Zero-Infinity Dimensional Recursion (ZIDR) Framework

Abbreviations, Mathematical Symbols, and Master Equations Reference

ZIDR Project Hub – https://zidrproject.org

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I. Abbreviations

Abbreviation	Expanded Term / Meaning
ZIDR	Zero-Infinity Dimensional Recursion
0D / 2D / 3D / 4D	Zero / Two / Three / Four-Dimensional
CMB	Cosmic Microwave Background
JWST	James Webb Space Telescope
ΛCDM	Lambda Cold Dark Matter (Standard Cosmology Model)
SW	Sachs-Wolfe Background Plateau Effect
EPR	Einstein-Podolsky-Rosen (Paradox)
ESA	European Space Agency
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II. Mathematical Symbols & Variables

Symbol	Definition
$\mathcal{M}$	Infinite-dimensional recursive universe manifold ($\mathcal{M} \in \ell^2$)
D	Infinite-dimensional dimensional state vector $(D_1, D_2, D_3, \dots)$
D_n	Scalar magnitude of the n-th recursive dimensional component
λ	Geometric recursion decay parameter $(0 < \lambda < 1)$
$\rho_D(x)$	Local Dimensional Density Field
$\bar{\rho}_D$	Global mean baseline of the Dimensional Density Field
$\Phi_D(x)$	Emergent Dimensional Compression Potential
Φ_c	Critical threshold potential governing black hole gates
$g_{\mu\nu}$	Effective 4D spacetime projection metric tensor
$\eta_{\mu\nu}$	Flat background Minkowski metric tensor $\mathrm{diag}(-1, 1, 1, 1)$
κ	Fundamental dimensional internal coupling constant
l	Multipole moment tracking angular scales
C_l	Raw calculated angular power spectrum coefficients
D_l	Scaled power spectrum formatting $\frac{l(l+1)}{2\pi} C_l$ ($\mu\mathrm{K}^2$)
$\mathcal{G}_\sigma$	Continuous Gaussian geometric line-broadening dispersion operator
σ	Spectral line-broadening parameter ($\sigma \equiv 1/\sigma_c$)
σ_c	Characteristic structural coherence length
$\mathcal{B}_l$	Large-scale boundary variance floor
$\mathcal{A}_{\mathrm{SW}}$	Large-scale Sachs-Wolfe equivalent amplitude
l_0	Boundary stabilization cutoff
l_{cut}	High-multipole dissipation horizon
z	Cosmological redshift

Symbol	Definition
V_{eff}	Effective volumetric projection horizon into 3D spacetime
R^2	Bounded structural norm across recursive dimensional layers ($\sum D_n^2$)
$\mathcal{D}(x_i, x_j)$	Multi-dimensional distance metric between two spatial points
$f_{\text{geom}}(x)$	Geometric force correction factor (Dark Matter alternative)
$\rho_{\text{baryon}}(x)$	Cosmic web density distribution
α	Conversion scaling parameter mapping Φ_D to physical observables ($\Phi_{\text{phys}} = \alpha\Phi_D$)

III. Master List of ZIDR Framework Equations

Category	Equation	Description / Context
Geometry & Recursion Constraints	$D_n \sim \int D_{n-1}\, dn$	Heuristic sequence scaling relation driving recursive layering.
	$f(D_n) = \frac{\sum D_n^2}{D}$	Structural decay function.
	$\lim_{n\to\infty} D_n = 0$	Convergence condition grounding baseline thermal floor.
	$dt^2 = \sum_{n=1}^{\infty} g(D_n)\, dD_n^2$	Metric line element for emergent time transit.
	$\|D\|^2 = \sum_{n=1}^{\infty} D_n^2 < \infty$	Infinite-dimensional Hilbert space norm constraint ($\mathcal{M} \in \ell^2$).
	$D_{n+1} = \lambda D_n \quad (0 < \lambda < 1)$	Linear recursive state vector step rule.
Emergent Gravitational Dynamics	$g_{\mu\nu}(x, D) = e^{-2\Phi_D(x)}\eta_{\mu\nu}$	Localized 4D spacetime projection metric tensor.
	$\nabla^2\Phi_D(x) = \kappa\rho_D(x)$	Spatial Poisson field equation for dimensional potential.
	$g(x) = -\nabla\Phi_D(x)$	Emergent 3D gravitational field vector.
	$\kappa_{\text{eff}} = \kappa_0 \prod_{n=1}^{\infty} \lambda^{2(n-1)}$	Geometric dilution factor deriving the absolute weakness of gravity.
Null Geodesics & Time Dilation Proof	$c^2 d\tau^2 = -ds^2 = -g_{00}(x_e)c^2 dt_e^2$	Invariant interval for a stationary clock.
	$dt_e = e^{\Phi_D(x_e)} d\tau$	Clock rate translation between coordinate and proper time.
	$ds^2 = 0 \Rightarrow c\frac{dt}{dr} = 1$	Null geodesic trajectory proof establishing invariant c.
	$\Delta t_o - \Delta t_e = 0 \Rightarrow \Delta t_o = \Delta t_e$	Coordinate duration conservation during photon propagation.

Category	Equation	Description / Context
	$1+z=\frac{\nu_e}{\nu_o}=\sqrt{\frac{g_{00}(x_o)}{g_{00}(x_e)}}=e^{\Phi_D(x_e)}$	Cosmological redshift derived purely as a potential gradient effect.
	$\Delta\tau_o = \Delta\tau_e \cdot e^{\Phi_D(x_e)} \Rightarrow \Delta\tau_o = \Delta\tau_e(1+z)$	Exact derivation of Type Ia Supernovae time dilation.
Thermodynamic CMB Spectrum	$T(\theta,\phi)=\kappa\frac{R^2}{V_{\text{eff}}}+\delta T(\theta,\phi)$	Invariant isotropic thermal baseline field.
	$D_l \equiv \frac{l(l+1)}{2\pi}C_l$	Standard power spectrum formatting.
	$\rho_D(x)=\bar{\rho}_D+\delta\rho_D(x)$	Stochastic spatial variations in dimensional density.
	$C_l^{\text{final}}=\sum_{l'}\mathcal{G}_\sigma(l,l')C_{l'}^{\text{raw}}$	Geometric convolution operator over raw multipole moments.
	$\mathcal{G}_\sigma(l,l')=\frac{1}{\sigma\sqrt{2\pi}}\exp\left(-\frac{(l-l')^2}{2\sigma^2}\right)$	Line-broadening dispersion kernel across multipole space.
	$D_l=\frac{l(l+1)}{2\pi}[\mathcal{G}_\sigma * C_l^{\text{raw}}]+\mathcal{B}_l$	Final continuous CMB power spectrum profile.
	$\mathcal{B}_l=\mathcal{A}_{\text{SW}}\left(1-e^{-l^2/l_0^2}\right)e^{-l^2/l_{\text{cut}}^2}$	Large-scale boundary variance floor.
Black Hole Gates & Transitions	$\Phi_D(x)\geq\Phi_c$	Critical structural threshold defining a black hole gate.
	$3\text{D}\rightarrow 2\text{D}\rightarrow 1\text{D}\rightarrow 0\text{D}$	Sequential dimensional reduction preserving quantum info.
	$\Phi_{\text{phys}}=\alpha\Phi_D$	Scaling relation mapping internal updates to physical potential.
	$S_{\text{BH}}=\frac{k_B A}{4G\hbar}$	Standard Bekenstein-Hawking entropy target limit.
Quantum Non-Locality & 0D Proximity	$\lim_{n\to\infty}x_i^{(n)}=x_{0D}$	Boundary limit mapping all 3D coordinates to a shared 0D origin.
	$\mathcal{D}(x_i,x_j)^2 = \|x_i-x_j\|_{3\text{D}}^2 + \sum_{n=4}^{\infty}\lambda^{2(n-1)}[D_n(x_i)-D_n(x_j)]^2$	Multi-dimensional spatial distance metric.
Dark Matter & Dark Energy Alternatives	$f_{\text{geom}}(x)\propto\kappa_0\nabla\left(\sum_{n=1}^{\infty}D_n(x)^2\right)$	Geometric force correction factor replacing dark matter.
	$\rho_{\text{baryon}}(x) = \rho_0\prod_{n=1}^{\infty}\lvert\sin(\omega_n\cdot x\cdot D_n(x))\rvert$	Self-similar fractal mapping deriving the cosmic web.
Lagrangian Action (Appendix A)	$S=S_{\text{manifold}}+S_{\text{matter}}$	Total variational action of the system.
	$\mathcal{L}_{\text{manifold}} = -\frac{1}{2}\sum_{n=1}^{\infty}\lambda^{2(n-1)}g^{\mu\nu}\partial_\mu D_n\partial_\nu D_n - V(D)$	Manifold Lagrangian density with kinetic conditioning.

Category	Equation	Description / Context
	$V(D) = \frac{1}{2}M_0^2 \sum_{n=1}^{\infty}(D_{n+1} - \lambda D_n)^2$	Self-interaction potential driving states toward 0D.
	$\lambda^{2(n-1)}\Box_g D_n = M_0^2[(1+\lambda^2)D_n - \lambda(D_{n-1} + D_{n+1})]$	Coupled Euler-Lagrange wave equations.
Statistical Testing	$\chi^2 = \sum_l \frac{(D_l^{\mathrm{ZIDR}} - D_l^{\mathrm{obs}})^2}{\sigma_l^2}$	Likelihood chi-squared metric against Planck satellite data.