The Fisher Halo

Universal Information Hydrodynamics: Gravity from Information Response

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Context: The Missing Mass Problem. Galaxies rotate too fast to be held together by their visible matter alone. The standard explanation adds a new kind of invisible particle: cold dark matter. UIH explores a different possibility: the "dark" component is not particulate, but a structured vacuum response determined by information geometry.

The Proposal. A **Fisher halo** is the macroscopic, nonlocal response of a Fisher structured vacuum to a baryonic mass distribution. The halo is not made of particles. It is a susceptibility field that is *sourced* by baryons and *screened* beyond a characteristic length.

One sentence definition: A Fisher halo is a screened, information-geometric susceptibility that converts baryonic structure into an additional vacuum-response contribution to the weak-field potentials.

1. What the halo is

The Fisher halo is a **field response**, not an extra matter component. Operationally, it is an effective susceptibility that depends on the baryonic configuration in a nonlocal way, with a finite correlation length.

- **Response, not substance:** the halo is generated by baryons and disappears when the source is removed.
- **Nonlocality with a scale:** the response is mediated by a screened kernel, so only baryons within a range of order the screening length contribute strongly at a given location.
- **Universality:** once the screening length and susceptibility normalisation are fixed, the shape of the response is largely determined by baryonic geometry.

2. How it affects motion and lensing

The halo contributes an **additional vacuum-response term in the weak-field potentials**. In the Newtonian limit this appears as an extra contribution to the *inferred* radial force law (or, equivalently, to the circular velocity). In UIH language, baryons induce a Fisher "polarisation" of the vacuum, and gradients of that polarisation enter the metric potentials that govern geodesics.

- **Intermediate-range $1/r$ behaviour:** over an extended galactic range, the extra contribution to the effective radial force can scale approximately like $1/r$, producing near-flat rotation curves.
- **Screening at large radii:** beyond the screening length, the response shuts off and the halo ceases to grow without bound.
- **No exotic matter stress needed:** the effect arises from the response kernel and susceptibility, not from a free dark matter density profile.

3. What it predicts differently than particle dark matter

Because the halo is a response to baryons rather than an independent particle fluid, it makes distinctive predictions at the level of the weak-field potentials and their observables.

1. **Baryon-locked morphology:** halo structure should track baryonic structure more tightly than in collisionless particle models, including correlations with disc features and bulge concentration.
2. **Environmental dependence through screening:** systems with characteristic sizes below the screening length respond differently than systems well above it, producing a natural scale dependence without tuning per galaxy.
3. **Slip and lensing diagnostics:** when the reversible current sector is activated, the model predicts measurable gravitational slip and gravitomagnetic signatures, with suppression when currents are isotropised.

4. Minimal empirical programme

A Fisher halo model is useful only if it can be falsified with clean diagnostics.

- **Rotation curves:** fit large samples with a small global parameter set (screening length, susceptibility normalisation) and check whether residuals correlate with baryonic morphology.
- **Lensing maps:** compare predicted lensing potentials against weak lensing reconstructions, focusing on slip-type observables rather than raw mass maps.
- **Controlled baryon families:** test response scaling on synthetic baryon families to separate genuine model structure from data idiosyncrasies.