Section 3. Mathematical Preliminaries

The present section introduces the minimum mathematical objects required to express the entropic field dynamics of CUWF in a controlled way. The equations are deliberately kept simple. The purpose of this paper is not to overwhelm the reader with formal machinery, but to show that the conceptual novelty of CUWF lies primarily in the interpretation of the variables, not in mathematical complication for its own sake.

This choice is methodological. At the present stage of the argument, what matters most is that each operator carries a clear ontological meaning and can later be connected to the cosmological phenomena usually attributed to dark matter and dark energy. Complexity, where necessary, can be added in later papers. Here the goal is to establish a minimal symbolic language capable of expressing structural deformation, entropic curvature, convergence or divergence of informational flow, and the breathing dynamics of accessible configuration space.

The definitions below should therefore be read as foundational operators rather than final formal closure. They are the smallest mathematical vocabulary needed to move from the ontological framework of Section 2 to the cosmological reinterpretation developed in the later parts of A-15. They should not be read as introducing hidden energy reservoirs or auxiliary driving substances. Their role is structural: to describe how the entropic manifold deforms, responds, and reorganizes.

3.1 Entropic Density Field S(x)

The first object is the entropic density field, written as

S(x) = local degree of informational deformation

This quantity measures how strongly a given region has departed from the Still Wave baseline. In intuitive terms, it indicates how distorted from informational stillness the universe is at the location or configuration x.

Low values of S(x) correspond to relatively calm, low-structure regions, such as void-like domains. High values correspond to highly structured regions, such as galaxies, clusters, or dense gravitational systems. Entropy in this framework is therefore not being used as a synonym for disorder. It is being used as a measure of deformation from primordial stillness.

This definition is important because it provides the first scalar field from which all later structural gradients, curvature measures, and effective cosmological behaviors will be derived.

3.2 Entropic Curvature Operator $\Xi(x)$

The second object is the entropic curvature operator, defined schematically as

$$\Xi(x) = \partial S(x) / \partial \Omega$$

where Ω denotes configuration volume in entropic phase-space.

This operator measures how rapidly the local entropy structure changes when the accessible configuration domain is slightly deformed. In conceptual language, it answers the question: if the universe is perturbed here by a small change in configuration accessibility, how sharply does the structural state respond?

For this reason, $\Xi(x)$ should not be read as ordinary geometric curvature. It is curvature of the entropic field itself. The fundamental deformation is informational and structural before it is geometric in the conventional sense.

This operator is central because it gives CUWF a way to speak mathematically about structural bias without introducing matter-like dark components or energy-like driving agents at the outset.

3.3 Entropic Divergence Operator $\nabla \cdot \Xi(x)$

Once the entropic curvature field is defined, its divergence becomes the next natural object:

$\nabla \cdot \Xi(x)$

This quantity indicates whether entropic curvature is locally converging or diverging. A convergent structure corresponds to inward concentration, compression, or structure formation. A divergent structure corresponds to outward relaxation, rarefaction, or void-like release.

In human terms, $\nabla \cdot \Xi(x)$ tells us whether the entropic field in a given region is pulling structural organization inward or allowing it to relax outward. This is the operator that later acquires direct cosmological significance. In the CUWF interpretation, observational cosmology may misread such entropic tension effects as evidence for unseen matter, when in fact they are consequences of field-structure divergence and convergence.

For this reason, $\nabla \cdot \Xi(x)$ plays a key role in the later reinterpretation of dark-matter phenomenology.

3.4 Configuration Volume $\Omega^{E}(t)$

The final object introduced in this section is the entropic configuration volume, written as

$\Omega^{E}(t)$ = total accessible entropy-weighted configuration space at time t

This must be interpreted carefully. $\Omega^{E}(t)$ is not the size of the universe in a naive spatial sense. It is the total volume of accessible entropy-weighted configuration space at a given stage of cosmic description.

In intuitive language, $\Omega^{E}(t)$ measures how many ways the universe is allowed to configure itself at that stage. When $\Omega^{E}(t)$ increases, the universe is not necessarily becoming larger as a physical container. It is becoming less constrained and more free to rearrange its informational structure.

The symbol t should also be handled carefully. At this stage of A-15, t functions as a cosmological or reporting parameter used to describe large-scale evolution. It should not be read as a primitive ontological time existing prior to the Still Wave framework.

This quantity will later become crucial for the reinterpretation of cosmic expansion. In CUWF, expansion is not first described as the stretching of a spatial box, nor as the effect of some hidden energy source. It is described as the breathing of accessible configuration space itself.

3.5 Role of These Operators in the Rest of A-15

Taken together, the operators introduced here form the minimal mathematical core of the paper. S(x) defines local informational deformation. $\Xi(x)$ measures structural curvature in the entropic field. $\nabla \cdot \Xi(x)$ tracks convergent or divergent behavior of that curvature. $\Omega^{E}(t)$ measures the accessible volume of entropy-weighted configuration space.

With these operators in place, the later sections of A-15 can reinterpret dark matter as entropic tension and what is observationally interpreted as dark energy as breathing acceleration of the entropic manifold, without introducing exotic substances or additional driving energies as primitive explanatory entities.

The important point is that the mathematics remains intentionally modest while the ontology becomes significantly deeper. This is precisely the strategy of CUWF: minimal formal objects, maximal structural reinterpretation.