Gravitational Lensing Based on Entangled Duality

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Abstract

A lensing-like framework is described, based on Entangled Duality, where galaxies interact through two domains: either relativistic, spacetime S, or entangled, E. The core idea is that every physical system participates in both domains. Observations — such as galactic rotation curves and lensing-like mass effects — are the combined outcome of S + E, not S alone. This dual-domain model produces effects that mimic gravitational lensing and dark-matter-like behavior without invoking dark matter.

Keywords: Entanglement, Spacetime, Galactic duality, Galactic rotation curves, Dark matter, WIMPs, Gravitational lensing, ΛCDM, MOND.

Characteristics of the Dual-Domain Model

The S-domain is characterized by local, relativistic interactions—limited by c, governed by standard spacetime geometry and general relativity (GR)-like behavior. The E-domain is characterized by nonlocal, effectively instantaneous interactions—correlations and influences that are not constrained by light speed and don't live "inside" spacetime in the usual way.

The dual-domain model [1, 2, 3] introduces the idea of a separation of relativistic effects and entanglement effects in a galaxy. It's not just convenience. If you treat the two phenomena separately you get real results. Each phenomenon operates in its own domain. It's also not a question of nomenclature nor is it just semantics. It distinguishes between an ontological and an epistemological layer of reality.

Each of the separate domains is necessary for a complete description of the physics. It clarifies what is nonlocality; it separates causation from correlation; and it attempts to reconcile quantum theory with relativity. Entanglement exists in a nonlocal domain. Relativity has dynamics.

In all of this there is no signal transmission. Therefore, there is no contradiction with standard relativity. We compute galactic rotation curves, and the alignment between observed and calculated values is excellent.

Galaxies are easily delineated into either relativistic, spacetime S, or entangled, E. There is no velocity in E, interaction or otherwise. This is not a signal velocity nor is it superluminal. It does not carry information and it preserves Lorentz causality. The E domain does not have forces. However, force can arise as emergent.

There is no velocity in E, however we will propose one, infinity. It is purely a mathematical construct which reflects the real nature of interactions in E which are instantaneous. If something takes no time to occur, we could claim it acts at infinite speed. It is a useful fiction to calculate galactic rotation curves.

A previous study compared those calculations with observation. The resulting disparities [4, 5, 6] between observed curves and the theoretically generated ones are remarkably small for undistorted galaxies, with ratios in the range of 2-4.

Definitions of the S and E Domains

We can assume that there is a duality of interactions in a galaxy. We identify S matter to follow Einstein relativity. S is used to denote spacetime. For example, no relativistic interaction can occur at speeds greater than c. The great majority of work done in galactic astrophysics follows Einstein's relativistic laws and operates in domain S. We could term typical galactic matter as relativistic matter since it is so closely and broadly correlated with relativity and defines a relativistic domain.

The other kind of galactic matter, which doesn't obey the rules of relativity, we will identify as entanglement matter E [7]. While the two share a galaxy, they don't share much else. Entanglement matter E operates in its own domain distinct from relativity. If you speed up E matter, its mass will not increase [8]. In reality you cannot speed it up. It will be not be moving in the E domain. There is no spacetime. The E domain is nonlocal, instantaneous, and does not have forces. Forces can arrive as emergent quantities from the E domain from patterns of entanglement. They interact with no time delay at all. They do not have position or trajectory. If all this sounds wild and strange, it is.

S is a space of source constraints. An easy way to visualize S is as a group of springs. They work just fine in their own domain. The interesting thing about E is that the typical qualities of space can emerge from E. There are no paths, but the space that emerges from E can have paths.

Some of what is going on here can mimic dark matter. Spacetime in S explains gravity as curvature. A nonlocal kernel is a mathematical function that defines how a point in space interacts with other points over a distance. It depends on values at all other points. It doesn't just depend on derivatives but also integrals because it integrates over a region. They are important in modeling interactions across a distance. Quantum interactions do not involve any physical interaction traveling at infinite speed. They show instantaneous correlations which cannot transmit information. This is Einstein's "spooky action at a distance." It is actually nonlocal correlation. Nonlocal kernels describe how space is interconnected. The system's mathematics show the effect of values at distant points with no time delay. In summation, we get instantaneous mathematical coupling. Whatever is going on, there is no transmitted signal, no energy moves, or no causal influence. Nothing actually propagates. Mathematically this is equivalent to infinite speed but nothing is actually moving.

Relation to Gravitational Lensing

The dual-domain model does not compute gravitational lensing in the traditional GR sense. Instead, E-domain interactions create mass-distribution effects that accurately reproduce galactic rotation curves. They reduce or eliminate the need for dark matter. They further imply alternative explanations for gravitational anomalies, and .yield mass-distribution predictions that functionally replace what gravitational lensing normally tells us.

Step-by-Step Analysis of S-E Dynamics

The conceptual dual-domain structure consists of four steps.

1. The first step is to decompose reality. The S-domain has metrics, curvature, geodesics, and local fields. The E-domain has global, nonlocal correlations that can redistribute "influence" without moving mass in S.

2. The second step is to provide a dual description of a system. A galaxy, for example, has S-mass distribution, i.e., what you'd infer from visible matter, gas, and stars. The E-structure relates to how that matter is entangled with itself and with other systems.

3. The third step involves effective forces. The S-observer feels:

$\vec{a}_{\text{total}} = \vec{a}_S + \vec{a}_E$, where:

$\vec{a}_S$ is what GR/Newtonian gravity would predict from visible mass.

$\vec{a}_E$ is an effective acceleration emerging from E-domain correlations.

4. The fourth step involves the following observational consequence. When you fit $\vec{a}_{\text{total}}$ using only S-domain gravity, you misinterpret $\vec{a}_E$ as extra mass, i.e., dark matter.

Comparison with ΛCDM and MOND

If a single E-domain rule, or small family of rules, fits a wide range of galaxies, then it plays the same empirical role as a universal dark matter halo profile, or a universal MOND-like law. However, its interpretation is different. It's: not "hidden mass," but hidden nonlocal structure.

The ΛCDM (Lambda Cold Dark Matter) model is a widely accepted cosmological view of the Big Bang. Under this theory, gravity is purely S-domain general relativity, and extra acceleration comes from cold dark matter halos. In contrast, the S-E model considers gravity-like effects as S+E, and that extra acceleration comes from E-domain correlations, not extra S-mass. The key contrast is that ΛCDM adds dark matter in S, while the S-E model adds new structure, via the E-domain, that modifies effective dynamics.

Modified Newtonian dynamics (MOND) is a theory that proposes a modification of Newton's laws to account for observed properties of galaxies. Under this theory, MOND modifies the law of gravity/acceleration at low accelerations such that:

$$\mu\left(\frac{a}{a_0}\right)a = a_N$$

Whereas, the S-E model keeps S-domain gravity standard, but adds:

$a_{\text{total}} = a_N + a_E$, where:

a_E is an emergent term from the E-domain.

Therefore, gravity behaves differently in MOND in the low-acceleration regime. For the S-E model, in contrast, gravity behaves normally, but a whole domain of influence is missing. In practice, both can fit galactic rotation curves, but the difference is ontological.

Can the S-E Model Reproduce Lensing?

This is the crux of the matter. Gravitational lensing is sensitive to the spacetime metric in standard GR. As a result, light deflection depends on the total stress-energy in the S-domain. Dark matter works because it adds S-mass, which curves spacetime more [9, 10, 11].

For the S-E model to match lensing, one of two things must be true:

1. The E-domain affects the S-metric such that the E-domain correlations back-react on S so that the metric looks as if there is extra mass. Then lensing sees the same "extra" curvature that rotation curves infer.

OR

2. The E-domain directly affects light propagation such that light's path is influenced by E-domain structure, not just S-curvature. Then lensing is partly an E-phenomenon, not purely GR.

Lensing gives a picture of the curvature of space. If that curvature is produced by dual-domain effects, we surprisingly have the variables which we can use to investigate curvature.

Consistency Requirements

To be a be a full alternative to dark matter, the S-E model must fit galactic rotation curves, which was previously demonstrated. It must also fit strong and weak lensing maps of clusters and galaxies. It must further fit Cosmic Microwave Background and large-scale structure, since dark matter is crucial there as well.

This means the S-E framework needs a clear rule for how the E-domain contributes to the effective metric or to photon trajectories. It needs predictions that can be checked against both Bullet Cluster–type systems (where mass and baryons separate), as well as weak lensing shear fields around galaxies and clusters.

Conceptually, the S-E model can mimic “extra gravity”. The open question is whether it can mimic the full lensing phenomenology without sneaking in dark-matter-like behavior in disguise.

Conclusion

The premise in this paper is that relativity and entanglement are so different that they should be treated as separate entities. They each have their own specialized domains in which they operate.

Instead of referring to missing mass, we postulate a missing domain of interaction — the E-domain — that co-determines what S looks like. That reframes dark matter as misattributed E-domain influence, and reframes lensing and rotation anomalies as signatures of S-E interplay, not of invisible particles.

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