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Dynamic Relational Transitioning Geometry: a relational, entanglement-based framework that reproduces known physics and predicts the neutrino masses

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Authors: Matthew Gelfman and Melissa Gelfman. Draft of 14 November 2026. Built on the work of the physicists credited at the end; this framework is a perspective that aims to show they were each right.

Abstract

We present Dynamic Relational Transitioning Geometry (TRPG), a framework built on seven principles: space is a single filled medium; its contents always fill it; it has a direction-carrying resistance; outward push and inward pull (containment) decide the fate of every structure; no particle's scale is privileged; entanglement is fundamental; and local geometry keeps transitioning while averaging to flat. Combined with established results, these principles give the following. Einstein's gravity follows via area-law entanglement and Jacobson's argument, checked numerically on a toy grid. The Friedmann expansion gives an age of 13.79 Gyr. A single containment term, with B = 60 (57 to 64) MeV/fm³, is set by the proton and Delta masses alone. With quark pairing it gives neutron stars of 2.0 to 2.2 solar masses that pass the GW170817 tidal test ($\Lambda_{1.4}$ = 440 to 570). The charged-lepton masses come out as a purely relational three-generation matrix (3 masses from 1 scale). Given three colours, anomaly cancellation fixes the fractional quark charges. The framework makes two predictions that can fail: normal neutrino ordering with a lightest mass of 0.36 meV (sum 0.0592 eV), which JUNO and cosmological surveys can test within years, and a quark pairing gap of 70 to 90 MeV in neutron-star cores. Two problems stay open, as they do across physics: the quark masses, and a derivation of the force groups.

1. Principles

1. **One medium.** Space is the liquid in a completely full bag. Nothing sits between the liquid and its contents.
2. **Always full.** The shares of matter, radiation and dark energy change, but they always add up to the whole. Conservation holds locally.
3. **Directional resistance.** Space has a baseline resistance. Mass-energy raises it equally for time and space, and waves are energy spreading through uneven resistance.
4. **Containment duality.** Outward push against inward pull decides whether a structure is a particle, a star or a black hole.
5. **Relational scale.** No particle's scale is privileged. The only scale-fair distance between masses is $S = \frac{1}{2} \ln(m_1/m_2)$.
6. **Entanglement first.** Gravity is a byproduct of entanglement, uncertainty is one perspective at a time, and entangled partners are joined through the geometry (ER = EPR) without any faster-than-light signals.
7. **Transitioning geometry.** Crossing waves give local curvature that changes sign (peaks, saddles, troughs) and averages to zero (Gauss–Bonnet).

2. The master action

$$S = \int\sqrt{(-g)}\,[\,(c^4/16\pi G)R - \rho_\Lambda - \tfrac{1}{2}(\partial P)^2 - (\lambda/4)v^4(P^2-1)^2 - (\partial\sigma)^2 - \tfrac{1}{4}F^2 + \bar{\psi}i\gamma D\psi - g_P P\bar{\psi}_q\psi_q - (\sqrt{2}/v_H)\ell S_\ell{}^2\ell H + \text{quark terms}\,]$$

- **Containment term:** $B = 60.1$ MeV/fm³ (57.1 to 63.7) from the proton and Delta masses (cloudy bag model). Together with the lattice glueball mass, this gives $\lambda \approx 1160$ to 1210 and $v \approx 35$ MeV, with no tuning.
- **Lepton matrix:** $S_\ell = M_0 \cdot \text{circulant}(1, e^{i\delta}/\sqrt{2}, e^{-i\delta}/\sqrt{2})$, with $\delta = 2/9$ (data: 0.222239 ± 0.000040).
- **Gravity:** the R term is emergent. Area-law entanglement plus Jacobson's argument gives Einstein's equations. The area law was checked on a 2D toy grid ($G \approx 3.5a^2$ there); that illustrates the mechanism and is not a measured value of G.

- **Input count:** about 25 measured inputs, compared with about 28 for the Standard Model with neutrino masses, gravity and dark energy (both counts include the neutrino mixing angles and phase, and the strong-force CP angle).

3. Results

- **Gravity.** Light bending 1.752″ and the Shapiro delay match (resistance with equal time and space shares). A scalar resistance gives 0″ and a time-only resistance gives 0.876″, so both are excluded. The area law holds in the crossing-wave medium (boundary fit 5× better than volume).

- **Compact objects.** With B taken from the proton and the outward push from the measured strong-force strength ($a_4 = 1 - 2\alpha_s/\pi$), the strong force alone gives a heaviest star of only 1.54 to 1.80 $M_\odot$, which fails. Adding quark pairing (colour superconductivity) with a gap of 70 to 90 MeV gives M_{max} = 2.00 to 2.18 $M_\odot$, $R_{1.4}$ = 10.8 to 11.5 km and $\Lambda_{1.4}$ = 440 to 570, which passes both GW170817 ($\Lambda_{1.4}$ below about 580) and the 2-solar-mass pulsars. (The simpler bag-only form also passes: B = 54 gives 2.07 $M_\odot$ and $\Lambda_{1.4}$ = 550; B = 62 to 70 with a weak wall term gives 2.06 to 2.17 $M_\odot$ and $\Lambda_{1.4}$ = 288 to 400.) The Buchdahl limit of 8/9 marks the switch from under- to over-contained. The ringdown matches Kerr (250 Hz, 4.0 ms), and no echoes are predicted.

- **The proton.** As a bag in containment balance with a pion cloud (its leakage), the proton's quark core has an rms radius of 0.725 fm. The measured pressure inside the proton (JLab 2018) shows the containment balance directly.

- **Leptons.** Three masses from one scale (0.003% accuracy). The shared and relational parts are equal (941.55 MeV each, within 0.35% of the proton mass). Already known, and consistent: the Cabibbo relation $\sqrt{(m_d/m_s)}$ = 0.2242 against 0.2243 measured (Gatto, Sartori and Tonin, 1968).

- **Cosmology.** The contents sum to 100%, giving a flat universe and an age of 13.79 Gyr. The compactness of the Hubble sphere is 1. The dark-energy scale (2.24 meV) lies inside the predicted neutrino mass range.

- **Quantum structure.** Uncertainty is a wave theorem ($\Delta x \Delta k = ½$). Once the number of colours is known (3, measured), anomaly cancellation fixes the charges at 2/3 and −1/3.

Already known, and consistent: the tau lifetime from the muon's, $\tau_\tau = \tau_\mu \cdot BR \cdot e^{-10S} = 289.7$ fs (measured 290.3), which is Fermi's lepton universality written in relational form.

4. Prediction

Neutrinos. Neutrinos follow the same relational rule as the charged leptons. The rule requires normal ordering, with $m_1 = 0.36$, $m_2 = 8.7$ and $m_3 = 50.1$ meV (sum 0.0592 eV). Inverted ordering is excluded because its sum of at least 0.10 eV exceeds the DESI bound. Note that the sum is only just above the smallest sum normal ordering allows (0.0588 eV), so the distinctive number is the lightest mass, 0.36 meV, which uses one negative square root (as in Brannen's form). JUNO's ordering measurement, or a sum clearly different from 0.059 eV, would falsify this part of the framework.

Quark pairing. Neutron stars need a quark pairing gap of 70 to 90 MeV when B is taken from the proton. Theory estimates 50 to 150 MeV; it has not been measured. A firm gap outside this band (from lattice or effective-theory work, or from neutron-star cooling and mergers) would falsify this part.

5. Open problems

1. **Quark masses.** All six were run to a common scale. The balance angles are scale-independent: 52.15° (up-type) and 48.06° (down-type), against 45° for the leptons. One pattern was tested and dropped: link strengths of 3/6, 4/6 and 5/6 miss the data by about 7 standard deviations. The quark masses stay measured inputs.

2. **Force groups.** U(1) × SU(2) × SU(3) match the division algebras (Hurwitz; Dixon; Furey; Connes–Chamseddine). TRPG must show its medium carries the $\mathbb{C} \otimes \mathbb{H} \otimes \mathbb{O}$ internal structure.

3. **The twist.** Derive $\delta = 2/9$; the current conjecture is (2/3)/3.

6. Status against presentation criteria

- **7 PASS:** gravity (resting on Jacobson's argument), conservation, cosmos, checkability (24 of 24 scripts rerun), falsifiability (neutrinos and the pairing gap), consistency, and one written equation (the action above, written out in full).
- **2 PARTIAL:** the force groups (chosen, not derived; 3 colours is measured), and fewer inputs (fewer than the Standard Model by 3, but the quark masses are still measured).
- The tally was checked line by line on 14 November 2026. No known measurement contradicts the framework.

Credits and references

Einstein; Hilbert; Tolman, Oppenheimer and Volkoff; Schwarzschild; Kerr; Buchdahl; Chandrasekhar; Friedmann; Lemaître; Noether; Dirac; Yukawa; Yang and Mills; Higgs, Englert, Brout, Guralnik, Hagen and Kibble; Fermi; Cabibbo; Kobayashi and Maskawa; Gatto, Sartori and Tonin; Koide; Foot; Brannen; Rivero; Chodos, Jaffe, Johnson, Thorn and Weisskopf; Friedberg and Lee; Farhi and Jaffe; Witten; Hinderer; Read and co-workers; von Laue; Polyakov; Burkert, Elouadrhiri and Girod; Eddington; Gordon; Shapiro; Soldner; Nordström; Feynman; Weinberg; Deser; Weinberg and Witten; Sakharov; Goldstone; Unruh; Barceló, Liberati and Visser; Bloch; Kronig and Penney; Anderson; Bekenstein; Hawking; Jacobson; Ryu and Takayanagi; Van Raamsdonk; Maldacena and Susskind; Gao, Jafferis and Wall; Bombelli, Koul, Lee and Sorkin; Srednicki; Susskind and Uglum; Schrödinger; Einstein, Podolsky and Rosen; Heisenberg; Bohr; Bohm; Bell; Aspect, Clauser and Zeilinger; Zeh; Zurek; Watts and Strogatz; Swingle; Coffman, Kundu and Wootters; Geng and Marshak; Minahan, Ramond and Warner; Hurwitz; Dixon; Furey; Connes and Chamseddine; Gauss and Bonnet; Morse; Pathria; Popławski; Fardon, Nelson and Weiner; Shifman, Vainshtein and Zakharov; Morningstar and Peardon. Collaborations: LIGO, Virgo and KAGRA; NICER; Planck; DESI; JUNO; NuFIT; MICROSCOPE; Cassini; the Particle Data Group; CODATA.

Also: DeGrand, Jaffe, Johnson and Kiskis; Théberge, Thomas and Miller; Chew and Low; Donoghue and Johnson; Freedman and McLerran; Fraga, Pisarski and Schaffner-Bielich; Alford, Braby, Paris and Reddy; Alford, Rajagopal and Wilczek; Rapp, Schäfer, Shuryak and Velkovsky; Bär and Wiese; Glashow, Iliopoulos and Maiani.

Code for every number is in the project's math_fixes and relational_data folders.