

Intrinsic Spectral Cosmology

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Abstract

We propose an intrinsic spectral cosmology based on intrinsic geometric wave mechanics, spectral dynamics, localized resonances, HJ source flow, and Hamilton–Jacobi gravity for point masses. The intrinsic field is represented through its time-local spectrum $P(\mathbf{k}, t)$, whose second moment defines M_2 , an intrinsic scale $R_I = M_2^{-1/2}$, and $H_I = \dot{R}_I/R_I = -\dot{M}_2/(2M_2)$. A canonical spectral Hamiltonian gives a conditional continuity equation and current $\mathbf{J}_k = \partial h / \partial (\nabla_k \theta)$; the actual Hamiltonian needed to determine that current is not fixed by the intrinsic space-time weak equation. We exhibit a minimal scale-drift Hamiltonian as a clearly labeled closure ansatz, not as a derived result. Gravity acts only between finite point masses through their Hamilton–Jacobi dynamics. Redshift, distance, structure formation, and the relation of localized resonances to masses remain hypotheses or open derivations. The framework makes no claim of empirical validation.

Scope and status. The paper separates results established within the cited frameworks, direct mathematical consequences, and conjectural closure assumptions introduced here. The model excludes general relativity, quantum mechanics, and special relativity as foundations; it is a research proposal, not an empirically established cosmology.

1 Introduction

The intrinsic geometric wave-mechanics preprint develops a Hilbert-transform geometry, intrinsic weak derivatives, and a normalized space-time wave equation [1]. The spectral-dynamics preprint proposes a hierarchy from intrinsic state to spectral evolution, propagation, resonances, and observables [2]. The Haar-wavelet preprint gives a localization result for jump discontinuities [3]. The revised HJ-charge preprint proposes an action-generated source flow and candidate charge-like fields [4]. The HJ-gravity preprint formulates pairwise gravity for finite sets of point masses [5]. The cosmological proposal developed here has a deliberately narrow foundation:

1. intrinsic wave mechanics supplies the deterministic state and spectral representation;
2. spectral moments define a characteristic intrinsic scale;
3. localized, stable resonances are candidate material objects;
4. only after a resonance is assigned point-mass parameters does the finite-body Hamilton–Jacobi gravity sector apply;
5. an HJ source-flow sector may be associated with localized states, while its field interpretation remains conjectural.

No continuous gravitating mass density or gravitational field equation is introduced. The intrinsic scale evolution and the point-mass mechanics remain distinct until an explicit coupling is derived. In particular, this proposal does not yet give a closed predictive history for an expanding cosmos.

2 Literature survey

2.1 Hamilton–Jacobi mechanics and point-mass gravity

Hamilton’s characteristic and principal functions provide a classical formulation of finite-dimensional dynamics in terms of an action function and its first-order Hamilton–Jacobi equation [6]. The finite-body sector studied here belongs to that tradition: a chosen N-body Hamiltonian generates particle trajectories and a Hamilton–Jacobi equation for the principal function. The cosmological proposal does not claim a new Hamilton–Jacobi formalism. Its modeling choice is to restrict gravity to pair interactions among point masses and to leave the continuous spectral background outside that gravitational sector. This restriction distinguishes the present construction from continuum gravitational field models.

2.2 Spectral transfer and the problem of closure

In classical wave systems, Fourier modes can exchange energy through nonlinear interactions. Wave-turbulence theory derives statistical kinetic descriptions under explicit assumptions about the interaction regime and statistical state; Newell and Rumpf review the construction, its domain of validity, and open closure problems [7]. This literature is relevant methodologically rather than as a cosmological model: spectral normalization and a formal continuity equation do not determine a transfer current. The ISEC proposal similarly needs a specified spectral Hamiltonian with phase-gradient dependence before its conditional current becomes predictive. The assumptions used in wave-turbulence closures are not imported here.

2.3 Wavelets as localization tools

Haar introduced an orthogonal function system that became the basis for the Haar wavelet [8]. Subsequent wavelet analysis developed methods for locating singularities and estimating local regularity from scale-dependent transform behavior; Mallat and Hwang provide a foundational treatment [9]. These results motivate using Haar-scale signatures to locate candidate discontinuities in intrinsic fields. They establish a signal-analysis diagnostic, not the physical interpretation of a discontinuity as stable matter. That interpretation would additionally require a solution of the intrinsic dynamics, stability under perturbations, and a justified mass assignment.

2.4 Relation to the cited intrinsic-framework preprints

The cited preprints develop the intrinsic Hilbert geometry, spectral hierarchy and moment-defined scale, jump-localization construction, HJ source-flow proposal, and point-mass gravity sector [1, 2, 3, 4, 5]. This paper’s contribution is to organize those elements as a cosmological hypothesis and make their interfaces explicit. The phase-space formula for spectral current is conditional on a Hamiltonian that the intrinsic space-time weak equation does not yet specify as a time-local evolution law. The scale-drift term later in the paper is therefore an illustrative closure ansatz, not a result of the cited dynamics. The literature reviewed here supplies mathematical precedents; it does not validate the cosmological interpretation or its observational hypotheses.

3 Intrinsic geometry and wave mechanics

Let $\mathbb{T}^m$ denote the periodic domain used in the wave-mechanics preprint, and let f^h denote the Hilbert transform. The cited framework defines the embedding and inner product schematically by

$$T(f) = f + if^h, \quad \langle f, g \rangle_{\mathcal{H}} = \langle T(f), T(g) \rangle_{L^2(\mathbb{T}^m)}. \quad (1)$$

The induced norm is $\|f\|_{\mathcal{H}} = \|T(f)\|_{L^2}$. Intrinsic derivatives ∂_j^H are defined weakly by duality using this inner product. The wave-mechanics preprint states that on their natural domain these derivatives agree with classical weak derivatives, are skew-adjoint, and have Fourier eigenmodes with eigenvalues $2\pi i k_j$. Those operator claims belong to the preprint's mathematical construction [1].

The wave-mechanics source uses the space-time domain $\Omega = (0, 1)^3 \times (0, 1)$, a normalized intrinsic field $\psi \in \mathcal{H}(\Omega)$, and a wave-number parameter $\gamma > 0$. Its constrained variational construction yields a weak space-time equation of the form

$$\frac{1}{2\gamma} \langle \Delta_H \psi, \varphi \rangle_{\mathcal{H}} + \langle \bar{V} \psi, \varphi \rangle_{\mathcal{H}} + \sum_{j=1}^3 \langle A_j \partial_j^H \psi, \varphi \rangle_{\mathcal{H}} + \lambda \langle \psi, \varphi \rangle_{\mathcal{H}} = 0, \quad \|\psi\|_{\mathcal{H}} = 1, \quad (2)$$

for admissible test functions φ . The cited framework defines $\alpha = 1/(2\gamma)$, the Hilbert-transformed vector potential $\bar{A}^h$, and $\bar{V} = V + \partial_t^H \nabla_H^s \cdot \bar{A}^h$. It writes the constrained energy as $E(\psi) = \alpha \|\nabla_H^{st} \psi\|_{\mathcal{H}}^2 + \|\sqrt{\bar{V}} \psi\|_{\mathcal{H}}^2 + \|\bar{A} \cdot \nabla_H^s \psi\|_{\mathcal{H}}^2$, and states that the weak equation follows by constrained variation. Equation (2) is a space-time weak equation; it is not yet a closed first-order initial-value law for a time-local spectrum. The wave-mechanics preprint reports a Fourier-matrix solution and existence/uniqueness argument. For cosmological prediction, the boundary/initial data, the phase convention for a complex normalized solution, and continuous dependence of the time-local observables must be made explicit.

Here ψ is the intrinsic deterministic field defined by the framework. Its Hilbert-space norm and spectral weights are not given a quantum-mechanical measurement or Born-rule interpretation. The model uses neither quantum postulates nor special-relativistic kinematics; these are exclusions of its proposed foundations, not experimentally established conclusions.

4 Spectral state and intrinsic cosmological scale

Following the spectral-dynamics preprint's four-dimensional Fourier representation, write

$$\psi(\mathbf{x}, t) = \sum_{\mathbf{k} \in \mathbb{Z}^3} \sum_{\ell \in \mathbb{Z}} \hat{\psi}(\mathbf{k}, \ell) e^{2\pi i(\mathbf{k} \cdot \mathbf{x} + \ell t)}, \quad P(\mathbf{k}, t) = \sum_{\ell \in \mathbb{Z}} |\hat{\psi}(\mathbf{k}, \ell)|^2, \quad \sum_{\mathbf{k}} P(\mathbf{k}, t) = 1. \quad (3)$$

The spectral-dynamics preprint defines P as an intrinsic spectral density, not a quantum probability distribution [2]. Its broader overview also uses an ensemble power spectrum and a continuum integral. We retain both conventions as source statements but do not identify them without a specified normalization and continuum limit.

There is a time-indexing issue to resolve: as printed, the full temporal Fourier coefficients $\hat{\psi}(\mathbf{k}, \ell)$ in (3) do not themselves depend on the displayed time t . A cosmological evolution calculation therefore needs a time-local spatial spectrum. One possible new closure is to define spatial Fourier amplitudes $\tilde{\psi}_{\mathbf{k}}(t)$ on each time slice and set

$$P_{\mathbf{k}}(t) = \frac{|\tilde{\psi}_{\mathbf{k}}(t)|^2}{\sum_{\mathbf{q}} |\tilde{\psi}_{\mathbf{q}}(t)|^2}, \quad \sum_{\mathbf{k}} P_{\mathbf{k}}(t) = 1. \quad (4)$$

Equation (4) is our explicit time-slice definition, introduced to resolve the temporal-indexing ambiguity in the spectral preprint. Other ensemble or windowed-time definitions are possible and must be chosen before dynamics are computed.

With the discrete convention, define

$$M_2(t) = \sum_{\mathbf{k}} |\mathbf{k}|^2 P_{\mathbf{k}}(t), \quad R_1(t) = M_2(t)^{-1/2}, \quad H_1(t) = \frac{\dot{R}_1}{R_1}. \quad (5)$$

The spectral-dynamics preprint also writes the continuum version $M_2 = \int k^2 P(\mathbf{k}, t) d^3k$. In either convention, when $M_2 > 0$ and differentiable,

$$\boxed{H_1 = -\frac{1}{2} \frac{\dot{M}_2}{M_2}}. \quad (6)$$

This is an identity following from the definition. It defines the fractional growth rate of R_1 ; it is not by itself an observed expansion rate. With dimensionless torus modes, R_1 is a mode-space scale and requires a calibration length before comparison with physical distances. The spectral-dynamics preprint interprets cosmological expansion as spectral evolution rather than expansion of a dynamical spacetime metric [2].

5 Hamiltonian derivation of the spectral current and the closure gap

The spectral-dynamics preprint sets out a formal canonical construction that sharpens the current discussion. Write a time-local spectral amplitude as

$$a(\mathbf{k}, t) = \sqrt{P(\mathbf{k}, t)} e^{i\theta(\mathbf{k}, t)}, \quad \mathcal{H}_{\text{spec}} = \mathcal{H}_{\text{spec}}[P, \theta]. \quad (7)$$

The proposed canonical variables obey $\{P(\mathbf{k}), \theta(\mathbf{k}')\} = \delta^{(3)}(\mathbf{k} - \mathbf{k}')$, with evolution convention

$$\partial_t P = \frac{\delta \mathcal{H}_{\text{spec}}}{\delta \theta}, \quad \partial_t \theta = -\frac{\delta \mathcal{H}_{\text{spec}}}{\delta P}. \quad (8)$$

Suppose the Hamiltonian depends on θ only through $\mathbf{q} = \nabla_{\mathbf{k}} \theta$, and has a local functional representation $\mathcal{H}_{\text{spec}} = \int h(P, \mathbf{q}, \mathbf{k}, t) d^3k$. For variations vanishing at the spectral boundary,

$$\delta \mathcal{H}_{\text{spec}} = \int \frac{\partial h}{\partial \mathbf{q}} \cdot \nabla_{\mathbf{k}} \delta \theta d^3k = - \int \nabla_{\mathbf{k}} \cdot \left(\frac{\partial h}{\partial \mathbf{q}} \right) \delta \theta d^3k, \quad \frac{\delta \mathcal{H}_{\text{spec}}}{\delta \theta} = -\nabla_{\mathbf{k}} \cdot \frac{\partial h}{\partial \mathbf{q}}. \quad (9)$$

Combining (8) and (9) gives the continuity law and current

$$\partial_t P + \nabla_{\mathbf{k}} \cdot \mathbf{J}_k = 0, \quad \boxed{\mathbf{J}_k = \frac{\partial h}{\partial (\nabla_{\mathbf{k}} \theta)}}. \quad (10)$$

For a nonlocal Hamiltonian, replace the partial derivative by the functional derivative with respect to $\nabla_{\mathbf{k}} \theta$; a local vector current exists only if that variational derivative can be represented as such. A divergence-free addition to $\mathbf{J}_k$ leaves the continuity equation unchanged, so a unique current convention also requires boundary or constitutive information.

There is a sign inconsistency in the spectral preprint at this point [2]. Its displayed canonical equations $\partial_t P = \delta \mathcal{H} / \delta \theta$, $\partial_t \theta = -\delta \mathcal{H} / \delta P$, together with $\partial_t P + \nabla_{\mathbf{k}} \cdot \mathbf{J}_k = 0$, imply the plus sign in (10);

the manuscript's printed formula for $\mathbf{J}_k$ has a minus sign. Reversing the canonical bracket/evolution convention reverses both Hamilton equations and can yield that minus sign. This paper retains the explicitly displayed evolution convention and uses the mathematically corresponding plus sign. The sign choice should be reconciled with the source's symplectic convention before treating the current as fixed.

This is a structural derivation, not yet the requested physical closure. The wave-mechanics weak equation is a constrained weak equation on space-time involving Δ_H , potentials, and a norm multiplier. As written, it is not a first-order time-local Hamilton equation and does not specify the canonical spectral Hamiltonian $\mathcal{H}_{\text{spec}}[P, \theta]$, its phase-gradient dependence, or an initial-value evolution for $a(\mathbf{k}, t)$. The quadratic example in the spectral manuscript, $\mathcal{H}_{\text{quad}} = \int \omega(\mathbf{k}) P(\mathbf{k}) d^3k$, has no phase-gradient dependence and therefore yields $\mathbf{J}_k = 0$. Nonzero spectral transfer requires additional phase-dependent terms, nonlinear couplings, or a derivation from the underlying field action. Thus the framework determines the form of the current conditionally, but the cited preprints do not determine its value or predict expansion.

5.1 A minimal Hamiltonian ansatz realizing scale drift

To exhibit exactly what extra assumption closes a simple background model, consider the following explicit ansatz:

$$h(P, \theta, \mathbf{k}, t) = \omega(\mathbf{k})P - \nu(t)P\mathbf{k} \cdot \nabla_{\mathbf{k}}\theta, \quad \nu(t) \geq 0. \quad (11)$$

It is not derived from the intrinsic weak equation in the wave-mechanics preprint [1]. Applying (10) and (8) gives

$$\mathbf{J}_k = -\nu(t)\mathbf{k}P, \quad (12)$$

$$\partial_t P - \nu(t)\nabla_{\mathbf{k}} \cdot (\mathbf{k}P) = 0, \quad (13)$$

$$\partial_t \theta = -\omega(\mathbf{k}) + \nu(t)\mathbf{k} \cdot \nabla_{\mathbf{k}}\theta. \quad (14)$$

With sufficient decay at large $|\mathbf{k}|$, the continuity equation preserves $\int P d^3k = 1$ and positivity under its characteristic flow. Define $N(t) = \int_{t_*}^t \nu(s) ds$. Its solution and second moment are

$$P(\mathbf{k}, t) = e^{3N(t)} P(e^{N(t)}\mathbf{k}, t_*), \quad M_2(t) = e^{-2N(t)} M_2(t_*). \quad (15)$$

Consequently,

$$R_I(t) = R_I(t_*)e^{N(t)}, \quad H_I(t) = \nu(t), \quad \frac{\ddot{R}_I}{R_I} = \dot{\nu} + \nu^2. \quad (16)$$

These equations follow exactly from the ansatz. A constant ν gives exponential growth of the defined intrinsic scale; this does not follow from the intrinsic wave equation. The ansatz Hamiltonian is explicitly time-dependent when ν varies, and its admissible function space, lower-boundedness, physical units, and compatibility with the original wave action have not been established. A first-principles closure must derive $\mathcal{H}_{\text{spec}}$, including its phase-gradient terms, from the intrinsic dynamics and thereby determine ν or replace this ansatz. Until then, $\nu(t)$ is a free closure input rather than a prediction.

For the discrete torus spectrum, the functional derivatives above must be replaced by a defined lattice Hamiltonian and discrete summation-by-parts identity. The continuum derivation cannot be transferred to the discrete modes without that step. In either representation, normalization preservation, spectral boundary conditions, and continuous dependence on initial data must be proved for the selected Hamiltonian.

6 Localized resonances and Haar-wavelet diagnostics

The spectral-dynamics preprint proposes that matter consists of localized, dynamically stable intrinsic spectral resonances. It discusses Fourier jump localization and gives a Haar-wavelet theorem. For a locally bounded-variation function with jump set $\{x_m\}$ and jump amounts c_m , the Haar-wavelet preprint defines a scale-averaged transform $R_y(b_0)$ and states, with its normalization constant K ,

$$\lim_{y \rightarrow \infty} R_y(b_0) = \begin{cases} Kc_m, & b_0 = x_m, \\ 0, & b_0 \notin \{x_m\}. \end{cases} \quad (17)$$

This can serve as a proposed diagnostic for jump-like localization in candidate intrinsic structures [3, 2]. The theorem concerns a mathematical signal class; by itself it does not establish physical resonances, their stability, or a particle spectrum.

A candidate material object is thus a solution of the intrinsic wave system that is localized, regular in its allowed function space, and stable under the specified intrinsic evolution. Its position may be identified by a localization center. A mass assignment is not derived in the wave-mechanics or HJ-gravity preprints: they do not derive m_a from a resonance energy. For the gravity sector below, m_a must remain an independent point-mass parameter until a derivation is provided.

7 Gravity for point masses: Hamilton–Jacobi sector

Gravity in the proposed model is restricted to finite sets of point masses, following the HJ-gravity preprint [5]. For N masses m_i at $\mathbf{x}_i$, define $r_{ij} = |\mathbf{x}_i - \mathbf{x}_j|$. The pairwise potential and Newton equations in the HJ-gravity preprint are

$$V_G = -G \sum_{i < j} \frac{m_i m_j}{r_{ij}}, \quad (18)$$

$$m_i \ddot{\mathbf{x}}_i = -G m_i \sum_{j \neq i} m_j \frac{\mathbf{x}_i - \mathbf{x}_j}{|\mathbf{x}_i - \mathbf{x}_j|^3}. \quad (19)$$

The canonical Hamiltonian is

$$H_G = \sum_{i=1}^N \frac{|\mathbf{p}_i|^2}{2m_i} - G \sum_{i < j} \frac{m_i m_j}{|\mathbf{x}_i - \mathbf{x}_j|}. \quad (20)$$

Hamilton's equations $\dot{\mathbf{x}}_i = \nabla_{\mathbf{p}_i} H_G = \mathbf{p}_i / m_i$ and $\dot{\mathbf{p}}_i = -\nabla_{\mathbf{x}_i} H_G$ reproduce (19). Define Hamilton's principal function $S(\mathbf{x}_1, \dots, \mathbf{x}_N, t)$ and $\mathbf{p}_i = \nabla_{\mathbf{x}_i} S$. The N-body Hamilton–Jacobi equation is

$$\boxed{\partial_t S + \sum_{i=1}^N \frac{|\nabla_{\mathbf{x}_i} S|^2}{2m_i} - G \sum_{i < j} \frac{m_i m_j}{|\mathbf{x}_i - \mathbf{x}_j|} = 0.} \quad (21)$$

For an autonomous system with conserved total energy E , set $S = W - Et$; its stationary equation is

$$\sum_i \frac{|\nabla_{\mathbf{x}_i} W|^2}{2m_i} - G \sum_{i < j} \frac{m_i m_j}{|\mathbf{x}_i - \mathbf{x}_j|} = E. \quad (22)$$

Initial or boundary data select a particular solution and trajectory family.

For the two-body reduction in the HJ-gravity preprint [5], with a fixed central mass M , orbiting mass m , radius $r = |\mathbf{x}|$, and conserved angular momentum L ,

$$H = \frac{|\mathbf{p}|^2}{2m} - \frac{GMm}{r}, \quad \partial_t S + \frac{|\nabla S|^2}{2m} - \frac{GMm}{r} = 0. \quad (23)$$

For $S = W - Et$, the radial momentum and reduced action are

$$p_r = \frac{\partial W}{\partial r} = \sqrt{2mE + \frac{2GMm^2}{r} - \frac{L^2}{r^2}}, \quad W(r) = \int^r \sqrt{2mE + \frac{2GMm^2}{r'} - \frac{L^2}{r'^2}} dr'. \quad (24)$$

The HJ-gravity preprint identifies the resulting orbits as Kepler trajectories [5].

Equivalently, stationary action with

$$L_N = \sum_i \frac{m_i}{2} |\dot{\mathbf{x}}_i|^2 + G \sum_{i < j} \frac{m_i m_j}{|\mathbf{x}_i - \mathbf{x}_j|}, \quad \mathcal{A} = \int_{t_1}^{t_2} L_N dt, \quad (25)$$

and $\delta\mathcal{A} = 0$ yields (19). Along a classical path, $S = \int L_N dt$ and $dS = \sum_i \mathbf{p}_i \cdot d\mathbf{x}_i - H_G dt$.

Strict scope. This sector contains point masses and pairwise interactions only. No continuous mass density enters its gravitational law; no gravitational field equation or spacetime-curvature variable is introduced. In this cosmology proposal, a resonance can enter (20) only after a justified mapping to $(m_a, \mathbf{x}_a, \mathbf{p}_a)$. The mass remains an input. The finite-body equations do not determine the background spectral evolution, couple to M_2 , or provide a continuous-density cosmology. The user's restriction is therefore enforced throughout: there is no gravity law for continuous mass distributions.

8 HJ matter flow and candidate charge-like fields

The revised HJ-charge preprint *HJ-Generated Charge, Coulomb-Like Interaction, and Candidate Field Equations* changes the status and notation of the field sector. It defines an HJ source density ρ_H and obtains its current-like flow from a constituent action $S(\mathbf{x}, t)$,

$$\mathbf{p} = \nabla S, \quad \mathbf{v}_H = \frac{\nabla S}{m}, \quad \boxed{\mathbf{J}_H = \rho_H \frac{\nabla S}{m}}. \quad (26)$$

The associated proposed matter-flow equations are

$$\partial_t S + \frac{|\nabla S|^2}{2m} + V = 0, \quad \partial_t \rho_H + \nabla \cdot \mathbf{J}_H = 0. \quad (27)$$

For a region Ω ,

$$\frac{d}{dt} \int_{\Omega} \rho_H d^3x = - \int_{\partial\Omega} \mathbf{J}_H \cdot d\mathbf{a}. \quad (28)$$

Thus the integrated HJ source is conserved for an isolated domain with zero boundary flux. This is conservation of the modeled HJ source; it is not a derivation of electric charge conservation. The HJ-charge preprint describes this system as an effective large-wave-number description of localized states and does not derive it from the underlying intrinsic wave equation [4].

The revision proposes, rather than derives completely, electric-like and magnetic-like fields. For a point-source prescription it writes

$$\mathbf{E}_{HJ}(\mathbf{x}, t) = -\nabla \left[K_C \frac{\mathcal{Q}(S(\mathbf{x}, t))}{r} \right], \quad r = |\mathbf{x}|, \quad (29)$$

where K_C and the action-dependent effective source $\mathcal{Q}$ require specification. For an extended HJ source it proposes

$$\mathbf{E}_{HJ}(\mathbf{x}, t) = K_C \int \rho_H(\mathbf{x}', t) \frac{\mathbf{x} - \mathbf{x}'}{|\mathbf{x} - \mathbf{x}'|^3} d^3x' + \mathbf{E}_S, \quad (30)$$

with an unspecified action-dependent completion $\mathbf{E}_S$. Its candidate divergence equation is

$$\nabla \cdot \mathbf{E}_{HJ} = 4\pi K_C \rho_H + \mathcal{S}_E[S, \rho_H], \quad \mathcal{S}_E = \nabla \cdot \mathbf{E}_S. \quad (31)$$

A Biot–Savart-like kernel is proposed from HJ momentum flow,

$$\mathbf{B}_{HJ}(\mathbf{x}, t) = K_B \int \rho_H(\mathbf{x}', t) \frac{\nabla' S(\mathbf{x}', t) \times (\mathbf{x} - \mathbf{x}')}{|\mathbf{x} - \mathbf{x}'|^3} d^3x' = K_B m \int \frac{\mathbf{J}_H(\mathbf{x}', t) \times (\mathbf{x} - \mathbf{x}')}{|\mathbf{x} - \mathbf{x}'|^3} d^3x', \quad (32)$$

with candidate curl equation

$$\nabla \times \mathbf{B}_{HJ} = 4\pi K_B m \mathbf{J}_H + \mathcal{S}_B[S, \rho_H]. \quad (33)$$

The HJ-charge preprint leaves $\mathcal{S}_E$ and $\mathcal{S}_B$, the couplings, regularization of point-source expressions, and the full time-dependent field laws unresolved. In particular it does not assume $\nabla \cdot \mathbf{B}_{HJ} = 0$ or $\nabla \times \mathbf{E}_{HJ} = -\partial_t \mathbf{B}_{HJ}$. We therefore do not identify ρ_H with electric charge, nor call these equations Maxwell’s equations. They form an optional, conjectural field sector; they are not needed to define the background spectral scale or point-mass gravity.

Cosmological role and separation of sectors. A possible research program is to seek HJ-flow configurations among localized wave resonances, then compare their conserved source integrals and field kernels with observations. No map from a resonance to (S, ρ_H, m) , a derivation of the HJ flow from ψ , or a coupling of ρ_H to the spectral current $\mathbf{J}_k$. Nor does it make ρ_H a gravitational source. In this cosmology, gravity remains exclusively the pairwise Hamilton–Jacobi dynamics of finite point masses in Section 7; no continuous distribution gravitates.

9 Propagation, redshift, and intrinsic distances

The spectral-dynamics preprint introduces an intrinsic dispersion relation

$$D_I(\omega_I, \mathbf{k}; \Psi_I) = 0, \quad \mathbf{v}_{g,I} = \nabla_{\mathbf{k}} \omega_I, \quad \dot{\mathbf{k}} = -\nabla_{\mathbf{x}} \omega_I, \quad (34)$$

from which intrinsic propagation and deflection may be computed once D_I is specified [2]. The explicit dispersion law and the map from $(\omega_I, \mathbf{k})$ to measured signal frequency remain to be derived. Consequently the observed redshift, operationally measured by a ratio of emitted and received frequencies, is not yet predicted.

A candidate closure is

$$1 + z \stackrel{\text{hyp}}{=} \frac{R_I(t_0)}{R_I(t_e)}. \quad (35)$$

This assumes intrinsic signal frequency scales inversely with R_I ; it is a conjecture in the spectral-dynamics preprint, not a consequence of the wave equation [2]. Once a ray and group speed are

known, an intrinsic path length may be defined by $\chi_I = \int_{t_e}^{t_0} |\mathbf{v}_{g,I}| dt$ along that ray. To predict observed distances, the model still needs its spatial propagation geometry, source power transport, angular-size mapping, and instrumental calibration. Equation (35) plus H_I alone does not yield a luminosity or angular-distance law.

10 Cosmological perturbations and structure: hypotheses

The spectral-dynamics preprint discusses linear stability, mode-coupling, and initial-value well-posedness as parts of the research program. To turn these into a cosmology, one must first close the time evolution of ψ or P , choose an initial intrinsic state, and derive the linearized operator and nonlinear kernel. Perturbations are to be defined in the intrinsic field and its spectrum, not by postulating a continuous gravitating mass density. A possible program is to calculate spectral correlation functions from P and then identify localized resonances and their finite point-mass positions. Pair counts and position correlations of the resulting point set may be statistical diagnostics, but they do not source gravity in this model.

The cited spectral framework does not yet calculate a primordial spectrum, transfer function, growth history, or galaxy population [2]. Any claim about early-universe perturbations or structure formation is therefore a hypothesis. The model must derive observable signal statistics and compare them with sky measurements without introducing a continuous-mass gravitational law.

11 Acceleration, predictions, and tests

The intrinsic scale has a mathematically defined second derivative

$$\frac{\ddot{R}_I}{R_I} = \dot{H}_I + H_I^2. \quad (36)$$

A positive value describes acceleration of the defined intrinsic scale, not automatically acceleration of observed distances. The frequency law, path length, and signal propagation must first be derived. The cited preprints do not provide a fitted cosmological history or establish apparent acceleration.

The proposal becomes testable through the following sequence:

1. Specify the time-local spectrum and reconcile discrete torus modes with the continuum power-spectrum convention.
2. Derive a well-posed time-local Hamiltonian from the intrinsic wave action/equation, fix its canonical sign convention and phase-gradient dependence, and prove boundary-compatible normalization preservation and spectral transfer.
3. Derive or reject (35) from the intrinsic dispersion relation; predict frequency drift and signal propagation.
4. Use the Haar jump diagnostic to test localization signatures, then prove stability and derive whether resonances support a point-mass representation.
5. Treat the masses as explicit parameters until a resonance-to-mass derivation exists; predict finite-body trajectories with (21) and compare appropriate observations.
6. Specify the HJ source mapping and evaluate the candidate Coulomb-like and Biot–Savart-like kernels, including their correction terms, against measurements; do not identify the HJ source with electric charge absent a derivation.

7. Compute sky-level correlations and distance observables from the closed intrinsic and point-set model, and test a common parameter set against data.

No empirical validation is claimed here. A model result is a prediction only after its defining closure and parameters are fixed independently of the data used to evaluate it.

12 Limitations and conclusion

The cited preprints provide mathematical ingredients: Hilbert-transform geometry and intrinsic derivatives; a constrained space-time wave equation; discrete spectral weights and a moment-defined radius; a Haar-wavelet jump-localization theorem; a proposed HJ matter-flow sector with candidate charge-like kernels; and a complete finite point-mass Hamilton–Jacobi sector. They do not yet provide a single closed time-local law joining the wave field to $P(t)$, an unambiguous normalized spectrum with temporal dependence, a specified spectral Hamiltonian and hence a determined spectral current, a derived redshift or distance law, a resonance-to-mass map, or a coupling from H_I to point-mass dynamics. The HJ-gravity preprint formulation contains no gravity law for continuous mass distributions.

The resulting cosmology is a proposed hierarchy: intrinsic wave field $\rightarrow$ time-local spectrum $\rightarrow$ moment scale $\rightarrow$ localized stable resonances $\rightarrow$ point-mass Hamilton–Jacobi dynamics. The HJ source-flow and charge-like field proposal is a separate, conditional extension, not yet derived from the intrinsic field or identified with electromagnetism. The equation $H_I = -M_2/(2M_2)$ is definitional; the point-mass equations specify trajectories for assigned masses and initial data; the HJ source continuity equation follows from the proposed transport law, while its candidate field equations remain unclosed. The unclosed cosmological evolution, resonance masses, redshift, distance, perturbations, and structure predictions remain research tasks. This model is formulated without GR, QM, or SR foundations and is not presented as empirically confirmed.

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