THE NEXUS GRAVITON
DARK MATTER AND DARK ENERGY

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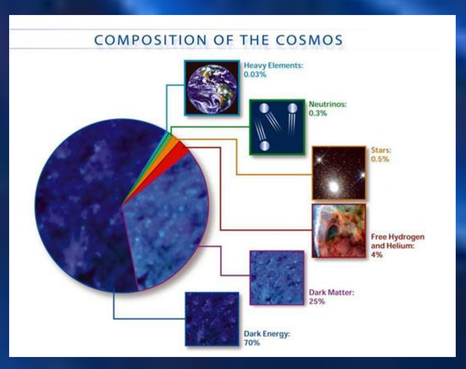
INTRODUCTION

There is a wide gap in our understanding of the physical world. Current astrophysical observations provided by a wide gamut of observational instruments at astronomy's disposal inescapably point out to the reality that huge amounts of Dark Matter (DM) and Dark Energy (DE) are needed to account for the large scale structures and cosmic acceleration. Data from the Planck 2013 [1, 2] and other sources [3–5] on the anisotropies of the Cosmic Microwave Background (CMB) radiation as well as optical observations on Type Ia supernovae [6, 7], galaxy rotational curves [8–10] and galactic cluster dynamics [11, 12] provide strongest evidence of the Dark Sector. Explaining the nature of DM and DE is a key challenge in modern astrophysics. This challenge is further compounded by the lack of direct detection of any material constituents of these phenomena by both space-based and ground-based experiments.

Here, I present a novel theory [13,14] to explain the enigmas of the dark sector and late time cosmic acceleration . The theory is called Nexus in the sense that it provides a self consistent theory of quantum gravity in which the nexus graviton, a composite spin-2 particle, emerges naturally to explain gravity ,space-time and the quantum vacuum. The Nexus graviton is not a messenger particle, but rather it induces constant rotational motion on any particle within its radius of action.



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Objective

To develop a self consistent quantum theory of gravity from the following basic postulates:

- An element of Minkowski space is treated as a pulse of space-time of intensity expressed by the interval.
- The vacuum state is a four-dimensional, smooth, connected Lorentzian manifold devoid of any event.
- The Hubble sphere is considered as a finite Minkowski space embedded in an infinite Lorentzian manifold.
- An element of Minkowski space is represented as Δx and a point in the Lorentzian manifold as x. The Lorentzian manifold acts as a background space for the finite Minkowski space.

Procedure

- An element of Minkowski space is expressed as a wave packet using Fourier analysis.
- The wave packet is the Nexus graviton having 10^{60} eigen states.
- General Relativity is applied to calculate the distortion of the line element by virtue of the graviton energy.
- Below is the resulting mathematical description of the nexus graviton.

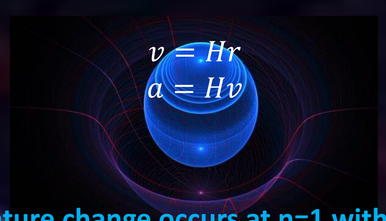
$$\Delta x_n^{\mu} = \frac{2\gamma_{\mu}\Delta r_{HS}^{\mu}}{n\pi}\int_0^{k^{\mu}} \frac{\cos(k_{\mu}x^{\mu})\sin(k_{\mu}r_{HS}^{\mu})dk^{\mu}}{k_{\mu}r_{HS}^{\mu}}$$

$$\Delta x_n^{\mu}\Delta p_{\mu,n} \leq \frac{h}{4\pi}$$

$$k^{\mu} = \frac{n\pi}{r_{HS}^{\mu}} \qquad n = \pm 1, \pm 2, \ldots \pm 10^{60} \qquad \Delta E_n = nhH_0$$

$$R_{(k)\mu\nu} - \tfrac{1}{2}R_{(k)}g_{\mu\nu} = n^2\Lambda g_{\mu\nu} \qquad \Lambda = 3\left(\tfrac{E_1}{hc}\right)^2$$

$$ds^2 = -\left(1-\tfrac{2}{n^2}\right)c^2dt^2 + \left(1-\tfrac{2}{n^2}\right)^{-1}dr^2 + r^2(d\theta^2 + sin^2\theta d\varphi^2)$$



- **Metric signature change occurs at n=1 with no singularity**
- **Metric exhibits asymptotic flatness with increasing n**

Results

A self consistent quantum theory of gravity in which the Nexus graviton is a fundamental constituent of space-time is developed.

- The Nexus graviton is Dark Matter and induces constant rotational motion on any test particle found within its radius .
- Dark Energy results from the emission of a ground state graviton by a higher energy graviton. A process that leads to the expansion of the high energy graviton as it assumes a low energy state.
- When the theory is applied to cosmology, it explains late time cosmic acceleration, galaxy rotation curves and the coincidence problem

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EQUATIONS OF COSMIC KINETICS

$$\frac{v^2}{r} = \frac{GM(r)}{r^2} + Hv - Hc$$

$$v = \frac{1}{2}Hr + \frac{\sqrt{H^2r^2 + 4r\left(\frac{GM(r)}{r^2} - Hc\right)}}{2}$$

EQUATION OF FREE FALL

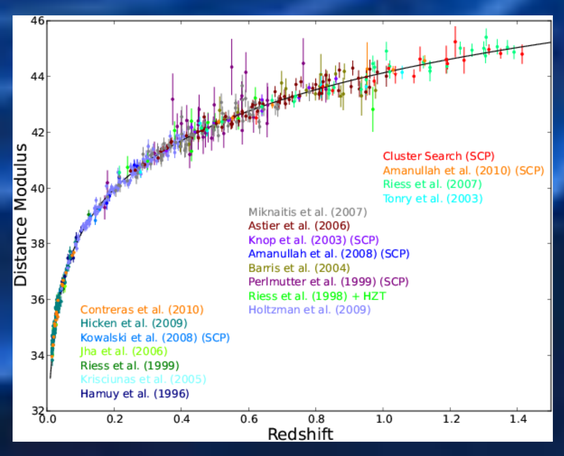
$when\ at\ t = 0$
$\frac{GM(r)}{r^2} = Hc$

COINCIDENCE SOLUTION +
CLASSICAL & QUANTUM GRAVITY NEXUS POINT

then

$$r = \frac{1}{H}e^{Ht}(GM(r)Hc)^{\frac{1}{4}}$$
$$v = e^{Ht}(GM(r)Hc)^{\frac{1}{4}}$$
$$a = He^{Ht}(GM(r)Hc)^{\frac{1}{4}}$$

EQUATIONS OF GALACTIC AND COSMIC EVOLUTION



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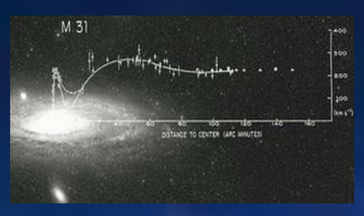
$$r = \frac{1}{H}e^{Ht}(GM(r)Hc)^{\frac{1}{4}}$$



$$v = \frac{1}{2}Hr + \frac{\sqrt{H^2r^2 + 4r\left(\frac{GM(r)}{r^2} - Hc\right)}}{2}$$

$when\ at\ t = 0 \quad \frac{GM(r)}{r^2} = Hc$

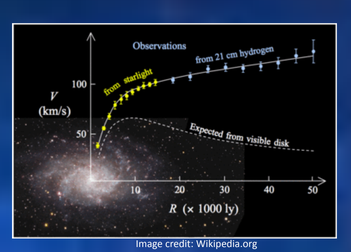


Image credit: Wikipedia.org

$$v = e^{Ht}(GM(r)Hc)^{\frac{1}{4}}$$

CONCLUSION

Here we have a model that brings together seemingly disparate cosmic phenomena such as DM, DE, quantum gravity, late time cosmic acceleration, the Tully–Fisher relation, galaxy rotation curves and evolution by explaining them as different manifestations of the same underlying graviton field

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