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The Introduction of Additional Spacetime Distortions (ASD) and New interpretations learned from it

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ABSTRACT

This paper introduces a concept: Additional Spacetime Distortions (ASD), defined as the non-linear overlapping of spacetime distortions driven by the temporal and spatial configurations of physical matters. We hypothesize that ASD Effect inherently is dark matter. This paper aims to present the foundational interpretation of Dark matter(Zwicky 1933) and to resolve cosmological puzzles related to Dark matter with ASD.

Keywords: Galaxies (573) — Cosmology (343) — High Energy astrophysics (739) — Interstellar medium (847) — Stellar astronomy (1583) — Solar physics (1476)

1. INTRODUCTION

Modern cosmology strongly supports the existence of dark matter through various observational evidences such as galaxy rotation curves, gravitational lensing phenomena, and cosmic microwave background radiation. However, despite decades of efforts, the nature of dark matter remains a mystery. In particular, existing particle-based models, such as WIMP (Weakly Interacting Massive Particles), have faced limitations, interpretations of certain dark matter phenomena, and have been unsuccessful in direct detection. This suggests that the existing paradigm of interpretation of dark matter phenomena itself is no longer sufficient.

This work presents a fundamental interpretation of dark matter phenomena that is completely different from existing concepts of invisible particles.

2. AN UNDERLYING FORMULA OF ADDITIONAL SPACETIME DISTORTIONS

We begin with Einstein's Field Equations (EFE), which describe the fundamental relationship between spacetime geometry and the distribution of matter and energy:

$$G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

Here, the terms are defined as follows:

- $G_{\mu\nu}$: The Einstein tensor, which encapsulates the curvature of spacetime. It is a complex, nonlinear function of the metric tensor ($g_{\mu\nu}$) and its derivatives.
- $T_{\mu\nu}$: The energy-momentum tensor, representing the density and flux of energy and momentum (including mass, pressure, and stress) that act as the source of spacetime curvature.
- G: The gravitational constant.
- c: The speed of light in vacuum.

It is crucial to emphasize that the EFE themselves are inherently nonlinear. This nonlinearity stems from two primary aspects:

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- The Einstein tensor $G_{\mu\nu}$ is a nonlinear function of the metric tensor $g_{\mu\nu}$. When fully expressed, $G_{\mu\nu}$ contains terms involving products of $g_{\mu\nu}$ and its derivatives (e.g., Christoffel symbols (Γ) appearing quadratically in the Ricci tensor, $R_{\mu\nu} \propto \Gamma\Gamma$). This means that the geometry of spacetime affects itself in a non-linear way.
- The gravitational field itself carries energy and momentum, and this energy-momentum contributes to the overall $T_{\mu\nu}$ that sources spacetime curvature. This self-interaction of gravity means the gravitational field not only dictates the motion of matter but also influences its own evolution, leading to a complex, nonlinear feedback loop.

3. DEGREES OF INTERACTION I AND ADDITIONAL SPACE-TIME DISTORTION(ASD) & DARK MATTER

Basically, the I meaning is the degree of interaction. ASD is somewhat based on configurations, Depending on the degree of interaction with the surroundings, the location and the configurations state change, As a result, it is a factor that affects the ASD Effect or the Dark Matter Effect. For a clearer explanation, the need to introduce the concept of ”I” was highlighted and accordingly The Degree of Interaction ”I” will be described in five stages.

- I_{none_high} **(High Interaction, Negligible ASD Effect due to Excessive Matter Density**: This region signifies situations where the degree of interaction is so extreme and intense that the non-linear Overlapping of Additional Spacetime Distortions, while still present, falls below the threshold for generating observable or significant dark matter effects in its expected form. (Interaction is too high)
- $I_{transition\_high}$ **(Upper Transition Zone)**: This threshold or surrounding area is characterized by extremely high matter density, where the Overlapping of spacetime distortions becomes excessive. The previously stable form of ASD starts to destabilize and rearrange in different ways, often leading to density flattening.
- I_{stable} **(Stable Dark Matter Effect)**: In this region, the amount, density, and temporal-spatial configuration of matter are at an appropriate level, allowing the non-linear Overlapping of spacetime distortions to be stable and continuous. Here, strong and consistent dark matter effects are observed.
- $I_{transition\_low}$ **(Lower Transition Zone)**: This is the threshold or surrounding area where the density and configuration of matter begin to generate meaningful ASD. The Overlapping of spacetime distortions commences, but it might still be unstable or only manifest intermittently.
- I_{none_low} **(Low Interaction, Absence/Meager Distortion)**: This region signifies instances where the amount or density of matter is either too small, so its temporal/spatial arrangement is too unstable for significant and stable Additional Spacetime Distortions (ASD) to occur or to persist. Consequently, dark matter effects are largely absent here.(Interaction is too low)

3.1. *The exact same Characteristics of dark matter& ASD*

ASD cannot interact with light. This is because, unlike matter, it is an Additional distorted spacetime itself. but it exerts gravity. This is exactly the same as dark matter. and Dark matter does not exist alone or move at all. (Halo-like examples will come to mind.) non-linear overlapping of spacetime distortions driven by the temporal and spatial configurations of physical matters. ASD cannot also exist completely independently. This, too, is the same as dark matter.

3.2. *Galaxy Rotation Curves*

Galaxy rotation curves show that outer stars spin too fast for visible matter alone(Rubin & Ford 1978), implying unseen dark matter. v(r) increases to some distance from the center of the galaxy But it’s not really a ”constant in the mathematical sense.” → Usually, there is a change of less than 10% to 20%.

Case in point: Milky Way

Approximately 220 to 240 km/s from the solar position

from 200 to 250 km/s on the outskirts

In other words, it means that the mass should not be concentrated only at the center of the galaxy, but should be distributed to the outside.

$$v(r) = \sqrt{\frac{GM(r)}{r}}$$

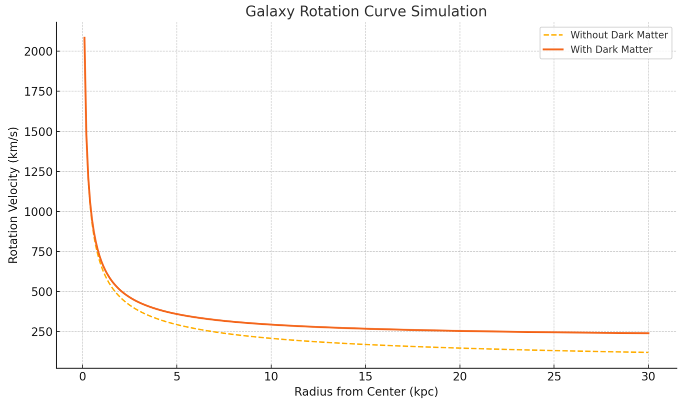

Figure 1. Galaxy Rotation Curves

$$v(r) = \sqrt{\frac{GM(r)}{r}} \quad \Rightarrow \quad v(r) \Rightarrow M(r) \propto r$$

mass measurements (excluding dark matter) are made based on visible matters, The closer we get to the center of the galaxy, we go through the $I_{transition\_high}$. If it's severe, it's going to be in the I_{none_high} phase, because of their high matter density. but the outer edge is relatively interactive in a stable manner, So the outer edges remain in I_{stable}. As a result, outer edge can has more ASD Effect, It is estimated that it will give gravity to the outer edge to move faster, creating a smoothness of velocity.

3.3. *Core-Cusp Problem*

The Core-Cusp Problem features are The biggest difference between dwarf galaxies, low-surface brightness galaxies and ordinary galaxies is that low-surface brightness galaxies and dwarf galaxies have significantly lower central baryon densities compared to other types of galaxies, such as spiral and elliptical galaxies. (The difference in density is known to be 20 to 750 times more.) Based on ASD and I, this phenomenon seems to have entered state of I_{none_low} and $I_{transition\_low}$, where the density is so low that ASD formation is almost impossible.

$$\rho_{\text{cusp (max)}} \approx 750 \times \rho_{\text{core (min)}}$$

3.4. *Halo Problems*

Actual observations show that Halo (Navarro, Frenk & White 1997) are thousands of times larger than galaxies. The halo region is neither too far nor too dense between matter, providing the most suitable environment for ASD to form stably. This is in exact agreement with observations that 80% to 90% of the galaxy's mass is concentrated in the halo in the form of dark matter through gravitational calculations. This agreement strongly suggests once again that this paper shows that ASD and dark matter are identical phenomena.

3.5. *A cluster of bullet galaxies*

Bullet cluster collision(Clowe et al. 2006)(1E 0657-56) show collisions in which two clusters of galaxies penetrate each other at superfast speeds, which are widely acknowledged as the most direct and powerful observational evidence for the existence of dark matter. At this collision site, the phenomenon of a clear separation of the distribution of matter unexpectedly is detected, perfectly reflecting the properties of matter described by existing dark matter models.

The observations show that the hot gas, the main baryon matter (general matter) in the cluster, clumped together and fell behind in the center of the collision through X-ray emission. This suggests that the gas particles lost momentum during the collision, experiencing strong electromagnetic interactions and frictional resistance. On the other hand, the center of the total mass distribution, as determined by the gravitational lensing effect, was clearly separated from the X-ray gas cloud, remaining in the region where the individual galaxies in the cluster were located. Since the gravitational lensing effect responds to the spacetime distortion factor, When there is too little visible matter compared to the observed gravitational effects, or when the center of gravity does not match the visible matter, we inevitably infer the existence of an 'invisible mass', that is, dark matter.

According to the Additional Space-Time Distortion (ASD) hypothesis presented in this paper, the identity of this 'invisible mass' is the ASD itself. ASD is not the matter itself, but the nonlinear curvature of space-time induced by the temporal and spatial arrangement of the matter. Due to these properties, ASD does not collide with each other or receive frictional resistance like physical particles. Thus, when two clusters of galaxies pass through each other at high speed, the baryon gas is left behind by the collision resistance, but the ASD passes almost directly through the collision region with the galaxies (stars) without interaction resistance. As a result, the 'center of total mass' revealed by gravitational lensing observations is to separate from the gas cloud, forming in the positions of the ASD and galaxies that have passed without resistance.

In conclusion, bullet galaxy clusters perfectly support the core premise of this hypothesis, which shows that the gravitational lens shows "total mass," and that the part of this total mass that is not accounted for by the visible matter is "dark matter," and that ASD is the physical mode of expression of that dark matter.

3.6. *Formation of Large-Scale Structure*

4. THE PRESENTATION OF EXPERIMENTAL METHODS AND WHAT WE KNOW FROM EXPERIMENTS

The gravitational lens effect is a phenomenon in which a large celestial body bends Spacetime and change the path of light. It is generally observed in large masses such as galaxy clusters and black holes, but there is a possibility that one can artificially form an overlapping point and visualize it at a close distance. In this study, juse two massive objects are placed, spatial distortion between the two mass is checked with gravitational lenses and atomic clocks, and the artificial light source and artificial lens effect are checked, Visualization and enlargement of gravitational lens effects through an artificial way is enough possible. the fact that it can be confirmed in all directions means that space-time distortion can be viewed in three dimensions. We've only seen it in one direction so far

5. WHAT EIGHTY YEARS MEANS IN SPACE TIME: THE UNCHANGING STATE OF DARK MATTER ϵ_T

$$\epsilon_t = \frac{\Delta t}{T_U} \tag{1}$$

- Δt: Observation period (e.g., 80 years)
- T_U: Age of the universe (approximately 13.8×10^9 years)

EXAMPLE CALCULATION

$$\epsilon_t = \frac{80}{13.8 \times 10^9} \approx 5.8 \times 10^{-9} \tag{2}$$

INTERPRETATION

- Since $\epsilon_t \ll 1$, the observed time span is only about **0.00000058%** of cosmic history.
- If the evolution of phenomena such as dark matter follows cosmic time scales, then the change over 80 years is effectively undetectable.

Thus, the message is:

> **"Dark matter may change, but within such a short observational window, we cannot possibly detect it."**

This is the key implication of $\epsilon_t \ll 1$.

6. A NEW METHOD FOR BLACK HOLE OBSERVATION: INFERRING INTERNAL INFORMATION EXCHANGE WITH DYNAMIC INTERACTION

Direct observations of the inside of a black hole beyond the event horizon are not possible with current techniques. However, this paper presents a new method of observation that leverages the concept of additional space-time distortion (ASD) to infer how the internal information of black holes is exchanged and reflected through ASD, which occurs during the dynamically interacting process of multiple black holes.

If existing observational methods focus on measuring fixed parameters such as the mass or spin of black holes, the new method aims to identify subtle 'information exchange' patterns between interacting black holes by analyzing the effects of black holes on each other, i.e., the properties of ASD arising through nonlinear overlapping of spacetime distortions.

In particular, when several black holes merge or engage in close-up interactions, the strong spacetime distortions around each black hole affect each other and form complex ASD. This ASD goes beyond simply gravitational effects resulting from the sum of the masses of each black hole, and can cause a unique spacetime 'wave' or 'pattern' depending on their intrinsic internal properties (e.g., initial formation conditions, accretion history, unknown internal structural factors). For example, certain forms of ASD may appear to be more pronounced when black hole binary systems have specific mass ratios, or in such a way that they generate microscopic gravitational wave signals different from conventional predictions during the merger.

By precisely analyzing the properties and changes of these dynamic ASD, we can indirectly understand how black holes 'exchange and receive' internal information through space-time in response to each other's existence and properties, even if we do not know direct information inside the event horizon. This has important implications for expanding our understanding of the nature of black holes and pioneering a new research field called 'internal interaction' of black holes, which was difficult to access with conventional gravitational wave observations. Ultimately, this method shows that the ASD concept can go beyond its role as dark matter and contribute to understanding the dynamic properties of black holes, one of the most mysterious objects in the universe.

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