Section 12. Empirical Handles and Distinguishers (What Could Differ)

This paper is primarily a reconstruction of meaning: it replaces unbounded vacuum bookkeeping with a structurally finite baseline defined by FWB (FBW) accessibility and entropic organization. Even so, a responsible reconstruction should indicate where empirical or observational leverage might exist—i.e., which classes of phenomena could, in principle, discriminate a finite-baseline CUWF vacuum from a purely subtractive or purely representation-based vacuum narrative. In this section, we therefore outline potential 'handles' at the level of principle, without committing to a full numerical program in the first draft.

12.1 Boundary-Sensitive Phenomena

Standard physics already recognizes that vacuum responses can be boundary-sensitive (cavities, interfaces, changing constraints). CUWF accepts this, but frames the sensitivity as a response of bounded DOF accessibility in the FWB baseline. The empirical question becomes: are there signatures of an underlying accessibility structure beyond what is naturally captured by an unbounded mode-sum representation?

Principle-level distinguishers CUWF highlights:

Constraint-topology sensitivity: responses that depend not only on geometric size but on how constraints reshape accessibility (connectivity/structure of admissible configurations).

Saturation / cutoff-like behavior that is structural: at sufficiently extreme boundary modulation (frequency, sharpness, or complexity), the response may deviate from naive unbounded counting because accessibility is bounded by structure, not by an arbitrary regulator.

Boundary-complexity scaling: engineered constraints with similar macroscopic geometry but different constraint microstructure could produce measurably different vacuum responses if accessibility is the primary driver.

12.2 Scale Dependence and Deviation Regimes

CUWF treats GR and much of low-energy QFT phenomenology as effective descriptions. Deviations should therefore not be expected in regimes where the effective models are already complete approximations. The likely deviation window is where (i) constraint-driven accessibility effects become dominant, or (ii) the assumption of effectively unlimited mode accessibility becomes an overreach.

CUWF-style deviation conditions (conceptual):

Ultra-strong constraints: regimes where boundaries/couplings restrict admissible micro-configurations so sharply that an unbounded representation is no longer a faithful proxy.

High-frequency / high-curvature constraint variation: situations where the response depends on the ‘rate of accessibility reshaping’ rather than on static geometry alone.

Cross-scale decoupling: cases where a purely geometric effective description predicts one scaling, but accessibility-structured DOF predict a different scaling because the micro-accessibility manifold is changing.

Importantly, CUWF does not assert that deviations must be large. It asserts that the correct diagnostic is structural: identify regimes where accessibility, not representation convenience, is the limiting factor.

12.3 Cosmological Implications

If Λ is a structural imprint of the FWB baseline (rather than a residue of canceled UV infinities), then cosmology is not merely a place where a mismatch appears; it becomes a domain where baseline structure should exhibit recognizable stability properties and potentially constrained evolution.

Principle-level implications of ‘Λ as structural imprint’:

Stability criterion: Λ appears constant when the cosmic-scale accessibility structure of the FWB baseline is near-stationary under coarse-graining.

Slow drift possibility: if the large-scale entropic organization of the baseline changes with cosmic history, Λ may drift slowly rather than remain exactly constant—while still behaving approximately constant over observational windows.

Response-to-structure framing: Λ should be interpreted as responding to (or being parameterized by) the large-scale entropic structure of the universe, not as a direct readout of an unbounded microscopic energy inventory.

These implications do not require abandoning standard cosmology as an effective model; they propose a different underlying mechanism for why a Λ-like term exists and why it has the stability properties it appears to have.

12.4 Falsifiability Framing

The falsifiability claim of A-11 is not 'we already predict a new number.' The claim is that CUWF identifies a different structural object as primary (bounded accessibility of FWB baseline DOF) and therefore points to different diagnostic questions. The framework becomes vulnerable where those diagnostic questions can be sharpened into tests.

What this paper proposes as test channels (principle-level):

Boundary-program tests: compare vacuum responses across constraint geometries designed to separate 'geometry-only' dependence from 'accessibility-structure' dependence.

Saturation diagnostics: search for systematic departures from unbounded-counting expectations under increasingly extreme constraint modulation, consistent with a bounded accessibility manifold.

Cosmological consistency tests: assess whether Λ's apparent stability and any allowed drift align more naturally with a structural-baseline imprint than with cancellation narratives.

In subsequent CUWF work, these channels would be developed into explicit models: specifying an accessibility measure, deriving a pressure functional, and mapping it to effective observables. For the present paper, the goal is to make clear that the reconstruction is not purely philosophical: it identifies concrete categories of empirical leverage where a finite-baseline vacuum should leave discriminating signatures.