Architectural and Computational Framework for the ArcSecs Relational Physics Engine: UI/UX and Simulation Mechanics

Introduction to the ArcSecs Paradigm and Computational Metaphysics

The architectural design of a physics engine fundamentally dictates the metaphysical assumptions of the virtual universe it simulates. Contemporary physical simulation frameworks, whether designed for interactive media or scientific modeling—such as PhysX, Havok, Bullet, and ReactPhysics3D—inherently rely on Object-Oriented Programming (OOP) paradigms and Cartesian coordinate systems.[1] These systems implicitly assume an absolute background space (a container or fabric) and simulate relativistic effects by artificially modifying local time scales or bending raycast trajectories to mimic the tensor fields of General Relativity (GR). Within these conventional engines, space is treated as a continuous physical manifold, and time is treated as an elastic, local variable.

The ArcSecs paradigm demands a radical, ground-up architectural departure from these computational tropes. To accurately reflect a universe governed by absolute time, purely relational distance, and massive electrodynamics, the engine must be rebuilt from the data layer upward. This necessitates abandoning the OOP rigid body hierarchies that anchor objects to a global coordinate origin, in favor of a specialized Entity-Component-System (ECS) integrated with a graph-based neural topology.[2] By integrating Proca electrodynamics, Weber's relational mechanics, and Machian inertial induction, the ArcSecs engine shifts the computational burden from continuous spacetime manifolds to discrete, relational, N-body interactions.

The ensuing sections outline the exhaustive theoretical frameworks, mathematical models, software engineering algorithms, and specific User Interface/User Experience (UI/UX) modules required to construct a simulation mechanics framework that explicitly rejects GR. The goal of this architecture is to render these heterodox physical concepts as undeniable, interactive mechanical facts within the simulation sandbox, thereby serving as a pedagogical instrument of computational metaphysics.

Engine Topology, Scaling, and the Entity-Component-System

Before detailing the specific interactive modules, it is necessary to establish the base unit

scaling and data architecture of the ArcSecs engine. Standard engines utilize arbitrary "world units" (often equated to one meter). The ArcSecs engine, designed for cosmological scale simulation, utilizes the astronomical definitions of the arcsecond and the parsec to define its floating-point precision matrices.
In astronomical terms, an arcsecond is a measure of angle, specifically 1/3600 of a degree, or a minute fraction of a radian (approximately 1/206265 of a radian).[4] A parsec is classically defined as the distance at which one Astronomical Unit (AU) subtends a parallax angle of exactly one arcsecond.[4] The mathematical relationship is expressed as $p = 1/d$, where d is the distance in parsecs and p is the parallax angle in arcseconds.[9] Consequently, one parsec is equivalent to 206,265 AU.[5]
To accommodate the vast relational distances of the cosmos without falling victim to floating-point precision errors (which plague standard Cartesian physics engines at large coordinates), the ArcSecs engine relies on a coordinate-free, component-free treatment of manifolds.[10] Within the ECS architecture, entities do not possess a global Transform.Position coordinate.[2] Instead, they possess a RelationalEdge component that defines their spatial relationship to other entities strictly via the arcsecond angles they subtend and the relational distance calculated between them.[3] This ensures that whether two bodies are separated by millimeters or gigaparsecs, their mechanical interaction is computed with perfect local precision, governed by a unified system of affine connection dynamical systems mapped to Riemannian manifolds.[10]

Module 1: Absolute Time and the Mechanics of Atomic Retardation

In standard simulations of relativistic physics, time dilation is handled computationally by scaling the fundamental simulation timestep (often denoted as Time.deltaTime or a localized time-scaling float) for individual agents based on their relative velocity or their proximity to a simulated gravitational well. This programmatic approach inherently reinforces the Einsteinian concept that time itself is a dimension capable of warping, pausing, or stretching. The ArcSecs engine explicitly rejects this model, establishing time as a universal, immutable, and absolute metric, while redefining apparent relativistic dilation as a localized mechanical retardation caused by environmental drag and gravitational potential energy.

The Universal Cosmic Clock Architecture

To visually and computationally enforce the reality of absolute time, the engine relies on a strictly bifurcated temporal architecture. The primary simulation loop is governed by a singular, immutable global counter that serves as the heartbeat of the ECS.
The computational implementation dictates that the engine utilizes a globally synchronized fixed timestep that governs the numerical integration of all physics systems. This clock cannot

be modified by local variables, spatial positioning, velocity vectors, or user inputs regarding simulated gravitational masses. The integration of all kinematic equations relies on this singular time scalar.

To communicate this to the user, a "Universal Cosmic Clock" is permanently pinned to the zenith of the global UI. This UI element represents the absolute temporal framework of the simulation sandbox. It is rendered with high-contrast, unyielding numerical precision. As users manipulate planetary masses, accelerate spacecraft to high velocities, or plunge objects into deep gravitational wells, the Universal Cosmic Clock remains absolutely static in its tick rate. It never warps, pauses, or dilates. This persistent visual element provides a constant psychological and computational anchor for the user, enforcing the foundational ArcSecs rule that "When" is a universal, unchanging absolute.

Local Oscillator Probes and Cesium-133 Mechanics

To explain the empirical observations of modern atomic clocks—which are known to slow down when placed in gravitational fields or accelerated—without invoking spacetime curvature, the engine simulates the mechanical reality of atomic retardation. Modern primary frequency standards, such as the Caesium atomic fountain, utilize photon absorption by transitions between two hyperfine ground states of Cesium-133 atoms to define the second.[13] By definition, the radiation produced by this transition in a perfect vacuum devoid of external magnetic or gravitational influence has a frequency of exactly 9,192,631,770 Hz.[14]

When an atomic clock is moved into a gravitational potential, the ArcSecs paradigm posits that the gravitational field physically interacts with the atomic structure itself, rather than warping the temporal dimension it occupies. The gravitational potential energy dictates that more kinetic energy is required for the electron to achieve the hyperfine transition, thereby physically slowing the mechanical oscillation.[13] This recontextualizes experiments like the classic Pound-Rebka experiment; instead of measuring the curvature of time, such experiments demonstrate that the local mechanism of the clock is subjected to a rising global gravitational potential.[17] The atom inside the gravitational field is hindered and can only undergo relatively fewer hyperfine transitions within the same absolute time frame.[16]

The simulation sandbox allows users to deploy "Local Oscillator Probes," which function as attachable atomic clock widgets. Users can attach these probes to different masses, such as a fast-moving satellite in orbit or a static probe on the surface of a massive celestial body.

The Mechanical Retardation Visualizer

When a user physically drags an Atomic Clock widget deeper into a gravitational well, the engine's UI must explicitly avoid labeling the resulting slowdown as "time dilation." To reinforce the mechanical nature of the phenomenon, the engine displays a "Gravitational Potential Energy" overlay directly on the probe's readout.

The engine calculates the local gravitational potential $U = -\frac{GMm}{r}$ and applies a physical

retardation coefficient to the local oscillation script of that specific entity, while leaving the global physics timestep untouched. The UI features a localized, dynamic 3D animation of a Cesium-133 atom. As the gravitational potential increases, the user visually witnesses the electron shell fighting against the ambient gravitational drag. The user can see that the gravitational potential physically demands more energy to achieve the spin-flip, thereby mechanically slowing the clock's tick rate.
While the localized probe ticks slower—accurately simulating the empirical data observed in real-world satellite telemetry—the Universal Cosmic Clock at the top of the screen ticks on normally. This creates a powerful cognitive dissonance that resolves into an understanding of the ArcSecs paradigm: clocks do not measure abstract time; they are physical mechanisms subjected to physical resistance.

Temporal Simulation Framework	**Standard General Relativity Engine**	**ArcSecs Relational Engine**
Global Timestep Integration	Subject to local relativistic scaling metrics.	Absolute, immutable, and universally synchronous.
Atomic Clock Behavior	Measures proper time (τ) along a specific geodesic worldline.	Measures local mechanical frequency subjected to potential energy drag.
Gravitational Effect on Clocks	Attributed to the curvature of the temporal dimension.	Attributed to physical interference with hyperfine atomic transitions.
UI Feedback Mechanisms	"Time Dilation Factor: x0.99"	"Mechanical Retardation: Gravitational Potential - X Joules"

Module 2: "Gridless" Relational Distance Rendering

Standard physics engines fundamentally rely on a Cartesian background grid. Whether implemented as a literal skybox grid or hidden in the underlying data structure via absolute (x, y, z) world coordinates, this system subconsciously implies to the user that space is a physical "fabric" or a preexisting container within which objects reside.[18] To enforce the relational mechanics championed by historical figures like Leibniz and Mach, the ArcSecs engine requires a strictly coordinate-free mathematical formulation.[10]

Coordinate-Free Architecture and the ECS Scene Graph

In a coordinate-free treatment of physical theory, the engine develops its concepts without reference to any particular global coordinate system.[11] There is no absolute origin point $(0, 0, 0)$ from which all other objects are measured. Instead, the positions, velocities, and accelerations of bodies are tracked strictly as relative vectors between interacting nodes.[12]
This is accomplished by substituting the traditional OOP scene hierarchy with a specialized graph-network ECS data structure.[2] The physics engine represents the simulated universe purely as a relative scene graph. Each physical entity (star, planet, ship, photon) acts as a node within the graph, while the edges connecting them contain the data for relative distance (r_{ij}) and relative velocity ($\dot{r}_{ij}$).[3] Because there is no root "world" node that stores absolute position data [23], the simulation calculates the constrained dynamics of the N-body system utilizing virtual holonomic constraints mapped onto Riemannian manifolds.[10]
To optimize this in real-time, the engine employs advanced algorithms (such as the Jonker-Volgenant algorithm or auction algorithms) to resolve the optimal coordinate mapping from initial relative coordinates to target relative coordinates at each timestep, maintaining spatial coherence purely through object interaction without ever referencing an external grid.[19]

Dynamic Distance Tethers and UX Interaction

The UI/UX must transparently reflect this graph-based reality to the user. All traditional background grids, absolute Cartesian coordinate trackers, and bounding box visualizations must be systematically excised from the rendering pipeline.
Instead, the simulation introduces "Dynamic Distance Tethers." When a user drops physical mass nodes into the empty sandbox, the engine renders "space" strictly as interactive, glowing tethers (visual representations of the graph edges). These tethers act as dynamic vectors that display the calculated area and distance strictly between the objects.[20] If a user spawns two planets, a single glowing tether connects them. If a third mass is added, a triangular network of tethers forms. The rendering explicitly demonstrates that space is not a place you can point to, but merely a continuous relationship between physical masses.

The Leibniz Void Demonstration

To cement this philosophical framework, the engine includes a critical pedagogical feature termed the "Leibniz Void Demonstration." This module programs a specific UI behavior: if the user utilizes the deletion tool to remove all physical matter (all nodes) from the scene, the rendering engine does not leave behind an empty black box overlaid with a grid.

Because the scene graph is reduced to zero nodes ($V = \emptyset$), the edges representing spatial distance ($E = \emptyset$) mathematically cease to exist. Consequently, the UI completely collapses all spatial trackers, tethers, and coordinate readouts. The viewport transitions into a pure, dimensionless void. This explicitly enforces the foundational rule that distance is purely a relational property of "where" things are relative to one another, and that in the absolute absence of matter, space itself does not exist.

Module 3: Corpuscular Gravitational Lensing via Soldner Mechanics

General Relativity explains the phenomenon of gravitational lensing as the natural consequence of massive celestial bodies bending the physical fabric of spacetime, forcing massless photons to travel along curved geodesic paths. The ArcSecs engine, denying the existence of a spacetime fabric, posits that gravitational lensing is a purely classical, Newtonian phenomenon caused by the direct gravitational attraction between a massive celestial body and massive photons (corpuscles of light).

Historical Context and Soldner's 1801 Formulation

The ArcSecs engine relies on the historical calculations of Johann Georg von Soldner (published in 1801) and Henry Cavendish (calculated circa 1784), both of whom utilized Newton's laws of motion and universal gravitation to predict the deflection of starlight.[26] Soldner treated light as a stream of massive corpuscles and calculated the hyperbolic trajectory of these particles as they grazed the surface of a gravitating body, such as the Sun.[26]

The physics engine calculates the deflection angle ω utilizing Soldner's original derivation. The classical half-angle deflection is derived as follows, where v is the velocity of the corpuscle, g is the local gravitational acceleration at the surface of the body, and R is the radius of the massive body [29]:

$$\tan \omega = \frac{2gR}{v^2 - 4gR}$$

Noting that $g = \frac{GM}{R^2}$ and assuming the velocity v approaches c, the quantity $\frac{4gR}{v^2}$ is infinitesimally small. Thus, the equation simplifies to the classic Newtonian half-deflection [26]:

$$\omega \approx \frac{GM}{c^2 R}$$

For the full deflection (measuring the angle between the incoming asymptote from infinity and the outgoing asymptote to infinity), the calculation yields [26]:

$$2\omega = \frac{2GM}{c^2 R}$$

It is a well-documented point in the history of physics that this classical corpuscular calculation yields precisely half the value of the later Einsteinian GR prediction ($4GM/c^2R$).[30] The ArcSecs engine boldly utilizes the Soldner formulation, enforcing the rule that light bends due to classical mass attraction.

Raytracing Massive Proca Corpuscles and Keplerian Integration

To simulate this visually and computationally, the rendering of light within the engine must transition from standard, instantaneous, massless raycasts (as used in Unity or Unreal) to the physical simulation of discrete, mass-bearing entities traversing the scene graph over time. When a light source is activated in the simulation sandbox, the engine spawns discrete "Proca Corpuscles." These are rendered not as continuous, instantaneous waves, but as a high-frequency stream of physical particles possessing a minuscule, yet non-zero rest mass.[28]
As these corpuscles approach a celestial body, their trajectories must be calculated dynamically. The path of the massive photon is computationally equivalent to the Kepler problem of celestial mechanics—specifically, a hyperbolic trajectory around a central mass.[32] The engine employs the numerical integration of Keplerian trajectories using Cowell's formulation ($\ddot{\mathbf{r}} = -\frac{\mu \mathbf{r}}{r^3}$).[34]
However, standard numerical methods (like basic Euler or Runge-Kutta integrators) often suffer from qualitative inaccuracies during long-term simulations of high-velocity hyperbolic orbits, including gradual energy drift, artificial precession of the orbital ellipse, and distortion of the orbital shape.[34] To ensure that a photon can travel across a simulated galaxy without accumulating floating-point errors, the ArcSecs engine deploys advanced symplectic numerical integrators.[33] These geometric integrators preserve the symplectic structure of the Hamiltonian system, guaranteeing that the corpuscles conserve energy and momentum precisely over vast cosmic timescales.[34]

UX/UI Overlay: Live Soldner Calculations

To explicitly demonstrate this mechanic to the user, the simulation features a highly interactive UI overlay. As the user watches a stream of massive photons graze a heavy celestial body, the engine overlays real-time, glowing Newtonian force vectors. These vectors originate from the star's center of mass and clearly depict the gravitational force pulling directly on the individual photon corpuscles.
Simultaneously, a live mathematical readout panel appears adjacent to the star. This panel tracks the orbital eccentricity of the photon's hyperbolic path, dynamically updating the value $e \approx \frac{c^2 R}{GM}$.[30] Furthermore, it displays the active, real-time derivation of Soldner's $\omega = \frac{GM}{c^2 R}$.[30]

By projecting these real-time mathematical proofs directly onto the viewport, the engine explicitly demonstrates to the user that the ray is bending due to classical gravitational attraction between masses, effectively dismantling the visual and conceptual necessity of a warped spacetime fabric.

Module 4: Tired Light, Massive Dispersion, and Proca Electrodynamics

The observation that light from distant galaxies is redshifted is traditionally attributed to the metric expansion of space—specifically, the Doppler shift caused by an inflating spacetime manifold stretching the wavelengths of light traveling through it. The ArcSecs engine completely replaces cosmic expansion with the mechanical realities of "Tired Light" theory and the physical implications of Proca electrodynamics.

Proca Electrodynamics and Vacuum Dispersion

If the photon possesses a non-zero mass, the standard Maxwell equations of electromagnetism must be modified into the Proca equations.[37] The Proca Lagrangian for a massive vector field is defined as [38]:

$$\mathcal{L} = -\frac{1}{2}F_{\mu\nu}F^{\mu\nu} + m^2 A_\mu A^\mu$$

Where $F_{\mu\nu}$ is the electromagnetic tensor and A_μ is the four-potential. A primary physical consequence of massive photon electromagnetic theory is that the speed of light in a vacuum is no longer a unique, invariant constant (c) for all wavelengths. Instead, the velocity of light depends on its frequency.[31] In this framework, the invariant speed c of special relativity acts merely as the upper asymptotic limit for photon velocity.[31]

The Proca dispersion relation for the frequency ω and wavenumber k of a massive photon introduces a mass-dependent cut due to the square root in the dispersion relation [40]:

$$\omega = c\sqrt{k^2 + \mu_\gamma^2}$$

where $\mu_\gamma = \frac{m_\gamma c}{\hbar}$ represents the photon mass normalized in units of inverse length.[41]

Consequently, the group velocity (v_g) of the electromagnetic wave packet is derived as [39]:

$$v_g = \frac{d\omega}{dk} = c\left(1 - \frac{\mu_\gamma^2 c^2}{\omega^2}\right)^{1/2} \approx c\left(1 - \frac{\mu_\gamma^2 c^2}{2\omega^2}\right)$$

This fundamental equation dictates that higher frequency electromagnetic waves (e.g., blue or ultraviolet light) travel slightly faster through a vacuum than lower frequency waves (e.g., red or infrared light).[39]

The Vacuum Dispersion Tracker

To visualize this phenomenon, the simulation provides a specific interactive sandbox module. The user is prompted to fire a multi-color, broad-spectrum light pulse across a vast relational distance. Because the physics engine calculates trajectory updates based on Proca mechanics, the user physically watches the blue photons slowly outpace the red photons as they traverse the void.

A real-time tracking graph plots their respective group velocities, demonstrating that they arrive at the final destination at different absolute times. This visualizes vacuum dispersion not as a glitch in the simulation, but as an inherent, mathematically proven property of massive light.

Tired Light and the Ambient Magnetic Vector Potential

To explain the cosmological redshift observed in astronomical data, the engine implements a "Tired Light" mechanism. Originally proposed by Fritz Zwicky in 1929, the tired light hypothesis suggested that photons gradually lose energy as they travel vast distances, rather than being stretched by metric expansion.[43] While early models struggled to identify a physical mechanism (ruling out Compton scattering as it would only affect high-energy X-rays and blur images) [44], the ArcSecs engine provides a rigorous electrodynamic mechanism: continuous energy dissipation into the cosmic ambient magnetic vector potential ($\boldsymbol{A}$).[46]

According to Proca electrodynamics, the energy density of the massive photon electromagnetic field includes a dominant contribution from the vector potential, defined as $\frac{\mu_\gamma^2 A^2}{2\mu_0}$.[47] The paired-photon vacuum embodies this vector potential [48], meaning that the "empty space" between galaxies is actually a physical substrate comprising the four-potential of the electric scalar potential (ϕ) and the magnetic vector potential ($\boldsymbol{A}$).[48] As the massive photon propagates through this substrate, it suffers repeated, infinitesimal energy losses through interactions with this ambient field (or through head-on collisions with soft Cosmic Microwave Background photons, which constitutes a primary mechanism for energy attenuation).[17]

The Energy Drain Gauge UX

To render this abstract quantum mechanical process intelligible to the user, the UI implements an "Energy Drain Gauge." When a user isolates a single traveling photon on a simulated multi-billion-year journey, this gauge attaches directly to the particle's HUD.

As the photon crosses the relational scene graph, the gauge shows its kinetic energy physically draining into the surrounding background. The background is visualized subtly as a faint, glowing substrate representing the vector potential field.[46] According to the Planck-Einstein

relation $E = h\nu$ [49], as the kinetic energy drops, the frequency drops proportionally.
The UI shifts the photon's visual color smoothly and continuously toward the red end of the spectrum as the energy bar depletes. An informational prompt explicitly appears on screen: "Cosmological Redshift Achieved via Mechanical Energy Loss. Metric Expansion: Zero." This proves to the user that cosmological redshift is a mechanical energy-loss function intrinsic to massive electrodynamics, completely negating the need for a Doppler shift derived from expanding space.[48]

Redshift Mechanism	Cosmological Standard Model (GR)	ArcSecs Proca/Tired Light Model
State of Space	Expanding (Scale factor $a(t)$ increases).	Static, purely relational graph.
Photon Mass	Strictly Zero.	Non-zero ($m_\gamma >$).[31]
Speed of Light	Constant (c) invariant for all frequencies.	Frequency-dependent ($v_g <$ for low frequencies).[39]
Mechanism of Redshift	Wavelength stretched by inflating spacetime.	Kinetic energy drained into cosmic magnetic vector potential.[46]

Module 5: Machian Inertia and Weber Force Induction

Perhaps the most radical departure from standard engine architectures is the ArcSecs engine's treatment of inertia. Newtonian mechanics and General Relativity treat mass—and therefore inertia—as an intrinsic, isolated, invariant property of an object. A body resists acceleration due to its own internal nature, regardless of what surrounds it.
The ArcSecs engine, adopting Mach's Principle via the application of Weber electrodynamics and Relational Mechanics, completely redefines inertia. In this engine, inertia is not a static variable stored in a rigidbody.mass component. Instead, it is a dynamic interaction energy—a real gravitational drag generated by the relative motion between the local body and the rest of the massive universe.[52]

Weber's Relational Law and Mach's Principle

Wilhelm Weber's fundamental force law, originally formulated in 1846 for electrodynamics [54], depends solely on the relative distance (r_{ij}), relative radial velocity ($\dot{r}_{ij}$), and relative radial acceleration ($\ddot{r}_{ij}$) between interacting bodies.[55] It is completely relational, depending only on magnitudes intrinsic to the system of interacting charges, and is entirely independent of absolute space.[55]

When generalized to gravitation by theorists like Tisserand, Erwin Schrödinger, and contemporarily by André Koch Torres Assis, Weber's potential energy between two masses m_i and m_j is defined as [58]:

$$U_{ij} = -\frac{Gm_i m_j}{r_{ij}}\left(1 - \frac{6\dot{r}_{ij}^2}{2c^2}\right)$$

Using this purely relational framework, Assis provided a complete mathematical implementation of Mach's principle.[58] According to relational mechanics, all inertial forces (including centrifugal and Coriolis forces) are real forces of gravitational origin acting between a body and the distant universe.[52] Specifically, Assis demonstrated that the force exerted by a linearly accelerated spherical shell (representing the isotropic distribution of cosmic matter) on an internal test body generates a force exactly proportional to the body's acceleration relative to the shell.[22] Therefore, Newton's second law ($F = ma$) is not an axiom, but a derived consequence of gravitational induction.[53]

The Machian Inertia Sandbox

To simulate this within a real-time physics engine, the software must continuously calculate the interaction between a local test mass and the cosmic background. This is a computationally heavy operation, made possible by the engine's graph-based ECS, which abstracts the distant universe into a single, cohesive background node acting upon the local nodes.

- **The Cosmic Shell Representation:** The background of the simulation sandbox is rendered not as an empty, decorative skybox, but as a faint, ubiquitous, interactive "shell" representing the distant galaxies and the tired-light/dark-matter substrate of the universe.[22] This shell represents the macroscopic mass of the cosmos.
- **Inertial Induction and Weber Tethers:** When the user applies a thrust vector to accelerate a spacecraft in the engine, the physics solver does not query a static mass variable to calculate acceleration. Instead, it calculates the Weber induction force. As the ship attempts to accelerate, the UI visualizes "inertia" dynamically. Glowing, elastic Weber force tethers appear, springing from the distant cosmic shell and connecting directly to the ship.[60]
- **Visualizing Relational Drag:** These tethers visually pull back against the ship's vector of acceleration. The mechanical resistance the user feels (e.g., the sluggishness of a massive ship turning or accelerating) is visually and mathematically proven via UI

readouts to be a relational gravitational drag emanating from the surrounding universe.[60]
- **The Cosmic Void Experiment:** To prove that inertia is relational, the sandbox allows users to manipulate the density of the cosmic shell itself. If the user flies the ship into a deeply isolated cosmic void, or uses developer tools to manually delete large swaths of the background universe from the simulation, the UI responds immediately. The Weber tethers visibly weaken and thin out. Without the gravitational drag of the distant stars, the ship's inertial mass mathematically drops.[52] The ship becomes incredibly responsive to thrust, accelerating at rates that would be impossible in a dense galaxy. This interactive experiment proves unequivocally that resistance to acceleration is an environmental variable, not an intrinsic property.

Conclusion

The ArcSecs Relational Physics Engine transcends the traditional role of a standard simulator; it functions as a comprehensive, interactive manifesto of computational metaphysics. By explicitly excising the Cartesian grid in favor of a coordinate-free Riemannian graph topology, overriding the standard relativistic scaling of time intervals to enforce absolute cosmic synchronicity, and manifesting light as a massive Proca corpuscle subject to classical Newtonian gravity, the engine systematically dismantles the intuitive and computational reliance on General Relativity.

Through the implementation of the Universal Cosmic Clock and the Retardation Visualizer, users learn that time is immutable, and that atomic clock dilation is a mere mechanical consequence of gravitational potential energy acting upon hyperfine transitions.[14] Through the dynamic tethers of the Leibniz Void and the Machian Inertia Sandbox, users experience space and mass not as isolated, intrinsic entities, but as continuous, interconnected relationships governed by Weber's relational force law.[22] Finally, through the visual translation of Tired Light and Soldner Lensing, the esoteric concepts of massive vector potentials and corpuscular celestial mechanics are rendered as visible, undeniable mechanical interactions.[29]

The resulting software architecture yields a rigorously constructed virtual universe where the abstract geometry of warped spacetime is entirely replaced by physical, relational mechanics. The ArcSecs engine provides profound proof-of-concept that a universe can be simulated, navigated, and comprehensively understood without ever invoking an expanding, curving fabric of space.

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