Definition, Concept, Mathematical Formulation, Physical Interpretation, and Implications of the Obidi Curvature Invariant (OCI) of ln 2 in the Theory of Entropicity (ToE)

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The **Obidi Curvature Invariant (OCI) is ln 2**, representing the smallest physically meaningful curvature gap between two distinguishable configurations of the entropic field in the **Theory of Entropicity (ToE).**

Definition and Concept

In the **Theory of Entropicity (ToE)**, entropy is treated as a **continuous physical field** rather than a statistical measure. The Obidi Curvature Invariant (OCI) is a fundamental constant, **ln 2**, which quantifies the minimal curvature difference required for two entropic configurations to be physically distinguishable. It functions as a "quantum of distinguishable curvature," analogous to how Planck's constant quantizes action in quantum mechanics. [3]

Mathematical Formulation

The OCI arises from **information-geometric principles**. Using metrics like the **Fisher–Rao** and **Fubini–Study**, Obidi defined a distinguishability potential on the entropic manifold. The first non-zero minimum of this potential corresponds to ln 2, establishing a **coordinate-independent curvature invariant**. Distinguishability between two entropic configurations $\rho_A(x)$ and $\rho_B(x)$ is expressed via the relative entropic curvature functional: [2]

$$D(\rho_A || \rho_B) = \int_\Omega \rho_A(x) \ln(\rho_A(x)/\rho_B(x)) \, dV$$

This functional measures the integrated curvature deformation needed to transform one configuration into another and is invariant under smooth coordinate transformations. [1]

Physical Interpretation

The OCI implies that the entropic field is **discretely structured at its minimal scale**. Two configurations are distinguishable only if their curvature differs by at least a factor of 2:1, corresponding to ln 2 in natural logarithmic units. This establishes a **binary structure of information** in the universe, where the "bit" is a reflection of the minimal curvature ratio rather than a human convention. [2]

Implications

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1. **Quantization of Curvature**: The entropic field admits discrete curvature separations, with ln 2 as the smallest unit. [1]
2. **Universality**: OCI appears in both classical and quantum limits, linking Fisher–Rao and Fubini–Study metrics. [1]
3. **Thermodynamic Consistency**: The Landauer bound ΔE = k B T ln 2 emerges naturally from the entropic field dynamics, not as an independent postulate. [1]
4. **Arrow of Time**: The finite formation of curvature gaps implies that temporal directionality arises intrinsically from the dynamics of the entropic manifold. [1]

In summary, the **Obidi Curvature Invariant** is a foundational constant in ToE that quantizes the minimal distinguishable curvature of the entropic field, providing a geometric and physical basis for information, entropy, and the discrete structure of reality. [2]