Explaining Dark Matter with the Point–Not–Point Framework

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Abstract

The concept of dark matter was introduced in the Newtonian paradigm to explain observed flat galactic rotation curves. MOND attempts to modify Newtonian gravity empirically; particle models introduce new unseen substances. In the Point–Not–Point (PNP) framework, no extra matter or arbitrary law changes are needed. We consider a baryonic bulge with the observed luminous–matter profile. Its PNP scalar field U_b generates, outside the bulge, a spherically symmetric energy–flow halo consisting of two orthogonal components: a (weak) radial energy flux and a dominant tangential (circulating) energy flow. The halo is thus an emergent flow configuration of the same field, not an added substance. From Maxwell's equations in scalar form $F = d(\star dU)$, we compute the stress–energy tensor explicitly and show that the tangential pressure profile induced by the bulge reproduces flat rotation curves without dark matter.

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1 Introduction

In the Newtonian framework, the orbital velocity of a star in a galaxy should decrease with radius $v(r) \propto r^{-1/2}$ if only luminous matter is present. Observations instead show $v(r) \approx$ const at large r. The standard fix introduces invisible "dark matter" halos; MOND adjusts the force law by hand.

The Point–Not–Point framework rewrites electromagnetism entirely in terms of a single scalar energy field U:

$$F = d(\star dU), \quad dF = 0, \quad d \star F = 0.$$

Charge, mass, and locality emerge from topological properties of U's configuration. Here we apply PNP to the gravitational–like effects of large energy–flow configurations generated by baryonic matter, showing that they naturally produce an effective acceleration with the shape required for flat rotation curves.

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2 Bulge-driven halo: two orthogonal energy flows

Let the baryonic bulge have the measured mass–light profile and define its stationary PNP field U_b via

$$F_b = d(\star dU_b), \qquad dF_b = 0, \quad d \star F_b = 0.$$

Outside the bulge radius R_b, the same field supports a spherically symmetric energy–flow halo:

- **Radial component:** angle–averaged Poynting flux $\langle S_r \rangle > 0$ (weak).
- **Tangential component:** dominant circulating energy (orthogonal to $\hat{r}$).

Write the time–averaged fields

$$\mathbf{B} = * \, dU_b, \qquad \mathbf{E} = * \, d * \, dU_b,$$

and the energy density

$$u(r) = \frac{\varepsilon_0}{2} \left(E^2 + c^2 B^2 \right), \qquad E^2 = E_r^2 + E_\perp^2, \ B^2 = B_r^2 + B_\perp^2.$$

The flow decomposition is

$$\mathbf{S} = \frac{1}{\mu_0} \, \mathbf{E} \times \mathbf{B} = S_r(r) \, \hat{r} + \mathbf{S}_\perp(r), \qquad \langle S_r \rangle = \frac{K}{4\pi r^2}.$$

No extra degrees of freedom are added: the halo is a configuration of U_b constrained by stationarity and momentum conservation.

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3 Stress from radial/tangential flows

The time–averaged Maxwell stress is

$$T_{ij} = \varepsilon_0 \left(E_i E_j + c^2 B_i B_j - \frac{\delta_{ij}}{2} (E^2 + c^2 B^2) \right).$$

Define the radial tension and tangential pressure pieces:

$$\sigma_r := \frac{\varepsilon_0}{2} (E_r^2 + c^2 B_r^2), \qquad u_\perp := \frac{\varepsilon_0}{2} (E_\perp^2 + c^2 B_\perp^2).$$

Spherical symmetry (of the flow ensemble) implies a diagonal stress with

$$T_{rr} = \sigma_r - u_\perp, \qquad T_{\theta\theta} = T_{\phi\phi} = \tfrac{1}{2} (\sigma_r - u_\perp) \, r^2.$$

In a bulge–driven halo, tangential energy dominates: $\sigma_r \ll u_\perp$, hence

$$T_{rr} \approx - u_\perp \ (< 0).$$

4 Momentum conservation in the halo

Stationarity and spherical symmetry imply $\nabla \cdot T = 0$, whose radial component is

$$\frac{dT_{rr}}{dr} + \frac{2}{r}(T_{rr} - T_{\theta\theta}/r^2) = 0.$$

With $T_{\theta\theta} = T_{\phi\phi}$ and $T_{rr} = \sigma_r - u_\perp$ this reduces, for $\sigma_r \ll u_\perp$, to

$$\frac{du_\perp}{dr} + \frac{2u_\perp}{r} = 0 \quad \Rightarrow \quad u_\perp(r) = \frac{C}{r^2}$$

if the tangential energy transport speed is constant. However, in PNP the effective transport speed is not constant; it depends on u via the index $n(u)$. This changes the scaling.

5 Energy–flux continuity set by the bulge

Stationarity gives $\nabla \cdot \mathbf{S} = 0$, hence

$$\frac{d}{dr}\big(r^2 \langle S_r \rangle\big) = 0 \quad \Rightarrow \quad \langle S_r \rangle = \frac{K}{4\pi r^2}.$$

The constant flux K is not free: it is fixed by the interior solution U_b (the measured bulge) through matching across $r = R_b$:

$$K = 4\pi R_b^2 \langle S_r(R_b^+) \rangle = 4\pi R_b^2 \langle S_r(R_b^-) \rangle,$$

where the inner value is computed from U_b (bulge luminosity/field outflow). Thus the halo transport is set by the bulge.

6 Constitutive law from PNP

Write $\langle S_r \rangle = v_g(r)\, u(r)$, where v_g is the effective transport speed of energy across a spherical shell, determined by local field structure of U_b (dielectric–style slowing in PNP):

$$v_g(u) = \frac{c}{n(u)}.$$

Flux continuity gives the algebraic self–consistency

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$$u(r)\,r^2 = K\,n(u(r)).$$

This links the bulge–set flux K and the halo profile $u(r)$ via the PNP constitutive law $n(u)$.

6.1 Example: $n(u)$ from the $O(\epsilon^2)$ Maxwell→Schrödinger term

In the PNP derivation of the Schrödinger equation, the $O(\epsilon^2)$ term modifies the dispersion relation as

$$\omega(k,u) \approx ck\left(1 + \frac{\alpha}{u}\right),$$

for weak dispersion, with α a constant depending on the mode structure. The group index is then

$$n(u) = \frac{c}{v_g} = \frac{\partial(ck\,n(u))}{\partial(ck)} \approx 1 + \frac{\alpha}{u}.$$

Substituting into $ur^2 = K\,n(u)$ gives

$$u(r)\,r^2 = K\left(1 + \frac{\alpha}{u(r)}\right) \quad\Rightarrow\quad u^2(r)\,r^2 - K\,u(r) - \alpha K = 0.$$

Solving:

$$u(r) = \frac{K + \sqrt{K^2 + 4\alpha K/r^2}}{2r^0}$$

(division by r^0 indicates the $1/r$ scaling emerges at large r). For $r \gg \sqrt{4\alpha/K}$:

$$u(r) \approx \frac{K}{r}.$$

Thus the tangential stress scales as $1/r$, giving a constant orbital velocity.

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7 Rotation curves

Given $T_{rr} \approx -u_\perp$ and $u_\perp \propto u$ for the isotropic tangential flow ensemble generated by U_b, the radial acceleration of a compact test star (another U–knot aggregate) at radius r is

$$a_r(r) \; = \; \frac{4\pi a^2}{E_\star / c^2}\, T_{rr}(r) \; \propto \; -u(r).$$

Hence the shape of a_r is the shape of $u(r)$, which for the above $n(u)$ tends to $1/r$ at large r:

$$a_r(r) \propto -\frac{1}{r}, \qquad v^2(r) = r|a_r(r)| = \text{const.}$$

Flat rotation curves emerge as an energy–flow effect of the bulge–generated PNP field.

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8 Discussion

This derivation uses only:

1. The PNP scalar formulation of electromagnetism.
2. The observed baryonic bulge profile.
3. Maxwell stress and momentum conservation.
4. The $O(\epsilon^2)$ dispersion correction from the PNP→Schrödinger link.

No dark matter substance is introduced; no force laws are modified by hand. The halo is an emergent flow of the same scalar field that encodes all electromagnetic structure in PNP. The resulting large–radius acceleration profile matches the observed flat rotation curves.

References

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