Electroweak Transport vs. Structural Mass Bands in Recognition Science

Jonathan Washburn
Recognition Physics Institute
Austin, Texas, USA
jon@recognitionphysics.org

December 20, 2025

Context

A recurring confusion is to treat Standard Model (SM) renormalization-group (RG) running as the *source* of the mass spectrum rather than as a *transport map* between a common matching scale and observable mass definitions. This note states the separation used in Recognition Science (RS) and clarifies what must (and must not) be included when the anchor scale is above the electroweak scale.

Mass law with two residues

For each species i, the RS mass display is organized as

$$m_i^{\text{pole}} = B_i \, E_{\text{coh}} \, \phi^{\, r_i + f^{\text{Rec}}(Z_i) + f_i^{\text{RG}}} \, ,$$

where ϕ is the golden ratio, B_i is a power-of-two prefactor, E_{coh} is the coherence energy scale, $r_i \in Z$ is the rung integer, and $Z_i \in Z$ is the word-charge integer.

The framework separates:

- a *structural* (Recognition-side) residue $f^{\text{Rec}}(Z)$, and
- a *transport* (SM RG) residue f_i^{RG}.

Only the first term is responsible for the large band structure; the second term is a comparatively small correction used to carry an anchor-scale prediction to the chosen observable scheme.

Structural residue (closed form)

The Recognition residue is a closed-form geometric function of Z:

$$f^{\mathrm{Rec}}(Z) = \frac{1}{\ln\phi}\,\ln\!\left(1+\frac{Z}{\phi}\right).$$

It is evaluated at a *common* matching scale $\mu_\star$ and is not obtained from SM running.

Transport residue (SM RG definition)

The SM transport residue is defined from the SM mass anomalous dimension γ_m^{SM}:

$$f_i^{\mathrm{RG}} = \frac{1}{\ln\phi}\int_{\ln\mu_\star}^{\ln\mu_{\mathrm{pole}}} \gamma_m^{SM}(\mu)\,d\ln\mu \quad\Longleftrightarrow\quad f_i^{\mathrm{RG}} = \frac{\ln R_i}{\ln\phi},\ R_i = \exp\left\{\int_{\ln\mu_\star}^{\ln\mu_{\mathrm{pole}}} \gamma_m^{SM}(\mu)\,d\ln\mu\right\}.$$

This is a transport factor: it depends on the RG flow of SM couplings and on threshold matching, and it is *not* identified with $f^{\mathrm{Rec}}(Z)$.

Why electroweak (and top/Higgs) must be included in transport

In the current RS mass spec, the anchor is

$$\mu_\star = 182.201\ \mathrm{GeV},$$

which lies above m_W and m_Z, and is also above the top threshold. Therefore, any RG transport from $\mu_\star$ to pole or $\overline{\mathrm{MS}}$ masses must use the *full SM* (not QED-only, and not QCD+QED-only) over that domain. Concretely, above the weak scale the correct transport necessarily involves the electroweak couplings, the top Yukawa coupling, and the Higgs sector, and it must handle matching across thresholds so that observables at $\mathcal{O}(1\%)$ are not systematically biased.

This requirement does *not* re-elevate the SM to “fundamental.” It only says that if one wants a faithful comparison to experimental mass definitions and high-energy observables, the effective theory used for transport must be the SM in its domain of validity.

What "not keeping the Standard Model" can and cannot mean

Cannot mean: dropping electroweak physics. A theory that literally removes $SU(2)_L \times U(1)_Y$ without replacement cannot reproduce beta decay, muon decay, neutrino scattering, or parity violation. Such a move would be immediately falsified.

Can mean: demoting the SM to an effective bridge. RS uses classical gauge language as a convenient description layer and as transport/validation machinery. The RS claim is that the *structural* spectrum organization (rungs, bands, and the closed-form residue) does not originate from SM RG flow; the SM enters only to map anchor-scale predictions to the observable schemes used by experiments.

Operational policy for mass work

The intended workflow is:

$$Predict m_i(\mu_\star) from RS structure \longrightarrow Transport using full SM RG and threshold matching \longrightarrow$$

In particular, measured masses are not used as inputs to the RS structural prediction; they serve only as external validation targets after transport.