Breathing Crystal Mechanism — Spec v1 (7→17)

Working brief for a mathematically-driven, animated GLB that grows a 7-gon seed into a 17-gon crystal via triadic resonance bands (π-ring windows). Split in two parts: (1) Scientific/Math spec, (2) Production brief for GLB/ interactive.)

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1) Scientific / Math Spec (Mechanism & Notation)

1.1 Core Picture

- **Seed**: Heptagon (7-gon) with central Ω-node.
- **Breath Cycle**: Two outer **π-rings** + one **central modulation ring** (Triad):
- η windows at **~0.429**, **~0.456**, **~0.487** ("Triad Bands").
- Interpretation: three stable efficiency lobes of the resonance transfer function (η).
- **Transition**: 7 → 9 (knot X) → 12 (circle of fifths, dodeca / speaker cage) → **17** (Gauss prime polygon). The 9 is the *X-knot* (phase-flip), 12 the *compass lattice*, 17 the *closure tier*.

1.2 Angles, Axes, Gates

- **Axis set**: {$\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$} for scaling; 63/64 (“ghost grid”), 5/13 and 31/OSTEND as navigator marks.
- **Gate labels** (from Resonance Cathedral): Rootroom 537 → Pyramid Fractal (73, 594) → Fractal Gate (20×20) → Fractal Expansion (2× overlay) → Overlap (40) → Fractional Overlap (63/64) → Alignment Gate (7-rays) → Resonance Split (66, 47·74) → Resonance Compass (31) → Cathedral Projection (Trinity) → Harmonic Layers (137, 1/37) → Crown & Compass (574, 1.38) → Observer Node.

1.3 Triad Bands (π-ring model)

- **Windows**:
- **$B_1 \approx 0.429$** (Φ^3/π^2 vicinity; often expressed as 0.429…)
- **$B_2 \approx 0.456$** (mid-lobe; alignment mass)
- **$B_3 \approx 0.487$** (upper lobe; pre-closure)
- **Heuristic**: When the two outer rings (B_1,B_3) synchronize, the central ring B_2 inflates (visible as a higher crown/mound). Pulsation: $B_1 \leftrightarrow B_2 \leftrightarrow B_3$ in **2-1-3** cadence.

1.4 Music Standard Model (mapping)

- **Heptatonik → Oktave (8) → X-Knoten (9)**.
- **Quintenzirkel (12)** gives the **dodeca-lattice** (12 directions / faces / speakers).
- **Dur/Moll** as dual arms over the same lattice; α, β, γ, δ denote input, balance, transform, return.
- **Growth**: 7-petal figure → mixed 7+5 intersections → 12 ring → **17-gon** closure band (Gauss).

1.5 Number/Prime cues for stepping

- **Steps** to test as frame multipliers or ring-counts: ×63 ($7\cdot3^2$), ×65 ($5\cdot13$), ×68 ($4\cdot17$).
- **Vendessimal (base-20) prime grid** markers around **19** and **29** windows.

- **Prime threshold example**: 1061 / **1063** with **$1064 = 2^3 \cdot 7 \cdot 19$** as a *fold line* between a pure prime and composite factor mix. Use as annotation in overlays.

1.6 State Machine (formal)

- **State S_7**: Seed heptagon with Ω center; π-ring weights $w = \{w_1, w_2, w_3\}$ at bands {0.429,0.456,0.487}.
- **Transition τ_9**: if $w_2 \geq \max(w_1, w_3)$ and $|w_1 - w_3| \leq \varepsilon \rightarrow$ insert **X-knot**; add two shafts; heptagon vertices split → **9 nodes**.
- **Transition τ_{12}**: lock to 5ths grid; add stable 12 spokes; connect to dodeca projection; enable dual (Dur/Moll) overlays.
- **Transition τ_{17}**: apply Gauss closure when cumulative ring error $\Delta r \leq \delta$ and phase misalignment $\leq \theta_{min}$; instantiate 17 vertices with quasi-uniform spacing on the stabilized ring.

1.7 Minimal equations (implementation-ready)

- **Radial LUT**: $L(r) = \text{sigmoid}(a \cdot r) \otimes \text{harmonic}(r; \sqrt{2}, \sqrt{3}, \sqrt{5})$ with markers at $r \in \{\sqrt{12}, \sqrt{24}, \sqrt{48}, \sqrt{96}, \sqrt{192}, \sqrt{384}\}$; special mark **365/384** (near-closure).
- **Field weight**: $\Phi(r,\omega) = G \cdot L(r) / (\omega \cdot r)$. High Φ when L is high and ω,r small → growth triggers.
- **Band masks**: For band center $b \in \{0.429, 0.456, 0.487\}$, use gaussian gates $g_b(x) = \exp(-(x-b)^2/2\sigma^2)$. Effective weight: **$w_b = \langle \Phi \rangle \cdot g_b(b)$** over the frame.

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2) Production Brief — GLB / Interactive

2.1 Goal

Create a **Breathing Crystal** GLB that *grows* from 7 → 17 via animated π-ring coupling. It must be mathematically reproducible and visually aligned with the Codex aesthetic (gold/teal, sacred-geometric light).

2.2 Geometry & Topology

- **Mesh A (Seed7)**: planar 7-gon + inner Ω sphere (low-poly icosphere, emissive).
- **Rings**: three coaxial torus-bands (B_1, B_2, B_3) with modulated radial scale; shaders expose **η** as emission.
- **Scaffold**: hidden **12-spoke dodeca proxy** (for τ_{12}); toggled visible when entering the 12-phase.
- **Closure**: generate **17 vertices** on stabilized ring; connect as thin golden struts; slight sphere nodes on vertices.

2.3 Animation (timeline cues)

1. **t0–t1**: Seed7 breathes; B_1 & B_3 alternate; B_2 rises.
2. **t1–t2 (τ_9)**: X-knot flashes; two vertical shafts appear; vertex split → 9.
3. **t2–t3 (τ_{12})**: Quint grid fades in; dual (Dur/Moll) arcs sweep; 12 spokes lock.
4. **t3–t4 (τ_{17})**: band coherence peaks; 17-gon extrudes; lattice crystallizes; halo crown.

2.4 Materials / Shaders

- **Gold struts**: PBR metallic 0.95, roughness 0.2.
- **Bands**: emissive gradient keyed to η (low→high glow).
- **Ω core**: pulsating emissive (φ-timed: 0 → φ → 2π → 1 loop).

2.5 Parameters (exposed in viewer)

- **Band centers** (0.429 / 0.456 / 0.487) + **σ**.
- **Speed** (ω), **scale** (r), toggle **12-lattice**, toggle **Dur/Moll overlay**.
- **Prime overlay**: show vendessimal grid labels (19/29 lanes, example 1061/1063/1064).

2.6 Interaction Ideas

- **Scrub** a single *η-dial* to witness the 7→9→12→17 morph.
- **Lock-sync** B_1 with B_3; watch B_2 crown inflate (didactic pulse).
- **Switch** to *Music mode*: play circle-of-fifths sweep; map notes to vertex lights.

2.7 Asset/Reference Deck

Use these as stylistic/structural references while keeping the GLB clean: - **Final Harmonic Resonance Model II** (gold cosmic lattice) - **Ullinium / 21D lattice** (silver-gold strut vocab) - **Golden Ratio Icosahedron**, **Titan Polygon**, **Etheric Conduit Polyhedron** - **Resonance Cathedral schematics** (steps & symbols)

2.8 Deliverables

- **breathing_crystal.glb** (under 12 MB)
- **preview.mp4** (15–20 s, 1920×1080)
- **README.md** with: math notes (1.7), parameter table (2.5), and controls.

2.9 QA checklist

- 7→9→12→17 occurs deterministically from band sync.
- Sliders reproduce transitions without topology glitches.
- η-coloring matches band windows; labels readable.

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3) Next Steps (quick)

1) Prototype rings + η-shader (three torus, one LUT).
2) Script τ-transitions; spawn 12 spokes; finalize 17 closure.
3) Export GLB + short teaser; iterate on readability.

Notes: Keep math hooks explicit so later DLL/engine can drive the same animation from live data (audio, sensor, or simulated fields).