**Distinctive RFT Prediction vs. ΛCDM**

Refined Relativistic Field Theory (RFT) posits that general relativity’s overlooked self-interaction effects can mimic dark matter, yielding unique signatures in galaxy dynamics and lensing. In particular, RFT predicts that **a galaxy’s own rotation induces extra gravitational “pull” (via frame dragging or field self-interaction) that boosts rotational speeds and light bending** beyond what visible matter alone would produce​

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[arxiv.org](https://arxiv.org/pdf/2403.03227#:~:text=plane,in%20General%20Relativity%20within%20the)

. This contrasts with ΛCDM, where flat rotation curves and strong lensing require an invisible mass halo that is static and symmetric. Under RFT, the **“phantom” mass effect is tightly linked to the galaxy’s baryonic structure** – for example, a thin disk produces more self-interaction (hence a larger apparent mass discrepancy) than a puffier disk​

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[ar5iv.org](https://ar5iv.org/abs/2004.05905#:~:text=We%20present%20a%20method%20to,separate%20sets%20of%20observational%20data)

. ΛCDM has no such direct dependence on disk thickness. Moreover, RFT predicts a subtle **anisotropy in gravitational lensing around spinning galaxies**: light passing on the co-rotating side of a disk is deflected slightly more than on the counter-rotating side​

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. This **gravitomagnetic lensing “twist”** is absent in ΛCDM’s stationary dark halo. In short, unlike ΛCDM, RFT ties the extra gravity to galaxy rotation and structure, leading to **distinct rotation–lensing relations** (e.g. a correlation between a galaxy’s disk morphology and its inferred “dark” mass) and **small lensing asymmetries** aligned with the galaxy’s rotation axis.

*Predicted rotation curve for a massive spiral under RFT (red) vs. Newtonian gravity (black), showing how relativistic self-interaction yields a flat outer profile (red) that would otherwise require a dark matter “missing mass” (blue) in Newtonian fits​*

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*. RFT uniquely ties this extra gravity to the galaxy’s baryonic disk (e.g. thinner disks get a larger boost​*

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*), unlike ΛCDM’s scale-free dark halos.*

**Observational Strategy with LSST and Euclid**

**Galaxy Rotation Curves:** Upcoming surveys will map rotation and mass profiles for thousands of galaxies, providing a critical test of RFT’s rotation curve predictions. The Vera Rubin Observatory (LSST) can photometrically identify **extreme low-surface-brightness galaxies and distant spirals**, which can then be followed up (with IFU spectroscopy or radio telescopes) to obtain detailed rotation curves out to large radii. A key measurement is how the **outer velocity profile behaves at the very edge of the visible disk**. RFT distinctly predicts a downturn once the self-interaction “saturates,” whereas ΛCDM halos maintain flat or rising curves until the halo edge. By targeting **very extended H I rotation curves** (possible with SKA-pathfinder data in synergy with LSST), we can see if speeds eventually drop without invoking a truncating halo. Crucially, LSST’s deep imaging will also measure **disk structural parameters** (scale length, thickness via edge-on surface brightness profiles) for an unprecedented sample. We can directly test RFT’s baryon–gravity linkage by checking if galaxies with thinner, more massive disks systematically show smaller fall-offs (or need less dark matter) than puffier disks of the same stellar mass​

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. A **tight correlation between apparent dark matter fraction and disk thickness or radius** across many galaxies would strongly favor RFT​

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, while ΛCDM predicts only a loose correlation (since halo mass is not causally tied to disk scaleheight).

**Gravitational Lensing:** Both Euclid and LSST will deliver high-precision weak lensing maps and find new strong lenses, enabling **galaxy-by-galaxy lensing mass measurements**. The strategy here is to compare the **gravitational lensing signal to the rotation-based mass** for the same galaxies. In ΛCDM, lensing mass and dynamical mass (within the same radius) should agree if the presumed dark matter halo explains both. RFT, on the other hand, might show a small systematic offset: because the relativistic effect can enhance rotational support more than it bends light (or vice versa, depending on radius), **RFT could predict a particular ratio of lensing mass to rotation curve mass** distinct from 1. Upcoming surveys allow a statistical test of this. For example, using **stacked galaxy–galaxy lensing**, we can measure the average lensing profile around isolated spirals binned by their rotation curve shapes (or disk properties). RFT expects the **lensing “excess” to track the baryonic mass distribution** (flattening out beyond the disk), whereas ΛCDM expects an extended NFW-like profile. If lensing signals drop off faster outside galactic disks than the standard halo model predicts, it would hint at RFT’s cutoff.

Most decisively, **LSST and Euclid can search for the tiny lensing asymmetry from frame dragging**. By combining many nearly edge-on, strongly rotating disk galaxies, one can compare the shear experienced by background sources on the **approaching vs. receding sides** of the foreground disks. Any systematic difference (e.g. a consistently stronger shear on the co-rotation side) would indicate a gravitomagnetic contribution to the lensing mass​

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. Euclid’s sharp imaging and LSST’s volume of galaxies make this feasible: one would align galaxy images by rotation axis and stack the weak lensing signal. The expected signal is on the order of a few percent of the total shear​

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– small, but within reach given the millions of galaxies available. Similarly, in strong lens systems where the lens is a spiral, LSST time-domain data could identify cases where the lens’s rotation direction is known (via emission line kinematics) and test if, say, **images on the prograde side are slightly closer to the lens or brighter** than those on the retrograde side (beyond what an oriented mass distribution alone would cause). Such fine measurements have never been done on a large scale, but **Euclid’s stable PSF and LSST’s deep imaging of lens galaxies** will provide the necessary data quality to attempt this novel test.

**Validation and Falsification Criteria**

**Validation:** A clear positive detection of RFT’s distinctive signature would strongly support the theory. For instance, if LSST+Euclid find that **galaxies’ required dark matter mass correlates one-to-one with disk thickness or surface density** (far tighter than ΛCDM hydrodynamical simulations predict), it would confirm RFT’s core claim that gravity is amplified by baryonic geometry​

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. Likewise, **finding a non-zero gravitomagnetic lensing signal** – even a subtle one – would be a game-changer. A measured lensing asymmetry aligned with galaxy rotation (above systematic errors) would directly validate an RFT effect, since a conventional dark halo cannot produce frame-dragging​

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. Even a detection of an orientation-dependent lensing strength (e.g. edge-on disks lens more strongly than face-on ones for the same stellar mass) would favor RFT’s anisotropic gravity over isotropic halos. Any of these observations coming out of LSST/Euclid in the next few years would provide **smoking-gun evidence** that the “extra” gravity in galaxies is due to modified relativistic effects rather than particulate dark matter.

**Falsification:** On the flip side, RFT will be strongly challenged (if not falsified) if these surveys do **not** observe the predicted deviations. If after five years no gravitomagnetic lensing pattern is detected and lensing signals remain perfectly symmetric around disks, it implies that frame-dragging from galactic rotations is negligible – undermining a key RFT prediction. Furthermore, if the **rotation curve shapes and lensing profiles continue to align with ΛCDM’s dark halo expectations** for all galaxies (e.g. no dependence on disk morphology, and extended mass profiles exactly as NFW halos), then RFT’s refinements would seem unnecessary. For example, should Euclid’s weak-lensing radial acceleration relation extension show that **gravity follows the same universal relation for both high- and low-thickness disks with only halo mass as the variable**, it would mean baryonic structure has little effect – contradicting RFT​

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. Non-detection of any correlation between a galaxy’s “missing mass” and its structure would likewise refute RFT’s distinctive coupling. In summary, **if LSST and Euclid data can be fully explained by a conventional ΛCDM model with a single halo profile per galaxy (and no residual anomalies)**, then the refined relativistic effects posited by RFT would be rendered either too small to matter or simply incorrect. Such a result would falsify RFT’s claim of solving galaxy rotation curves via modified gravity, reaffirming that dark matter (if yet unseen) remains the necessary explanation.

Ultimately, this focused suite of tests – from mapping **rotation curves to extreme radii** to detecting **minute lensing twists** – provides a concrete, near-term roadmap for validating RFT. A positive result on even one of these predictions (e.g. a confirmed lensing anisotropy or a baryon–gravity coupling) would be a landmark victory for RFT, while a null result across the board would leave ΛCDM standing on firmer ground. The next five years of LSST and Euclid observations will thus decisively check RFT’s bold prediction that **“general relativity itself” can explain galaxy dynamics​**

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– either elevating this refined theory to new prominence or ruling it out as surveys unveil the true distribution of gravity in galaxies.

**Sources:** RFT theoretical predictions from Deur (2020)​

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; gravitomagnetic lensing effects from GR frame-dragging models​

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; observational test strategies adapted from current lensing and dynamics analyses​

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