Appendices

These appendices consolidate supporting material for CUWF Paper A-14. They are optional for first-pass reading, but they provide a stable reference for terminology, notation, and micro-worked intuition examples.

Appendix A. Mountain Analogy Dictionary (Expanded)

This dictionary extends the Step 2 mapping and is intended to be used as a quick lookup. The goal is conceptual consistency: when the text uses terrain language, it always refers to the same structural object in CUWF.

A.1 Core terrain objects

Mountain height: CUWF: the scalar entropic/collapse potential height, $\Phi^E(x)$. Higher means greater instability / higher collapse-tension; lower means more stabilized structure.

Slope: CUWF: the gradient $\nabla\Phi^E(x)$. The natural descent direction is $-\nabla\Phi^E(x)$.

Peak / hilltop: CUWF: unstable critical regions where small perturbations diverge rapidly into different descent outcomes.

Basin / bottom: CUWF: stable attractor-like regions (local minima) where descent tends to concentrate and history-record persistence is high.

Valley / channel: CUWF: preferred descent pathways (high-accessibility routes) where collapse updates proceed stably and efficiently.

Ridge: CUWF: basin separators (decision boundaries). A small deviation sends descent toward different basins.

Saddle / mountain pass: CUWF: transition corridors between basins; stable along some directions and unstable along others.

Ring-shaped channel: CUWF: closed or quasi-closed valley that supports sustained circulation (orbit families, photon-ring intuition).

Watershed: CUWF: the effective boundary set (often ridge-connected) that partitions domains of pathway accessibility.

A.2 Micro-topography terms

Micro-ridges / micro-saddles: Fine-scale accessibility boundaries created by entropic heterogeneity and collapse regularization; not meaningless noise.

Local flats / terraces: Regions where $\nabla\Phi^E$ is small over an extended patch; locally weak descent tendency but still embedded in a global landscape.

Gullies / micro-channels: Small-scale preferred pathways that appear when collapse updates repeatedly select a particular route as the most stable/accessible.

Fractured crest lines: Ridge subdivision caused by competing basins and multi-scale shaping (source sculpting plus Δ^E-like smoothing).

A.3 Domain and range terms

Domain (stability domain): A region of the landscape with a characteristic attractor structure (basin + boundary set + transition corridors).

Coupling: How strongly two domains co-deform the same continuous landscape; near domains generate pronounced ridges/saddles and easier exchange corridors.

Range (domain range): A connected set of domains forming a continuous terrain; the natural unit for multi-body systems.

Appendix B. One-Page Math Sheet (Minimal Gravity Toolkit)

This is a compact reference for the symbols and relations used in the gravity core. Equations are stated in CUWF-native form; Newton/GR notation may appear elsewhere only in clearly labeled comparison boxes.

B.1 Landscape, slope, and descent

[EQ]

$\Phi^E(x)$ = entropic/collapse potential (landscape height)

$g(x) := -\nabla\Phi^E(x)$ (canonical gravity law)

τ = collapse sequencing parameter

$dx/d\tau = -\kappa \nabla\Phi^E(x)$ (minimal descent / gradient-flow law)

Δ^E = entropic Laplacian (collapse-based shaping/regularization operator)

[/EQ]

B.2 Source-to-landscape prototype

A-14 uses a schematic source relation to express that the landscape is generated rather than assumed.

[EQ]

$\Delta^E \Phi^E(x) = S\_E(x)$ (collapse-source to landscape)

$\Phi^E = (\Delta^E)^{-1} S\_E$ (operator inversion view)

$\Phi^E(x) = \int G^E(x, x') S\_E(x') dx'$ (Green's-function intuition)

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B.3 Local stability and tides

[EQ]

$H(x) := \nabla\nabla\Phi^E(x)$ (Hessian / local second-derivative matrix)

Critical point: $\nabla\Phi^E(x^*) = 0$

Type from H(x*): basin (positive), ridge/peak-like (negative direction), saddle (mixed signs)

Tidal slope-variation: $\delta(\nabla\Phi^E) \approx H(x) \cdot \delta x$

[/EQ]

B.4 Equation ladder (memory box)

[EQ]

Level 0: $g = -\nabla\Phi^E$

Level 1: $dx/d\tau = -\kappa\nabla\Phi^E$

Level 2: $\Delta^E\Phi^E = S\_E$

Level 3: $g = -\nabla(\Delta^E)^{-1}[S\_E]$

Level 4: classical appearance recovered after calibration and coarse-graining (Newton-like forms as reporting language)

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Appendix C. Micro-Worked Examples (Intuition, Not Full Derivations)

These examples are deliberately small. They do not replace the full formal program; they show how the same slope-based mechanism can be applied consistently across familiar situations.

C1. Falling Rock (Free-Fall and Weight)

Setup. Consider a small test object in a region where the landscape slope is approximately constant over the object's scale.

C1.1 Free-fall as unconstrained descent

In CUWF, free-fall corresponds to an unconstrained descent update along the local slope.

[EQ]

$g(x) := -\nabla\Phi^E(x)$

$dx/d\tau = -\kappa\nabla\Phi^E(x) = \kappa\, g(x)$

[/EQ]

When the object is not constrained by contact forces, it follows the descent direction. The key point is that the rule depends on the landscape at x, not on the object's mass as a test property.

C1.2 Weight as constraint reaction

Now place the object on a rigid support. The object's descent is blocked; the support supplies a normal reaction that enforces the constraint (no-penetration / no-descent in the constrained direction).

In this regime, the vivid "force feeling" is weight. In CUWF framing:

• The descent tendency is still present (the slope is still present).

• The experience of force arises because the constraint must oppose the descent direction.

For clarity in this paper's notation, the normal reaction is denoted N (weight reading). N is a constraint-level quantity, not a fundamental interaction postulate.

C1.3 Newton-side comparison (objection box, optional)

Comparison only (not a CUWF postulate). In Newtonian notation, universality of free fall is reproduced because the gravitational force is assumed to be exactly proportional to inertial response:

[EQ]

$F_g = G_N m M / r^2$

$a = F_g / m = G_N M / r^2$

[/EQ]

This reproduces UFF, but only because the force law is constrained to be exactly proportional to inertial response. CUWF instead treats universality as the natural consequence of a landscape rule (shared slope) plus near-universal response in the classical regime.

C2. Ring Valley (Orbit Stability as Channel Dynamics)

Setup. Consider a landscape with a central basin and an annular (ring-shaped) channel around it. This is the terrain picture behind orbit families.

C2.1 Why circulation can persist

If the ring channel provides local stability (small perturbations return the trajectory to the channel), then motion can persist as guided circulation rather than immediate inward descent.

In CUWF language, an orbit is a stable pathway family: the system remains within a valley because leaving the valley increases instability or reduces pathway accessibility.

C2.2 Why the object does not stop at the ring location

The ring location is not a static endpoint unless dissipation removes tangential motion and the landscape provides a true minimum there. A ring channel typically stabilizes radial deviation but does not eliminate tangential degrees of freedom.

Thus, the object reaches the channel and then continues to evolve along it: the channel constrains one direction of descent while leaving a low-cost path for circulation. If dissipation is present, the orbit may slowly decay (inspiral) as the system transitions to a deeper attractor.

[EQ]

Radial stability: deviations are restored by local landscape curvature (Hessian structure)

Decay/inspiral: slow drift when smoothing/dissipation favors deeper basin access

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C3. Two Basins + Saddle (Binary Intuition)

Setup. A binary system is represented by two major basins in a shared landscape, separated by a ridge network with saddle-like transition corridors.

C3.1 Why exchange corridors appear

When two basins co-exist, there must be a boundary set (ridge/watershed) separating their dominant accessibility regions. The most likely cross-domain transitions occur near saddles (passes) where the barrier is lowest.

This directly maps to orbit families:

• S-type: stable channels around one basin (circumprimary/circumsecondary).

• P-type: circumbinary channels surrounding both basins as a coupled unit.

• Exchange/transition: trajectories that cross near saddle corridors; often chaotic because small perturbations change which side of the watershed the path falls into.

C3.2 Inspiral/merge as landscape evolution

If the coupled system experiences dissipation or smoothing (Δ^E-like regularization in the effective description), channel families can deform and shrink, producing inspiral and eventual merge as the system settles into a deeper combined attractor.

C4. Photon Ring Intuition Near a Black-Hole Boundary

Setup. Near an extreme boundary regime, accessibility and pathway structure can change sharply. The terrain picture emphasizes ring-shaped channels and pathway closure rather than a force spike.

C4.1 Light bending as path preference

In CUWF, light bending is treated as a preference for pathways with lower instability / higher accessibility under the generated landscape. This is analogous to refraction: trajectories follow the most compatible corridor through a structured medium.

C4.2 Photon ring as an extreme ring channel

A photon ring corresponds to a narrowly stable (or marginally stable) ring-shaped channel for light-like modes. It can be viewed as the limiting case of the orbit channel picture, where leaving the ring either falls inward (pathway closure) or escapes outward depending on accessibility.

C4.3 Inside-region intuition (closure)

In the inside regime, the decisive feature is pathway closure/topology: escape routes become inaccessible under the landscape rules. The statement "cannot escape" is therefore expressed as a constraint of available descent pathways, not as an infinite force requirement.