Title: A Composite Three-Body Model for Dark Matter
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A COMPOSITE THREE-BODY MODEL FOR DARK MATTER

A conceptual white paper by James Howland

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Abstract

This paper proposes a novel composite-particle model for dark matter consisting of three bound constituents:
(1) a positively charged baryonic particle (proton-like),
(2) a hypothetical heavy negatively charged particle (“negaton”), and
(3) a neutral stabilizing mediator (“neutraltron”).

The system forms a dynamically stable, electrically neutral, non-radiating bound state through a three-body orbital configuration analogous to a figure-8 solution in classical mechanics. This configuration prevents electromagnetic collapse and annihilation between the charged constituents. The resulting composite particle exhibits the key observational properties of dark matter: gravitational mass, electromagnetic invisibility, long-term stability, and weak self-interaction.

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1. Introduction

Dark matter must satisfy four empirical constraints:

- Non-luminous: does not emit, absorb, or scatter electromagnetic radiation
- Stable: persists over cosmological timescales
- Massive: contributes to gravitational structure formation
- Weakly interacting: does not collide or dissipate like baryonic matter

Existing candidates include WIMPs, axions, sterile neutrinos, and dark atoms. This paper introduces a new class of composite dark matter based on a frustrated three-body charge-balanced system.

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2. Constituents of the Proposed Particle

2.1 Proton-like positive core

A standard proton or proton-analog provides:
- positive electric charge
- baryonic mass
- gravitational contribution

2.2 Negaton (hypothetical heavy negative particle)

The negaton is defined as:

- a stable, massive particle with charge -1
- non-annihilating with protons
- not participating in electromagnetic radiation

Its mass must exceed that of the proton to ensure orbital stability.

2.3 Neutraltron (neutral mediator)

The neutraltron is a neutral, massive particle that:
- interacts with both charged constituents
- prevents collapse of the proton–negaton pair
- enforces a stable three-body orbital configuration
- carries no electric charge

It acts as a dynamical “separator,” preventing annihilation or tight Coulomb binding.

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3. The Figure-8 Orbital Configuration

Three-body systems can form stable figure-8 orbits under specific mass and force conditions. In this model:

- the proton and negaton attempt to collapse due to Coulomb attraction
- the neutraltron oscillates between them
- each pass disrupts the collapse trajectory
- the system settles into a repeating figure-8 pattern

This configuration:
- prevents radiation of photons
- prevents annihilation
- prevents formation of a dipole moment
- yields a net-neutral, non-interacting composite particle

The particle becomes effectively “dark.”

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4. Macroscopic Behavior and Dark Matter Properties

4.1 Electromagnetic invisibility

The composite has:
- zero net charge
- no dipole moment
- no radiative transitions

Thus it does not emit or absorb light.

4.2 Stability

The figure-8 orbit is dynamically stable and non-radiating, allowing survival over cosmic timescales.

4.3 Collisionless behavior
The composite particle:
- lacks electromagnetic cross-section
- interacts only gravitationally
- passes through baryonic matter

This matches observations of galaxy halos and cluster collisions.

4.4 Mass and structure formation
The combined mass of the proton, negaton, and neutraltron provides sufficient gravitational influence to seed large-scale structure.

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5. Formation in the Early Universe

The model suggests formation pathways:
- negaton–proton attraction
- neutraltron capture
- stabilization into a three-body bound state

Formation would occur after baryogenesis but before recombination, allowing dark matter to decouple early.

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6. Predictions and Testable Consequences

- Self-interaction: mild, due to internal structure
- No annihilation signatures: unlike WIMP models
- No electromagnetic scattering: consistent with CMB constraints
- Possible gravitational substructure: due to composite nature

These predictions align with current astrophysical observations.

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7. Conclusion

This paper introduces a new composite dark-matter candidate: a proton–negaton–neutraltron three-body system stabilized by a figure-8 orbital configuration. The model naturally satisfies the defining properties of dark matter without requiring new forces or exotic fields beyond the negaton and neutraltron. Its internal dynamics suppress electromagnetic interactions while preserving gravitational mass, making it a viable and testable dark-matter framework.

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TECHNICAL EXPANSION: A COMPOSITE THREE-BODY DARK MATTER CANDIDATE
Extended theoretical paper by James Howland
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1. Overview

This document expands the conceptual white paper into a more formal theoretical framework. The proposed dark-matter candidate is a composite three-body system consisting of:
- a baryonic positive particle (proton or proton-analog),
- a hypothetical heavy negative particle (“negaton”),
- a neutral mediator particle (“neutraltron”).

The system is stabilized by a non-radiating figure-8 orbital configuration that prevents collapse and annihilation. This model is motivated by the need for a dark-matter particle that is:
- electromagnetically inert,
- gravitationally significant,
- stable over cosmic time,
- weakly self-interacting,
- capable of forming in the early universe.

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2. Particle Definitions and Properties

2.1 Proton or Proton-Analog
The proton provides:
- mass m_p
- charge +e
- baryonic identity
- gravitational contribution

2.2 Negaton
The negaton is defined as:
- mass $m_n \gg m_p$
- charge -e
- no annihilation channel with protons
- no electromagnetic radiation transitions

2.3 Neutraltron
The neutraltron is a neutral particle with:
- mass m_0
- no electric charge
- short-range attractive potential with both proton and negaton
- the ability to dynamically separate the charged pair

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3. Orbital Dynamics

3.1 Classical Three-Body Figure-8 Solution
The figure-8 orbit is a known stable solution to the Newtonian three-body problem (Chenciner & Montgomery, 2000).
In this configuration:

- all three bodies follow the same closed curve,
- the system is periodic,
- no net radiation is emitted,
- no pair collapses into a two-body bound state.

3.2 Application to the Proposed Particle

In the proposed model:
- the proton and negaton attempt to collapse due to Coulomb attraction,
- the neutraltron repeatedly passes between them,
- each pass redirects their trajectories,
- the system settles into a stable figure-8 orbit.

This prevents:
- annihilation,
- dipole formation,
- photon emission,
- radiative cooling.

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4. Quantum Considerations

4.1 Non-Radiating Bound State

A quantum analog of the figure-8 orbit would require:
- a three-body wavefunction $\Psi(r_1, r_2, r_3)$
- no allowed dipole transitions
- suppressed quadrupole transitions

4.2 Effective Hamiltonian

The effective Hamiltonian is:

$$H = \sum_i \left(p_i^2 / (2 m_i) \right) + V_{pn}(r_{pn}) + V_{p0}(r_{p0}) + V_{n0}(r_{n0})$$

Where:
- V_{pn} is Coulombic,
- V_{p0} and V_{n0} are short-range neutraltron potentials.

Stability requires:

$$dH/dr_i = 0$$

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5. Cosmological Formation

5.1 Early Universe Conditions

Formation requires:
- negaton–proton attraction
- neutraltron capture
- cooling into a three-body bound state

5.2 Abundance
The abundance depends on:
- negaton mass
- neutraltron density
- capture cross-section

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6. Macroscopic Behavior

6.1 Collisionless Dynamics
The composite particle:
- has no charge
- has no dipole moment
- does not scatter photons
- does not scatter baryons

6.2 Self-Interaction
Internal structure allows:
- mild self-interaction
- consistent with observed galaxy-core profiles

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7. Diagram of the Figure-8 Configuration

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                 (Neutraltron)
                       o
                      / \
                     /   \
                    /     \
         (Proton) o         o (Negaton)
                    \     /
                     \   /
                      \ /
                       o
                 (Neutraltron)
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8. Predictions

- No gamma-ray annihilation lines
- No electromagnetic scattering
- Mild self-interaction cross-section
- Possible dark-matter substructure
- Stability over cosmic time

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9. Conclusion

The proton–negaton–neutraltron composite particle is a viable dark-matter candidate. Its three-body figure-8 orbital configuration naturally suppresses electromagnetic interactions while preserving gravitational mass. This model satisfies all major observational constraints and provides a new direction for composite dark-matter research.