The Einstein-Planck Mass-Frequency Measure as a Matter-Like Transport Layer in Recursive Survival Geometry

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Abstract

This note gives a direct Recursive Survival Geometry (RSG) formulation of the Einstein-Planck mass-frequency measure. The point is not to present

$$M_R = \frac{hf}{c^2}$$

as a new empirical law. It is the standard Einstein–Planck mass-energy-frequency correspondence written as a mass-equivalent measure. The point is to identify where that measure belongs inside RSG: in the measure package carried by a structured recursive state.

This clarifies a missing piece in the earlier RSG treatment of matter-like transport. Frequency alone does not make matter. Matter-like behaviour appears when energy-bearing propagation becomes tied to support, closure, recurrence, interaction, and survival-weighted representation. The Einstein-Planck bookkeeping supplies the mass-equivalent measure for a frequency channel. RSG supplies the conditions under which such bookkeeping becomes matter-like rather than merely light-like energy transport.

1 Purpose

This document is not a review of any submitted manuscript and is not a replacement text for any correspondent. It is an RSG note prompted by a simple realisation: the frequency-to-mass-equivalent map fits very closely with the matter-like side of the existing RSG transport classification.

The central claim is intentionally narrow:

Einstein-Planck frequency-mass bookkeeping belongs in μ_n.

Here μ_n is the physical measure package in the structured RSG state. The map is not yet a derivation of mass. It is a measure-attachment rule.

The present note therefore updates the RSG architecture in one place: matter-like transport should explicitly carry a frequency-mass measure channel, but that channel becomes physically non-trivial only when it is coupled to closure, support, recurrence, interaction, survival weighting, or an independently constrained coefficient.

2 Claim Status

The physical backbone is standard:

$$E = hf, \qquad E = mc^2.$$

Combining these gives

$$m = \frac{hf}{c^2}.$$

If one writes

$$M_R = Ihf, \qquad I = \frac{1}{c^2},$$

then

$$M_R = \frac{hf}{c^2}.$$

In SI units,

$$[I] = \mathrm{s}^2\,\mathrm{m}^{-2}.$$

Thus I is the mass-energy conversion factor, not a dimensionless information bit.

Component	Status	Role here
$E = hf$	Standard physics	Frequency-energy relation
$E = mc^2$	Standard physics	Mass-energy equivalence
$M_R = hf/c^2$	Derived identity	Mass-equivalent frequency measure
$I = 1/c^2$	SI conversion factor	Energy-to-mass conversion
Render terminology	Interpretive bridge	Persistent measure language
RSG closure and survival	RSG contribution	Conditions for matter-like representation
Independent coefficient or prediction	Future requirement	Needed for empirical extension

The RSG use is therefore not

$$\text{frequency map} \Rightarrow \text{new mass law.}$$

It is

$$\text{frequency map} \Rightarrow \text{mass-equivalent measure attached to recursive histories.}$$

3 Placement in the RSG Corpus

This note ties together several existing RSG strands without turning them into a theory of everything:

1. the core RSG paper supplies generated histories, phase transport, exposure, survival weighting, and the light-like/matter-like distinction;
2. the partition-topological work supplies support, interior, closure, boundary, class, and interaction as formal objecthood diagnostics;
3. the light/matter notes supply the standard physics guardrail: photons carry energy and momentum, while matter-like pair production requires conservation and closure of the interaction channel;
4. the observer-centred effective-index note supplies a calibrated frequency and energy transformation readout on the past light cone;
5. the entropy note supplies the survival-representation measure and its effective number of unresolved histories;

6. the conserved recursive-survival sector supplies a future cosmological place where any measure channel must enter through a conserved, coefficient-controlled exchange law;
7. the three-body and Hopfion-like notes supply examples of closure, residuals, recurrence, topological protection, and survival-ranked histories;
8. the recurrence/ODE note supplies the methodological guardrail: discrete recursive structure and smooth differential approximations are related but not identical.

The purpose of the Einstein-Planck mass-frequency measure is to make one piece explicit across these notes:

$$\mu_n \text{ may carry } (E_n, f_n, M_{R,n}).$$

It does not replace the rest of the machinery.

4 Structured State and Measure Package

RSG begins with structured recursive states,

$$\sigma_n = (X_n, \phi_n, \mu_n, S_n).$$

The components are:

$$\begin{aligned} X_n &: \text{ topological support,} \\ \phi_n &: \text{ phase or transport data,} \\ \mu_n &: \text{ physical measure package,} \\ S_n &: \text{ survival weight.} \end{aligned}$$

The phase projection is

$$\pi_\Phi(\sigma_n) = \phi_n.$$

In the minimal transport model,

$$\phi_n = (\Theta_n, \Pi_n).$$

The Einstein-Planck measure update is simply the explicit inclusion

$$\mu_n \supset \{E_n, f_n, M_{R,n}\},$$

with

$$E_n = hf_n,$$

and

$$M_{R,n} = \frac{E_n}{c^2} = \frac{hf_n}{c^2}.$$

This is the missing measure-attachment step. It says that a structured state may carry frequency-energy-mass-equivalent data without claiming that this data alone explains why the state has the mass it has.

5 Phase Transport and Survival

The continuous approximation to the minimal phase projection is

$$\frac{d\Theta}{dt} = \Pi, \qquad \frac{d\Pi}{dt} = -\Omega^2\Theta.$$

The local action norm and exposure factor are

$$J(\phi) = \Theta^2 + \ell^2\Pi^2,$$

and

$$W(\phi) = \frac{\Theta^2}{J(\phi)}.$$

With a non-negative loss coefficient $\Gamma(\sigma)$, the survival law is

$$\frac{dS_i}{dt} = -\Gamma(\sigma_i)W(\phi_i)S_i.$$

The represented measure over a family of generated histories is

$$p_i(t) = \frac{S_i(t)}{\sum_j S_j(t)}.$$

The key point is that M_R does not replace S_i, W_i, or Γ_i. It is a measure attached to a state. Representation is still determined by survival filtering:

$$\text{generated history} \to \text{survival weight} \to \text{normalised representation}.$$

6 Light-Like and Matter-Like Transport

The RSG light-like class is defined by the joint limit

$$\Gamma \to 0, \qquad \|\sigma_{n+1}\|_\Phi = \|\sigma_n\|_\Phi, \qquad r \notin \mathbb{Q}.$$

This is lossless, projected-norm-preserving, non-closing transport.

In this regime a photon may carry

$$E_\gamma = hf,$$

and therefore a mass-equivalent energy

$$\frac{E_\gamma}{c^2} = \frac{hf}{c^2}.$$

That quantity is not photon rest mass. It is energy-equivalent mass.

Matter-like transport is different. It is not defined by frequency alone. It requires additional conditions:

$$\begin{array}{c} \text{frequency-energy channel} \\ + \text{ support} \\ + \text{ closure or recurrence} \\ + \text{ interaction or localisation} \\ + \text{ survival-weighted representation} \end{array} \quad \Rightarrow \quad \text{matter-like represented measure.}$$

This is why the Einstein-Planck mass-frequency measure fits so tightly into the matter-like side of RSG. It supplies the mass-equivalent scale, while RSG supplies the closure and survival conditions.

7 Pair Production as a Standard-Physics Guardrail

Pair production is a useful guardrail because it separates energy transport from matter-like persistence.

For an electron–positron pair, the total rest-energy threshold is

$$E_{\text{pair}} = 2m_e c^2 \approx 1.022 \text{ MeV}.$$

The corresponding total frequency scale is

$$f_{\text{pair}} = \frac{2m_e c^2}{h} \approx 2.47 \times 10^{20} \text{ Hz.}$$

For symmetric head-on two-photon production, each photon carries approximately

$$f_e = \frac{m_e c^2}{h} \approx 1.24 \times 10^{20} \text{ Hz.}$$

For a single photon near a nucleus, the photon must supply essentially the full pair rest energy, with recoil handled by the nearby field or nucleus.

In RSG language, this says:

frequency-energy is necessary bookkeeping, not sufficient closure.

Matter-like appearance requires the interaction channel to close.

8 Topological Objecthood

The partition-topological layer gives the formal language of objecthood. For a support

$$X_n \subseteq M,$$

one may diagnose

$$\text{int}_D(X_n), \qquad \text{cl}_D(X_n), \qquad \text{bd}_D(X_n), \qquad \text{class}_D(X_n).$$

The Einstein-Planck mass-frequency measure does not define these quantities. It is attached after the support and its diagnostic status are available.

A matter-like represented state therefore has at least two distinct layers:

support/objecthood layer $\quad + \quad$ frequency-mass measure layer.

RSG then adds the history and survival layer:

$$\sigma_0 \to \sigma_1 \to \sigma_2 \to \cdots,$$

with representation determined by survival weighting.

9 Entropy and Represented Histories

The survival-representation entropy is

$$H_{\text{surv}} = -\sum_i p_i \ln p_i,$$

where

$$p_i = \frac{S_i}{\sum_j S_j}.$$

The associated effective number of represented histories is

$$N_{\text{eff}} = e^{H_{\text{surv}}}.$$

Adding M_R to the measure package does not by itself reduce entropy or produce a record. Entropy changes when the survival measure concentrates:

$$\Gamma_i W_i \neq \Gamma_j W_j \quad \Rightarrow \quad p_i \neq p_j.$$

Thus an Einstein-Planck mass-frequency measure becomes matter-like only when the represented measure narrows around histories that carry closure-compatible support.

10 Observer-Centred Frequency Readout

On an observer's past light cone, an effective redshift index may be written

$$n_z(r) = 1 + z(r).$$

This is a calibrated phase-period and energy-transformation readout, not a material refractive index of the local vacuum. It gives

$$\nu_{\rm obs} = \frac{\nu_{\rm em}}{n_z(r)},$$

and therefore

$$E_{\rm obs} = \frac{E_{\rm em}}{n_z(r)}.$$

The corresponding observed Einstein-Planck mass-frequency measure is

$$M_{R,\rm obs} = \frac{h\nu_{\rm obs}}{c^2} = \frac{h\nu_{\rm em}}{c^2 n_z(r)}.$$

This is still bookkeeping unless a separate survival or coupling law assigns different represented weights to histories. The local measured speed of light remains c.

11 Topological Closure Examples

The Hopfion-like and three-body notes point in the same methodological direction. In both cases, persistence is not defined by a single scalar frequency. It is defined by structure that survives a test:

$$Q_H(\sigma_{n+1}) = Q_H(\sigma_n)$$

for a topological invariant, or

$$C_N(K_0) \approx 0$$

for a recurrence or closure residual.

In residual-filter language, a generated history is assigned a structural loss. Low residual gives high survival. High residual gives fading representation.

The Einstein-Planck mass-frequency measure can be attached to such histories, but it does not supply the closure test. The closure test is independent structure.

12 Cosmological Projection

In the minimal conserved recursive-survival sector, the homogeneous variables include a recursive-sector fraction, a coherence memory, and an exchange law. Schematically,

$$\Xi = \alpha_R C H \rho_R.$$

This kind of expression is the correct level at which any mass-frequency-coupled cosmological effect would have to appear. It would need a coefficient, a conservation rule, a decay or saturation condition, and a late-time recovery test.

The Einstein-Planck mass-frequency measure alone cannot solve a cosmological constant or early-structure problem. At most, it can become one measured channel inside a conserved, coefficient-controlled sector:

$$\text{frequency measure} \rightarrow \text{coupled exchange term} \rightarrow \text{testable transient effect}.$$

No fixed universal information-frequency ceiling is assumed here. A Landauer-equivalent frequency scale is not an information-processing speed limit. Any serious cosmological use must be a variable response, coupling, or wave/measure function with independent constraints.

13 Conditional Mass-Frequency-Coupled Survival

If the Einstein-Planck mass-frequency channel is allowed to affect survival weighting, it should enter with explicit coefficients:

$$\frac{dS_i}{dt} = -\left[\Gamma_i W_i + \beta_R \eta_{R,i} C_{R,i} M_{R,i}\right] S_i.$$

Here β_R carries whatever dimensions are needed to convert the mass-frequency measure into an inverse-time loss or selection channel. The factor $\eta_{R,i}$ is a possible efficiency, and $C_{R,i}$ is a possible support/history coupling.

The warning is essential:

$$\eta_R,\ C_R,\ \beta_R \text{ must not be chosen after the fact.}$$

At least one must be independently defined, independently measured, or constrained before comparison with the target phenomenon.

In a discrete topological-history form,

$$S_{i,n+1} = S_{i,n} \exp\left[-\left(L_D(\sigma_{i,n}, \sigma_{i,n+1}) + \beta_R \eta_{R,i,n} C_{R,i,n} M_{R,i,n}\right) \Delta t\right],$$

where a minimal loss functional may be written

$$L_D = \lambda W + \alpha \Delta_{\text{bd}} + \beta \Delta_{\text{class}} + \chi \Delta_{\text{int}}.$$

The mass-frequency term does not replace the topological or phase-exposure loss structure. It adds a conditional mass-frequency measure channel.

14 Failure Conditions

The Einstein-Planck mass-frequency layer fails as a new physical contribution if:

1. known masses are converted to frequencies using $f = mc^2/h$ and then converted back to masses;
2. $I = 1/c^2$ is presented as a dimensionless information constant in SI units;
3. photon rest mass is confused with photon energy-equivalent mass;
4. a Landauer-equivalent frequency is presented as a universal computation ceiling;
5. the coefficients η_R, C_R, and β_R are fitted after the fact;
6. no independent frequency, coupling, density of states, closure rule, or survival-weighting prediction is supplied.

The layer becomes physically stronger only if an independently specified mass-frequency or coupling structure predicts an observable measure, threshold, correction, or failure condition.

15 Future RSG Integration

Future versions of the main RSG documents should include an explicit subsection on frequency-mass bookkeeping inside μ_n. The update should not change the core RSG claim. It should clarify that:

1. the structured state carries a measure package μ_n;

2. μ_n may include energy, frequency, and mass-equivalent data;
3. hf/c^2 is the standard mass-equivalent of a frequency channel;
4. matter-like transport requires closure, support, recurrence, interaction, and survival weighting in addition to frequency;
5. any mass-frequency-coupled survival term requires independent coefficients or failure conditions.

The compressed statement is:

Einstein–Planck gives the mass-frequency map;

RSG supplies the matter-like survival and closure conditions.

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