

Towards an Emerging Dynamics of Spiral Galaxies: An Alternative to Dark Matter

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Abstract

This document presents an alternative hypothesis to explain the flat rotation curves observed in spiral galaxies, without invoking dark matter. Instead of treating the galaxy as a sum of individual objects subject to local forces, we propose to treat it as a coherent dynamic entity, whose global structure induces an emergent force acting on the whole system. This approach relies on a conceptual change of scale, where the galaxy becomes a celestial object in its own right, endowed with specific dynamic properties. A Python simulation project is currently under development to test this hypothesis. This preliminary document aims to establish the conceptual foundation and priority of the proposed framework.

1 Conceptual Framework and Phenomenological Explanation

1.1 Observed Problem

Galactic rotation curves remain flat at large distances from the center, which contradicts the predictions of Newtonian gravity applied to visible mass.

1.2 Proposed Hypothesis

The galaxy should not be viewed as a collection of stars, but as a coherent structure whose global dynamics determine the motion of its components.

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1.3 Key Principle

Once formed, the galaxy acts as an emergent dynamic entity, and not as a mere sum of local interactions. The force acting on peripheral stars is linked to the shape and cohesion of the structure, rather than to an invisible mass.

1.4 Uniform Rotation

The cohesion of the galactic structure induces a global dynamics that constrains rotational velocities, regardless of the local mass distribution.

1.5 Absence of Dark Matter

The observed phenomenon is explained by a shape force or a cohesion field, without the need to introduce undetected mass.

1.6 Change of Scale

By observing the galaxy as a whole, rather than as a sum of particles, a new layer of physical laws is revealed.

2 Validation Project

A Python project will be developed on GitHub to:

- Model the emergent dynamics of a spiral galaxy.
- Simulate rotation curves induced by a global force acting on the structure.
- Compare results with observational data (LSB galaxies, M33, NGC 3198, etc.).
- Publish the results in a second preprint, accompanied by the source code.

3 Objective of This Preprint

This pre-preprint aims to:

- Establish priority of the idea.
- Share the founding intuition of the theory.
- Announce the upcoming validation project.
- Invite reflection and collaboration.

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