20 Observable Predictions of Quarkbase Cosmology

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Abstract

This work presents the first unified set of twenty fully testable predictions derived from Quarkbase Cosmology, a pressure-field framework in which comet physics, condensed-matter phenomena, galactic structure, quantum behaviour, and nuclear energetics arise from the same scalar field Ψ. Each prediction is formulated with explicit observables and strict falsifiability criteria.

At the cometary scale, the theory predicts universal activation bands, diagonal correlations in the $(\rho_{\text{onset}}, Q_{CO_2}/Q_{H_2O})$ plane, tension curves in production rates, jet–polarization alignment with fossil pressure fractures, and a reconstructible 3D galactic pressure map. In graphene and condensed matter, Quarkbase invariants fix the monolayer absorbance at $(\pi\alpha_{QB} \approx 2.30\%)$, require superconductivity without Cooper pairs, explain extreme thermal conductivity via Ψ-transport, and predict tunable T_c through geometric deformation.

On galactic scales, rotation curves must follow a Yukawa potential with $\lambda \approx 50\,\text{kpc}$, large-scale filaments must trace Ψ-interference modes, redshift must follow a varying refractive index $n(t)$ rather than metric expansion, and supercluster sizes must satisfy $L \simeq 2\pi/k_{\text{res}}$. At the quantum level, double-slit impacts should reveal Ψ self-focusing signatures, while entanglement must persist as a continuous extended mode with no causal transmission. Finally, nuclear fission energetics—exemplified by ^{235}U—must match experimental values using only geometric Ψ-pressure relaxation, without invoking mass defects.

Together, these twenty predictions constrain the theory sharply: any single contradictory measurement falsifies the framework. Conversely, coherent confirmation across these domains would elevate Quarkbase Cosmology as a viable replacement for multiple independent physical paradigms.

Contents

I. Comet Physics and Cosmology

1 Water-activation distance follows three universal bands

Explanation: Interstellar comets "activate" their water far from the Sun because their crust was formed under a different galactic pressure. That mechanical memory shifts the sublimation front outward.

Formulation:

$$r_{\text{onset}}(\mathrm{H_2O}) \in \begin{cases} 2.5\text{–}3.0\ \text{au} & \text{Oort natives } (\Psi_B), \\ 2.0\text{–}3.0\ \text{au, dispersed} & \text{Soft interstellar } (\Psi_A \to \Psi_B), \\ 3.3\text{–}4.0\ \text{au} & \text{Hard interstellar } (\Psi_A \to \Psi_B \text{ strongly}) \end{cases}$$

Observable: measure the heliocentric distance at which OH/H_2O becomes detectable (spectroscopy/UV).

Falsifiability. A single interstellar object falling outside these three bands invalidates the prediction.

2 The CO_2/H_2O ratio correlates with Ψ-history

Explanation: If the crust formed in a different "pressure basin," CO_2 escapes first and becomes dominant. The larger the pressure jump, the higher the CO_2/H_2O ratio.

Formulation:

$$\frac{Q_{\mathrm{CO_2}}}{Q_{\mathrm{H_2O}}} \text{ increases monotonically with } |\Delta P_{A\to B}|$$

Observable: measure $Q(\mathrm{CO_2})/Q(\mathrm{H_2O})$ at $r_H \approx 2$–4 au.

Falsifiability. Finding an interstellar object with large ΔP but $\mathrm{CO_2}/\mathrm{H_2O} \ll 1$ falsifies the prediction.

3 Interstellar objects must fall along a diagonal in the $(r_{\mathbf{onset}},\, Q_{\mathrm{CO_2}}/Q_{\mathrm{H_2O}})$ plane

Explanation: Instead of scattering randomly, all interstellar objects should align along a diagonal. This is the macroscopic signature of the galactic pressure jump they experienced.

Formulation:

$$(r_{\mathrm{onset}},\, Q_{\mathrm{CO_2}}/Q_{\mathrm{H_2O}}) \text{ form a unique } \Psi\text{-basin diagonal.}$$

Observable: plot r_{onset} vs. CO_2/H_2O for each new 4I, 5I, 6I ...

Falsifiability. If new points appear far off the diagonal → the model fails.

4 $Q(\mathrm{H_2O})$ vs. r_H in interstellar comets must show slope breaks ("tension curves")

Explanation: Interstellar comets do not "wake up" smoothly: they activate in bursts, like a crust breaking in separate patches. Their production curve contains visible steps.

Formulation: Water production **must not** follow a single smooth r^{-2} law. Discrete slope breaks must appear, caused by sequentially fracturing patches.

Observable: well-sampled $Q(\mathrm{H_2O})(r_H)$ curve (photometry + OH retrieval).

Falsifiability. An interstellar comet exhibiting a perfectly smooth r^{-2} law contradicts the model.

5 Jets and polarization align with the fossil Ψ-fracture map of their origin

Explanation: The crust retains "scars" from the pressure basin where it formed. When the comet enters a new basin, it fractures along those ancient lines, producing preferred jet directions.

Formulation: Jet directions and polarization satisfy:

$$\vec{j} \;\parallel\; \text{fracture-map}(\Psi_A)$$

Observable: high-resolution imaging + polarimetry.

Falsifiability. An interstellar object displaying completely random jet orientations and polarization nullifies the prediction.

6 Extreme polarization as a direct signature of Ψ-mismatch

Explanation: If the crust was formed under a different galactic pressure, it fractures anisotropically when entering the Solar System. This uneven mechanical breakup polarizes the scattered light far more strongly than in ordinary Oort objects.

Formulation:

$$\Pi_{\text{interstellar}} \gg \Pi_{\text{Oort}} \quad \text{for large } |\Delta P|.$$

Observable: visible/NIR coma polarimetry.

Falsifiability. Detecting interstellar objects with strong ΔP indicators (far r_{onset}, high CO_2/H_2O) but **low polarization** would contradict the prediction.

7 Three independent observables must correlate coherently

Explanation: In classical comet chemistry, these three quantities are independent. In Quarkbase, they all originate from the same cause: the pressure jump. Therefore, all three must move together in a coherent pattern.

Formulation:

$$\left\{ r_{\text{onset}},\ Q_{CO_2}/Q_{H_2O},\ \text{jets/polarization} \right\} \text{ must correlate as a single parameter: } \Delta P_{A\to B}.$$

Observable: the three measurements for each new interstellar object.

Falsifiability. Finding objects for which the three indicators **fail to correlate** invalidates the prediction.

8 Future interstellar objects will cluster into three Ψ-bands

Explanation: Interstellar comets are "fossil seeds" of the galactic regions where they formed. Their statistical distribution will not be uniform: three well-separated families must emerge.

Formulation: Three statistical groups must appear in any sample ≥ 5 objects:

- **Ψ_B (Oort natives)**
- **Intermediate (Borisov-like)**
- **Extreme (ATLAS-like)**

Observable: statistical analysis of r_{onset} and CO_2/H_2O for new 4I, 5I, 6I...

Falsifiability. If, with enough interstellar objects, the distribution becomes uniform, the model fails.

9 A 3D Ψ-pressure map of the Galaxy can be reconstructed from comet data

Explanation: Each interstellar object carries a "pressure value" frozen into its crust. By combining multiple objects, one can reconstruct a three-dimensional map of the Galaxy's pressure basins, much like creating a topographic map using distributed probes.

Formulation: Each object adds a point:

$$\left(\vec{x}_{\text{origin}},\ \Delta P_{A \to B} \right)$$

and the resulting cloud of points must reproduce a coherent pressure topography.

Observable: direction of origin + measured parameters (r_{onset}, CO_2/H_2O).

Falsifiability. If the ΔP distribution is chaotic and lacks spatial structure, the prediction fails.

II. Graphene & Condensed-Matter Physics

10 The graphene absorbance must be exactly $\pi\alpha_{\mathbf{QB}} \approx 2.30\%$

Explanation: Quarkbase predicts that graphene's absorbance arises from a universal ether-resonance, not from electronic transitions. Any deviation from this fixed value breaks the theory.

Formulation:

$$A_{\text{graphene}} = \pi\,\alpha_{\text{QB}} = 0.0230 \pm 0.0003$$

Observable: absorbance of monolayer graphene under ideal measurement conditions.

Falsifiability. A single ultraprecise measurement that does not match $\pi\,\alpha_{\text{QB}}$ falsifies the prediction.

11 Superconductivity in graphene occurs without Cooper pairs

Explanation: If perfect conduction arises from the pressure field rather than from paired electrons, the spectral signature must differ from that of a conventional superconductor. No "BCS fingerprint" means no Cooper-pair gap in the spectrum.

Formulation: A BCS gap associated with electronic pairing should **not** appear; superconductivity must emerge from **phase coherence of the Ψ-field**.

Observable: ARPES spectra, tunneling (STS), and gap measurements.

Falsifiability. Unequivocally detecting a classical BCS gap in superconducting graphene would falsify this prediction.

12 Ultra-high thermal conductivity in graphene is due to Ψ-transport, not phonons

Explanation: Heat travels through the Ψ-field, not through atomic vibrations. This allows conductivities far beyond what phonons can support.

Formulation:

$$k_{\text{thermal}} \gg k_{\text{phonon}}^{\max} \quad \text{and it does not follow } k \propto T^{-1}.$$

Observable: thermal conductivity at low and intermediate temperatures → it must deviate from known phonon-limited behavior.

Falsifiability. If all measured conductivity can be fully explained by phonons + defects, the prediction is nullified.

13 T_c can be increased by modifying the hexagonal geometry of graphene

Explanation: If superconductivity originates from Ψ-field modes trapped in the hexagonal lattice, deforming that lattice must change T_c in a predictable way. New geometry = new T_c.

Formulation:

$$T_c = T_c(\theta,\ \varepsilon,\ \text{curvature}) \quad \text{with strong dependence on local geometry.}$$

Observable: vary angle, strain, or geometric doping → measure T_c.

Falsifiability. A T_c completely insensitive to all controlled mechanical deformations falsifies the prediction.

III. Galactic Dynamics & Large-Scale Structure

14 Galactic rotation curves must fit a Yukawa potential with $\lambda \approx 50$ kpc

Explanation: There is no dark matter: there is a Quarkbase pressure-field screening. The characteristic radius of ~ 50 kpc is fixed. If observations do not match it, the model is wrong.

Formulation:

$$\Phi(r) = -\frac{GM}{r}\left(1 - e^{-r/\lambda}\right), \qquad \lambda \approx 50 \text{ kpc}.$$

Observable: rotation curves of galaxies and galaxy clusters.

Falsifiability. High-precision rotation curves that do not fit $\lambda \approx 50$ kpc invalidate the prediction.

15 Large-scale cosmic filaments (> 1000 Mpc) follow Ψ-interference patterns

Explanation: The cosmic web is a giant wave pattern: clusters sit on the maxima, voids on the minima. There must be rhythm and periodicity, not randomness.

Formulation: Filaments must show periodicity and orientation compatible with long-wavelength modes of the Ψ-field.

Observable: statistical analysis from SDSS, DESI, Euclid.

Falsifiability. Detecting a completely random distribution with no phase correlations falsifies this prediction.

16 Redshift evolution must track a varying refractive index $n(t)$, not metric expansion

Explanation: In Quarkbase, the "stretching" of light does not result from the expansion of space but from changes in the refractive index of the etheric medium. This produces an $n(t)$ curve that can be compared directly with observational data.

Formulation:

$$1 + z = \frac{n(t_{\text{obs}})}{n(t_{\text{emit}})}$$

Observable: H(z) curves, BAO measurements, CMB constraints → reconstruct $n(t)$.

Falsifiability. If the $n(t)$ reconstructed from cosmological data fails to match the observed redshifts, the prediction is discarded.

17 Supercluster scale must satisfy $L \simeq 2\pi/k_{\text{res}}$ with $k_{\text{res}} = \sqrt{\rho_q/\kappa}$

Explanation: The size of superclusters is not random: it is the natural "wavelength" of the ether. If the model is correct, the observed scale must coincide with this prediction.

Formulation:

$$L \approx \frac{2\pi}{\sqrt{\rho_q/\kappa}} \approx 100 \text{ Mpc}$$

Observable: characteristic size of clusters and superclusters.

Falsifiability. If the typical supercluster scale does not match the predicted value, the prediction fails.

IV. Quantum Phenomena

18 Double-slit impacts must match Ψ self-focusing, not probabilistic collapse

Explanation: Quarkbase states that the particle never "collapses": it simply concentrates in one region due to pressure-field focusing. The impact pattern must contain geometric signatures of that self-focusing process.

Formulation: The impact pattern must reflect self-focusing of the Ψ-field, with a distribution dependent on local geometry and pressure.

Observable: ultra-precision double-slit experiments (nanofabricated slits, slow electrons).

Falsifiability. If the distribution fits standard probabilistic collapse exclusively, with no structure compatible with self-focusing, the prediction is invalidated.

19 High-energy entanglement tests must show coherence without causal transmission

Explanation: If entanglement is a spatially extended Ψ-field mode, no "faster-than-light" communication is required. Coherence should survive even under extreme delay conditions.

Formulation: Bell correlations must persist even under extreme retardation:

$$\text{correlations} = \text{continuous extended mode of the } \Psi\text{-field.}$$

Observable: next-generation Bell tests with delays $> 10^4$–10^5 km or with ultra-stable optical fibers.

Falsifiability. Detecting correlation decay incompatible with a continuous extended mode falsifies the prediction.

V. Nuclear Physics

20 Nuclear fission energy (U-235) must match exactly using only Ψ-pressure geometry

Explanation: The model predicts that nuclear energy does not originate from mass defects but from geometric relaxation of the etheric pressure field. The final number must match the measured energy down to the last unit.

Formulation:

$$E_{\text{fission}}(^{235}\text{U}) \approx 200\ \text{MeV} \quad \text{predicted without mass, using only pressure and geometry.}$$

Observable: compare the released energy with the pure geometric Ψ-calculation.

Falsifiability. If the Ψ-based calculation cannot reproduce the measured value, the prediction fails.

Conclusion

The twenty predictions collected in this work form a cross-disciplinary test suite for Quarkbase Cosmology. Each prediction is tied to a single measurable observable, independent of theoretical assumptions, and therefore provides a decisive method for empirical validation. The strength of the framework lies in its breadth: it offers falsifiable signatures in comet behavior, graphene transport properties, galactic dynamics, large-scale structure, quantum coherence, and nuclear energetics—all stemming from the same underlying Ψ-field dynamics. Future measurements across these domains will determine whether the theory withstands empirical pressure or must be rejected. If observations confirm the predicted patterns, the Quarkbase model would provide a unified description of phenomena traditionally treated as disconnected, demonstrating that a single pressure-based mechanism governs structures from subatomic scales to the architecture of the cosmos.