M, and that when aligned, they form gravitational bonds that are stronger than that predicted by Newton and Einstein's isotropic theory of gravitation. In essence, dark matter is a graviton condensate.

References

[1] Misner et al. Gravitation. (1970)

[2] Zuse. Calculating Space. (1969)

[3] Wolfram. A New Kind of Science. (2002)

[4] Abrash. Michael Abrash's Graphics Programming Black Book. (1997)

[5] Hooft. Dimensional reduction in quantum gravity. (1993)

[6] Susskind. The World as a Hologram. (1994)

[7] Binney et al. Galactic Dynamics. Second Edition. (2008)

[8] Halayka. Is the anisotropic interaction of luminous matter responsible for the extrinsic gravitation usually attributed to exotic dark matter? (2008)

[9] Berger et al. Snowmass 2021 White Paper: Cosmogenic Dark Matter and Exotic Particle Searches in Neutrino Experiments. (2022)

[10] Aalbers et al. First Dark Matter Search Results from the LUX-ZEPLIN (LZ) Experiment. (2022)

[11] Quiskamp et al. Direct Search for Dark Matter Axions Excluding ALP Cogenesis in the 63-67 micro-eV Range, with The ORGAN Experiment. (2022)

[12] Haipeng et al. Direct detection of dark photon dark matter using radio telescopes. (2022)

[13] Hui et al. Ultralight scalars as cosmological dark matter. (2016)

[14] Ackerman et al. Dark Matter and Dark Radiation. (2008)