RCD 5.0 — Causal–Torsional Glossary

Definitions, Operators, and Axiomatic Dependencies

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Abstract

This glossary standardizes all core terminology of RCD 5.0, linking each definition to the corresponding axioms of the theory. All entries are concise, mathematically precise, and directly traceable to the operators used in Documents 1–3. The goal is to ensure terminological consistency and facilitate independent verification.

A. Axioms referenced

Every glossary item lists the axioms (A1–A5) on which its definition depends:

- A1 — Causal density combinatorics.
- A2 — Existence of cutoff scales.
- A3 — Dimensionless coupling constant C^*.
- A4 — Bounded torsional operator $\Omega(s)$.
- A5 — Absolute Rule (computational verifiability).

B. Glossary Table

Term	Definition and Axiomatic Basis
Causal Density ρ_{local}	Local combinatorial density of causal links normalized by Planck volume: $$\rho_{\text{local}}(x) = \lim_{V\to 0} \frac{N(\text{causal links})}{V/\ell_P^4}.$$ Depends on {A1}.
Cutoff Density ρ_{cut}	Upper bound for ρ_{local}. Ensures vacuum consistency and regulates T_{Causal}. Depends on {A2}.
Causal Term T_{Causal}	Dimensionless quantity: $$T_{\text{Causal}} = \frac{\rho_{\text{local}}}{\rho_{\text{cut}}} C^*.$$ Controls geometric response. Depends on {A1, A2, A3}.

Term	Definition and Axiomatic Basis
Suppression Factor D_T	Central operator: $$D_T = \frac{1}{1 + T^2_{\text{Causal}}}.$$ Determines deviation from GR. Depends on {A1, A2, A3}.
Torsional Operator $\Omega(s)$	Bounded response: $$\Omega(s) = \tanh(s/s_{\text{cut}}).$$ Prevents singularities. Depends on {A2, A4}.
Temporal Impedance $\Xi(T)$	Defined as: $$\Xi(T) = \frac{1}{\sqrt{\rho(T)}}.$$ Depends on {A2}.
Temporal Matrix A_{ij}	Transition tensor: $$A_{ij} = \big(\Xi(T_i) - \Xi(T_j)\big) F_{\text{norm}}.$$ Anti-symmetric; ensures stability. Depends on {A1, A2}.
Causal Gradient $\nabla\rho_{\text{local}}$	Spatial variation generating geometric anomalies when $\nabla\rho_{\text{local}} \neq 0$. Depends on {A1}.
RCD Metric $g^{\text{RCD}}_{\mu\nu}$	Effective metric: $$g^{\text{RCD}}_{\mu\nu} = g^{\text{GR}}_{\mu\nu}\, D_T.$$ Depends on {A1, A2, A3}.
Causal Circular Velocity V_{Causal}	$$V_{\text{Causal}}(r) = V_{\text{Newton}}(r) D_T(r).$$ Key empirical test operator. Depends on {A1, A3, A5}.
Absolute Rule	Requirement that all computations include full logs, units, and SHA-256 integrity. Depends on {A5}.
NASA/ESA Reproducibility Protocol	Independent replication via: pipeline-internal logs + cross-pipeline verification + hashing. Depends on {A5}.

C. Notes

This glossary avoids interpretative or phenomenological language; entries must remain strictly formal and traceable to RCD's operators.

References

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[3] F. Lelli, S. S. McGaugh, and J. M. Schombert, "SPARC: mass models for 175 disk galaxies with Spitzer photometry and accurate rotation curves", *Astron. J.* **152**, 157 (2016).