TERRENA

Relocation to our Solar System

Terrena lit by the Sun at 1.20 AU: cyan seas, ring, 3 elevators, glittering night side

Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

Seeded by a real Tuna-17 quantum job

Quantum Inspire · Tuna-17 · job 1476306 · 1,024 shots · 3.92 s on the QPU · finished Sep 26, 2026 6:44:30 PM PT

Uncle Benny® Quantum Research Division · report generated Sep 26, 2026

The cover image is a procedural render (visualization), not a photograph. Terrena and its story are built around the seeded numbers.

1 · Plain-language summary

Benjamin asked for Terrena, the cyan, glittering world from job 1476038, to be brought into our own Solar System. He chose the option of moving the planet by itself into an orbit around the Sun. On Sep 26, 2026 we ran one new job on the Tuna-17 quantum processor. It measured all 17 qubits 1,024 times, and those measured bits decided exactly where Terrena goes.

The bits placed Terrena 1.200 AU from the Sun, about 180 million km, between Earth and Mars. Its orbit is nearly circular (e = 0.028) and tilted 1.93° to Earth's orbit. A year there lasts 480 Earth days. We checked this orbit by simulating the Sun, all eight planets and Terrena for 1 million years. Terrena kept its path, and no planet was thrown out.

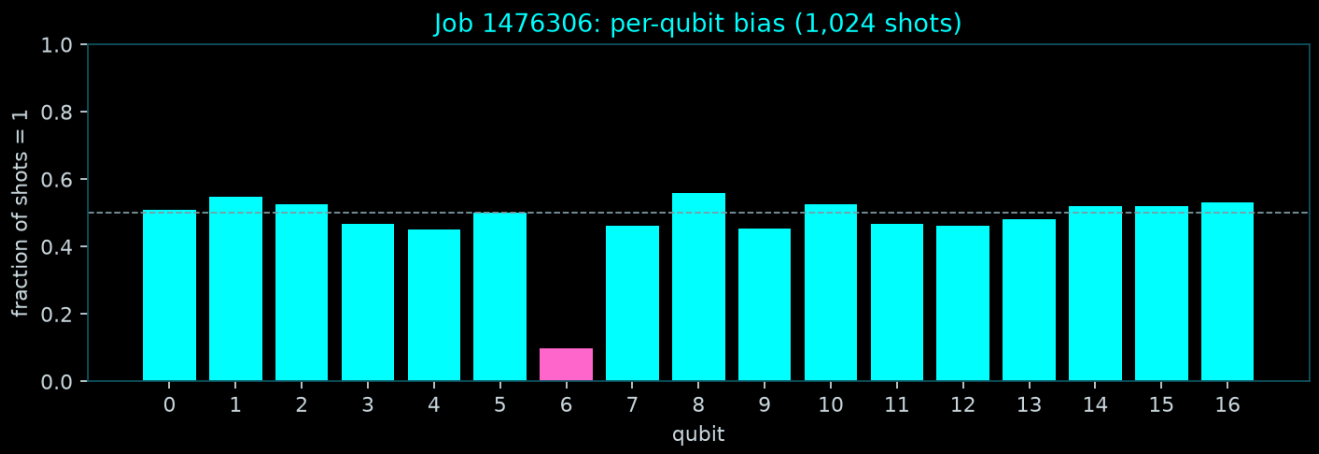
Seen from Earth, Terrena would be a brilliant cyan-white "star". Every 4.18 years it comes as close as about 22 million km and reaches magnitude -6.9, brighter than Venus ever gets. It would be easy to see with the naked eye and bright enough to cast faint shadows at a dark site. Light takes 1.2 to 18.7 minutes to get from Terrena to Earth. An efficient rocket needs about 211 days for the trip.

The catch: the Sun is dimmer for Terrena than Kestrel was. It would get only 69% of the sunlight Earth gets, about 67% of what it had at home. With its current air it would cool from about 18 °C to about -6 °C on average, which means a deep ice age. Section 7 explains how the Nethrai could cope.

What is real: the Tuna-17 job, its timing and its 1,024 measured bit strings. What is simulated: the mapping from bits to orbit, the physics numbers and the N-body check, which are real calculations built around the seed. What is worldbuilding: Terrena itself, its move, Qirport and the Nethrai, a story built around the numbers. All images and the video are visualizations.

2 · The real quantum job

Item	Value
Processor	Tuna-17 (Quantum Inspire, backend_type 7)
Job ID / batch	1476306 / 849554
Circuit	Hadamard on all 17 qubits, then measure all (same circuit style as job 1476038)
Shots	1,024 requested, 1,024 done
QPU execution time	3.923 s
Submitted → queued → finished	6:39:48 PM → 6:44:26 PM → 6:44:30 PM PT (Sep 26, 2026)
Distinct bit strings	1,021 of 1,024
Shannon entropy	9.994 bits (max possible for 1,024 shots: 10)
Most frequent strings	01110111010000110 ×2, 10001100110100101 ×2, 11000010010100000 ×2, 00000000000101111 ×1, 00000000000110111 ×1, 00000000010000011 ×1
Seed	SHA-256 of {job_id, sorted counts} = 40533f6cedc6456cc5ece26149864f3d298cac6a31b0b652301b061a20962a82



The per-qubit chart shows that most qubits came out 1 close to half the time, as an ideal Hadamard coin would. Qubit 6 is the exception: it read 1 only 10% of the time. That is a real hardware imperfection, most likely energy relaxation or a readout bias on that qubit, and we kept it rather than hiding it. Because all the numbers go through a SHA-256 hash, a bias like this does not skew the orbit choice.

The job was submitted from the Windows VPS the same way as job 1476038: the server-side Quantum Inspire session creates a project, a cQASM 3.0 file and a batch job on backend type 7, then enqueues it. The full job record, the raw counts (raw_counts.json) and all the scripts are in the relocation folder.

3 · How the bits chose the orbit

Benjamin chose option (b) himself, so the bits did not pick between options. They were used only to set the orbit. The mapping is fixed in relocate.py and is fully deterministic: run it again on the same counts and you get the same orbit.

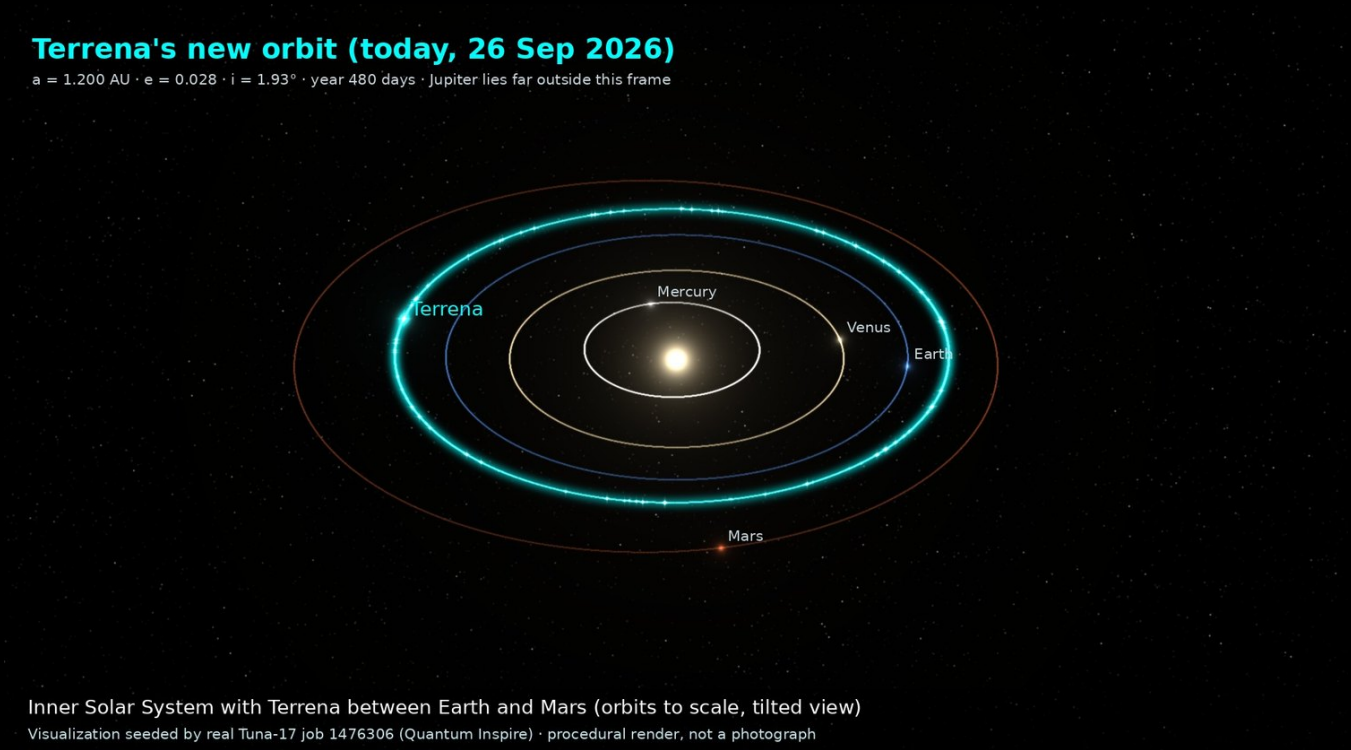
Step	Rule
1 · Seed	seed = SHA-256 of the canonical JSON {job_id, counts sorted by bit string} (the same rule as the original Terrena, sim.py)
2 · Uniform numbers	u_k = (hex characters 8k…8k+7 of the seed) / 2^{32}, k = 0…7
3 · Allowed zone	a between 1.17 and 1.34 AU (clear of Earth's aphelion 1.017 AU and Mars's perihelion 1.381 AU), minus ±0.006 AU bands around low-order resonances: Earth 4:3 (1.211), Mars 7:5 (1.218), Earth 7:5 (1.251), Mars 4:3 (1.258), Earth 3:2 (1.310), Mars 5:4 (1.313)
4 · Distance a	u_0 is mapped linearly across the allowed segments [1.170–1.205], [1.224–1.245], [1.264–1.304], [1.319–1.340]
5 · Shape and tilt	e = 0.003 + 0.027·u_1 · i = 2.5°·u_2 · node Ω = 360°·u_3 · perihelion ϖ = 360°·u_4 · starting longitude L = 360°·u_5 (J2000 epoch)
6 · Stability gate	Run a 1 Myr N-body simulation. Pass if nothing escapes, Terrena e < 0.12, Mars e < 0.20, Earth e < 0.08 and Terrena's a drifts by less than 0.03 AU. If it fails, draw a new u_0 = SHA-256(seed | k) and keep e, i, Ω, ϖ, L.

Draws actually made

Draw	u	a (AU)	Result
0	0.251270	1.1999	PASSED, chosen

`Seed-derived uniforms: u0=0.251270, u1=0.928807, u2=0.773146, u3=0.287206, u4=0.162303, u5=0.194103`

4 · The new orbit and why it is stable



Inner Solar System with Terrena's new orbit, planets placed at their positions for Sep 26, 2026. Visualization.

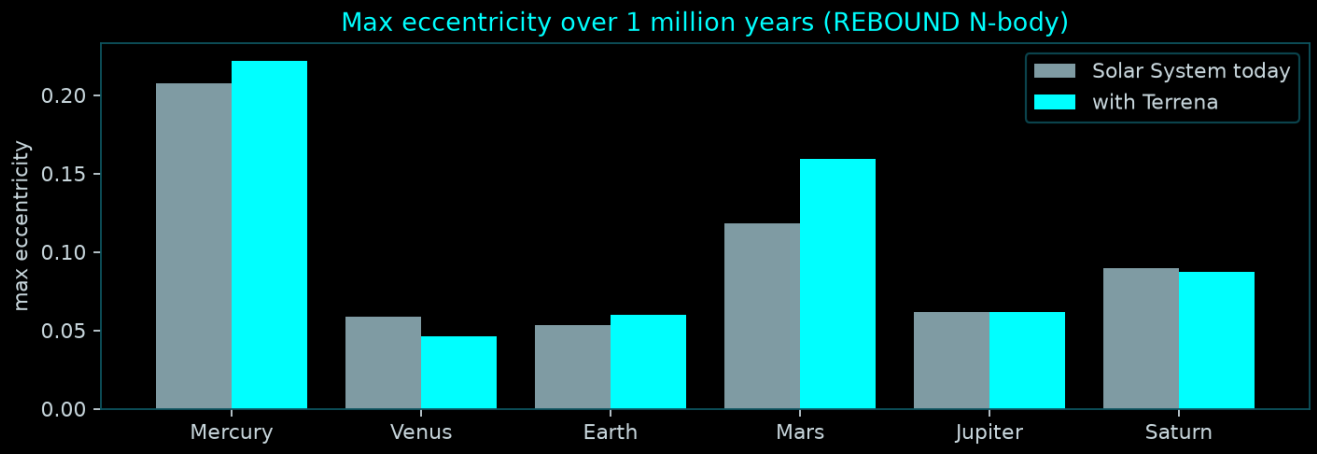
Orbital element	Terrena (new)	Earth	Mars
Semi-major axis	1.1999 AU (179.5 million km)	1.0000 AU	1.5237 AU
Eccentricity	0.0281	0.0167	0.0934
Perihelion / aphelion	1.166 / 1.234 AU	0.983 / 1.017 AU	1.381 / 1.666 AU
Inclination to ecliptic	1.93°	0°	1.85°
Year	480.1 days (1.314 yr), 432 local days	365.26 days	687 days
Mean orbital speed	27.2 km/s	29.8 km/s	24.1 km/s
Gap to neighbour	0.149 AU beyond Earth's aphelion; 0.148 AU inside Mars's perihelion		

Why it is stable

1. Spacing. Planets stay out of each other's way when they are separated by roughly 10 or more "mutual Hill radii", which measure how far each planet's gravity dominates. Terrena sits 14.3 mutual Hill radii from Earth and 22.8 from Mars. That is tighter than Venus and Earth (about 26) but well above the roughly 10 usually needed for long-term stability.

2. No resonance traps. We cut out zones where Terrena's year would be a simple ratio of Earth's or Mars's year, such as 3:2 or 4:3, because repeated tugs at the same point can pump eccentricity. The chosen distance sits between these zones.

3. Direct simulation. REBOUND (WHFast integrator, 3.65-day steps) followed the Sun, the 8 planets (JPL J2000 mean elements) and Terrena for 1 million years, and ran the same system without Terrena as a control. Terrena's distance stayed between 1.1997 and 1.2002 AU. Its eccentricity never went above 0.053 and its tilt never above 3.74°.



Honest limits: 1 Myr is about 0.02% of the Sun's age. The inner Solar System is weakly chaotic, so Gyr-scale stability would need many longer runs. Mercury's relativistic precession, tides and asteroids were left out. The result shows that the orbit is dynamically reasonable, not guaranteed forever.

5 · Terrena under the Sun: physical stats, climate and seasons

Quantity	At Kestrel (before)	Around the Sun (after)
Star	Kestrel, F9V, 6011 K, 1.31 L☉	Sun, G2V, 5,772 K, 1.00 L☉
Distance	1.125 AU	1.200 AU
Sunlight (Earth = 100%)	104%	69.5% (perihelion 74%, aphelion 66%)
Star's size in the sky	0.500°	0.444° (the Sun looks 79% as wide as it does from Earth)
Year	421 days	480 days
Season length	105 days	120 days
Day length / tilt	26.65 h / 23.7°	unchanged
Mass / radius / gravity	1.032 M⊕ / 1.009 R⊕ / 1.014 g	unchanged
Equilibrium temperature	-15 °C	-40 °C
Mean surface temperature, same air	18.3 °C	-6 °C (about -12 °C once extra ice brightens the planet)
Moon	332,609 km, 21.6-day orbit	stays bound: it orbits at 18% of Terrena's Hill radius (1.81 million km)

Climate

We kept Terrena's greenhouse effect at the same 33.5 K it had before, and its Bond albedo at 0.29. Its mean temperature then falls by about 25 K, to about -6 °C. Ice spreading toward the tropics would reflect more sunlight and push this lower still, which risks a "snowball" state. Terrena is still inside the Sun's broad habitable zone (about 0.95–1.67 AU), but only a thicker greenhouse would keep it warm.

Restoring today's 18 °C needs about 31 W/m² of extra warming. With CO_2 alone that means roughly 11% CO_2 (about 0.11 bar), a rough logarithmic estimate that is unbreathable for Nethrai and humans. Alternatives are 49% more sunlight from orbital mirrors, or a mix of mirrors and stronger greenhouse gases. Spread over the planet, that heating equals about 16,044 TW. Terrena's 63 TW fusion grid is more than 300 times too small, so mirrors are the realistic choice.

Seasons. With a 23.7° tilt and a nearly circular orbit, seasons still come from the tilt, as on Earth. Each season now lasts about 120 Earth days, roughly 40% longer than on Earth. The small eccentricity adds about ±6% of sunlight between perihelion and aphelion. Sunlight looks slightly warmer and yellower than Kestrel's, because the Sun is about 240 K cooler.

Terrena backlit by the Sun, with Earth and the Moon as faint points nearby. Visualization.

6 · What it looks like: Terrena from Earth, Earth from Terrena

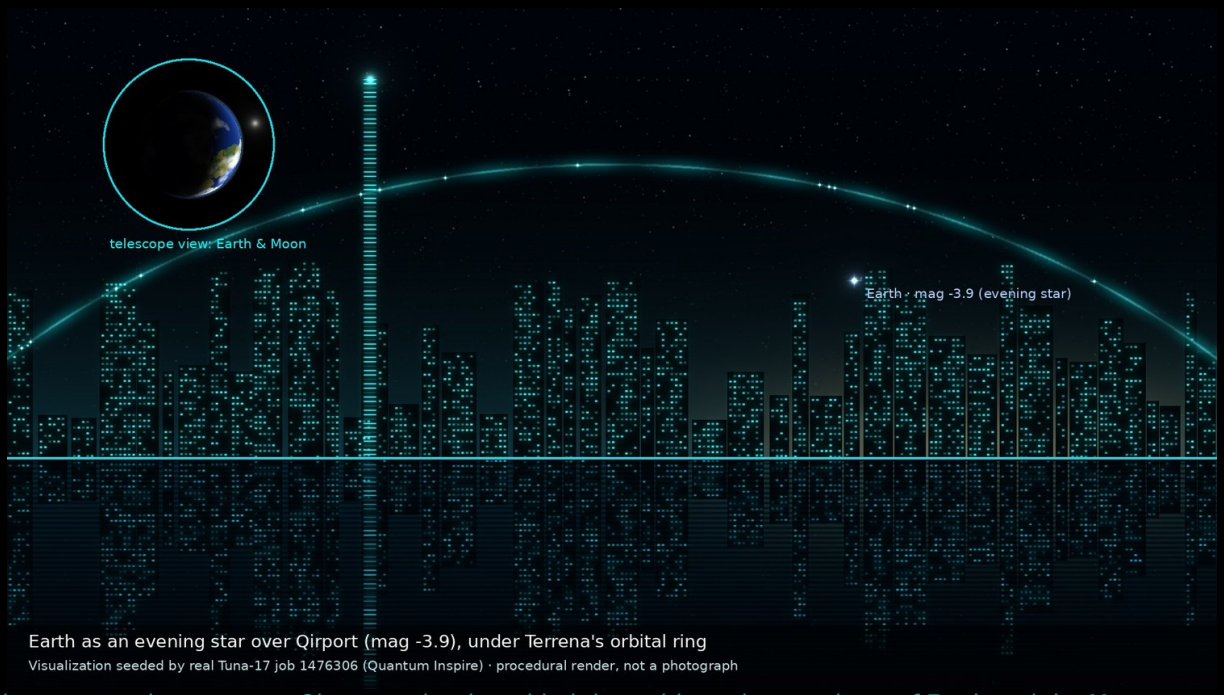
Terrena seen from Earth	Value
Closest / farthest	22 / 337 million km (0.149 / 2.250 AU)
Brightness	mag -6.9 at opposition, -3.9 at quadrature, -1.7 at its faintest (near the Sun)
Naked eye?	Yes, always, except when it is lost in the Sun's glare. At opposition it outshines Venus (−4.9 at best) and is second only to the Moon at night
Apparent size	89″ at opposition (Venus at most about 66″, Jupiter about 50″), 8″ when farthest
Best viewing	Every 4.18 years around opposition, visible all night like Mars
Its moon	moon at 333,000 km would be ~mag -2.9 at opposition (a separate bright point in binoculars)
Tonight (Sep 26, 2026)	In Virgo (RA 12.65 h, Dec -3.0°), 331 million km away, 7° from the Sun, mag -1.7. Too close to the Sun to see tonight: it is near conjunction, on the far side of the Sun. Light time 18.4 min

Terrena in Earth's night sky near opposition: a brilliant cyan "star", mag -6.9

Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

Terrena in Earth's night sky near opposition, with a telescope view inset. Visualization.

Earth seen from Terrena	Value
Type	Earth is an inner planet for Terrena: an evening/morning star like Venus, never more than 56° from the Sun
Brightest	mag -3.9 at about 50° from the Sun, a brilliant blue-white evening or morning star
Size at closest	88″ (then a thin crescent next to the Sun); the Moon is up to 44′ away, easy to split with binoculars
Mars	At best Mars comes within about 0.15 AU (22 million km), closer than it ever gets to Earth. It then becomes a vivid red point of magnitude −3 to −5



Earth as an evening star over Qirport under the orbital ring, with a telescope inset of Earth and the Moon. Visualization.

7 · Travel and light time

Route Earth → Terrena	Time
Light / radio signal	1.2 min at closest, 18.7 min at farthest (Mars: 3–22 min)
Hohmann transfer (efficient rocket)	211 days; Δv 1.32 km/s to leave Earth's orbit plus 1.26 km/s to match Terrena (on top of escaping Earth); a launch window every 4.18 years
Straight line at 30 km/s	12 days at closest approach
1 g torch ship (accelerate, then brake)	1.3 days at closest, 4.2 days at farthest

8 · Effects on the other planets

Orbits. Terrena is about as massive as Earth, so it tugs on its neighbours. Over 1 Myr, Earth's largest eccentricity went from 0.053 to 0.060 and Mars's from 0.118 to 0.159. Venus went from 0.059 to 0.046 and Mercury from 0.208 to 0.222. The largest tilts reached Earth 4.50° (control 3.33°) and Mars 5.73° (control 8.16°). The giant planets barely noticed. The inner planets stayed on stable paths, but their slow cycles of eccentricity and tilt changed.

Earth's climate cycles. Earth's ice ages are paced by these slow orbital cycles (Milankovitch cycles). A new neighbour of Earth's mass would retune those rhythms over tens of thousands of years. Nothing would change noticeably in a human lifetime.

Tides and night light. At closest approach Terrena raises tides on Earth only 178 millionths as strong as the Moon's, which is negligible. At opposition its reflected light is about 1/400 of the full Moon's, enough to cast faint shadows away from city lights.

Small bodies. Over millions of years Terrena would sweep up or scatter many Mars-crossing asteroids between Earth and Mars. Some of the scattered ones could become new near-Earth objects or meteor streams.

9 · Qirport and the Nethrai after the move

SPECULATIVE worldbuilding, consistent with the physics above. Not an observation.

Qirport (60.5 million people, a fjord coast at 20°S) keeps its 26.6-hour day, its 4 arcologies and the 2,013 m Glass Spire. Its sky changes completely. Kestrel is gone and a smaller, yellower Sun rises in its place. Over the long 120-day winters the fjord freezes further out from the Starwater Promenade, and sea-ice glitter replaces the summer spray. The orbital ring and the three elevators work as before. Solar mirrors assembled at the elevator shipyards would become the planet's biggest project, needed to hold back the ice.

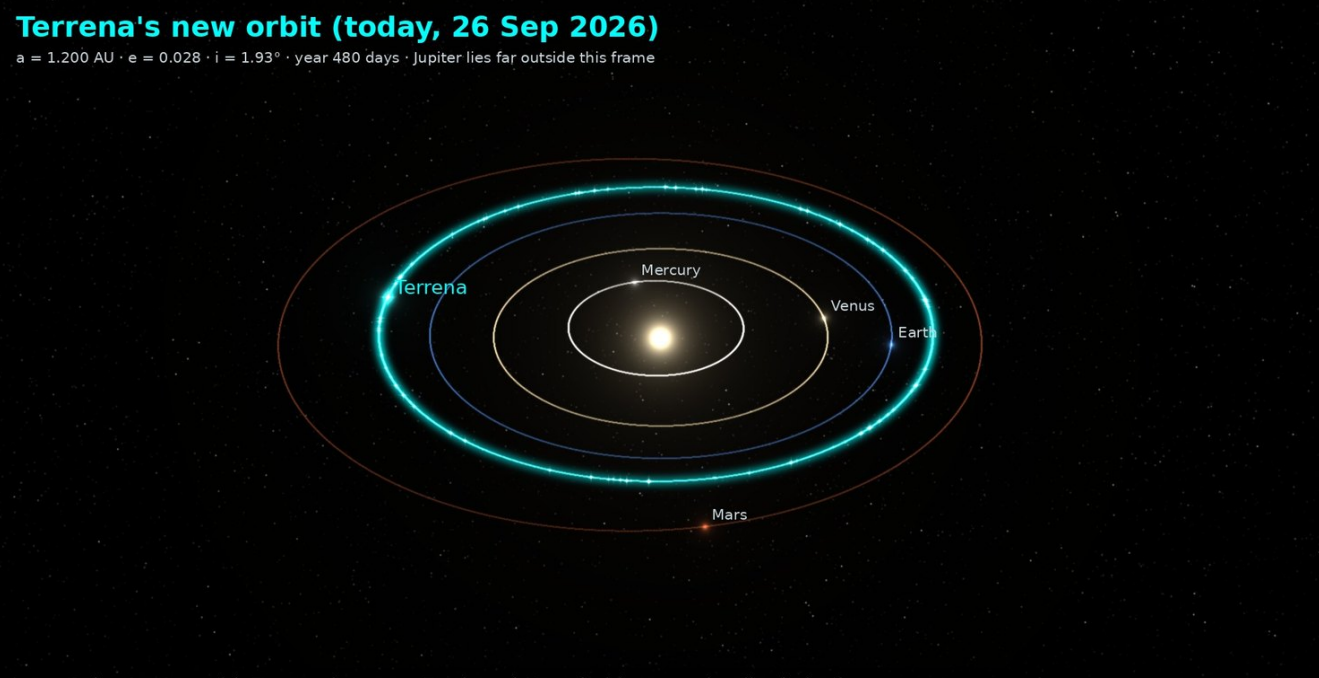
The Nethrai (1.93 m tall, with cyan photophores) evolved under Kestrel's bluer F9V light. Their large eyes now meet a Sun giving about 67% of the light they grew up with, so days look softer and warmer. The nightly Glitter Tide remains, and the new night sky gives it a

fresh meaning: Earth, a blue evening star at mag -3.9, and the red flare of Mars. A Tuna Archive legend about a "first seed" gains a second one, the relocation seed 40533f6cedc6….

Contact. With a light delay of about 2 to 19 minutes, Qirport and Earth could hold near-real-time conversations. At closest approach, Earth's large telescopes could make out the Glitter Tide as a flicker on Terrena's night side.

10 · Image gallery

All five images and the video are procedural renders made with the same Python renderer and planet textures as the original Terrena film (render_video.py). The glitter glints are re-seeded from job 1476306's measured bit strings. They are visualizations, not photographs.



Inner Solar System with Terrena between Earth and Mars (orbits to scale, tilted view)

Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

Terrena's orbit between Earth and Mars (tilted view, to scale). Visualization.

Terrena lit by the Sun at 1.20 AU: cyan seas, ring, 3 elevators, glittering night side

Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

Terrena lit by the Sun: cyan seas, orbital ring, elevators and a glittering night side. Visualization.

Terrena backlit by the Sun, with Earth and the Moon as faint points nearby

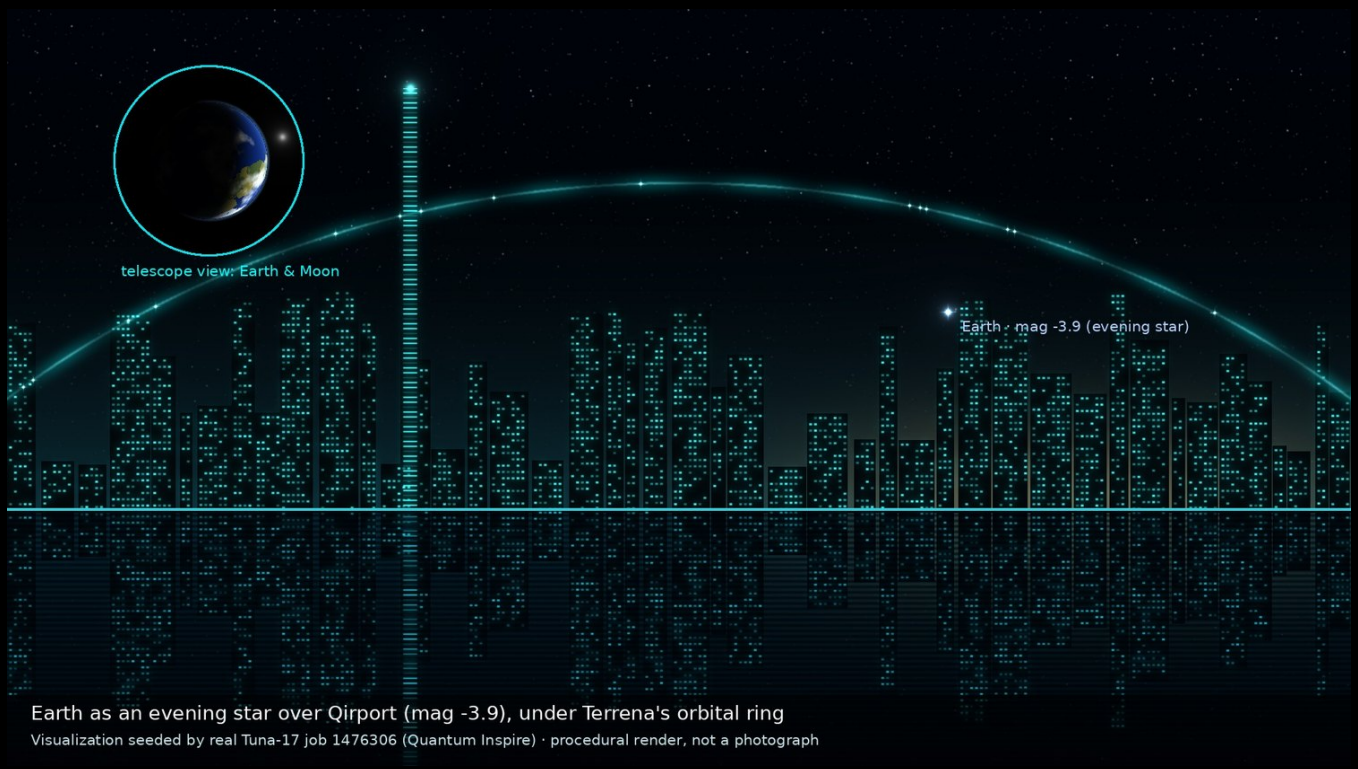
Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

Backlit by the Sun, with Earth and the Moon nearby. Visualization.

Terrena in Earth's night sky near opposition: a brilliant cyan "star", mag -6.9

Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

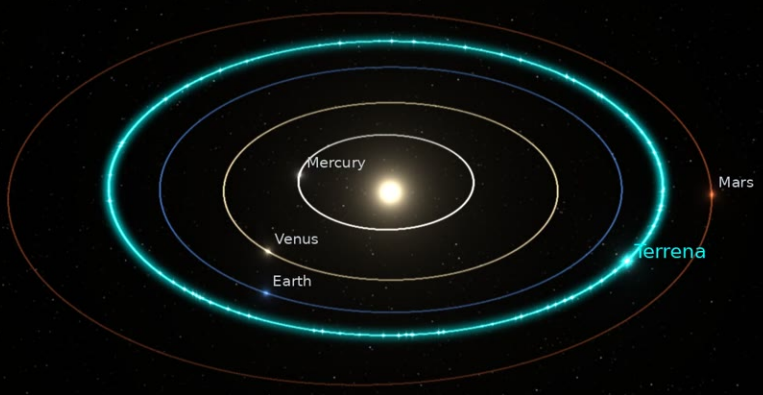
Terrena in Earth's night sky near opposition. Visualization.



Earth as an evening star over Qirport (mag -3.9), under Terrena's orbital ring

Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

Earth as an evening star over Qirport. Visualization.



Terrena's new orbit between Earth and Mars (planets sped up: 1 year ≈ 3 s)

Visualization seeded by real Tuna-17 job 1476306 (Quantum Inspire) · procedural render, not a photograph

Still from the relocation video (terrena-relocation.mp4, 1080p): Terrena's orbit drawn in among the inner planets. Visualization.

11 · Honesty note: real vs simulated

Category	What
REAL (quantum hardware)	Tuna-17 job 1476306: the circuit, the 1,024 measured 17-bit strings, their counts, the 3.92 s execution time and the timestamps from Quantum Inspire, including qubit 6's real bias.
REAL CALCULATION built around the seed	The SHA-256 seed, the bit-to-orbit mapping, the REBOUND N-body integration of the real Solar System plus Terrena, and the orbital, brightness, light-time and transfer numbers (standard formulas). The climate figures are simple energy-balance estimates, not a climate model.
WORLDBUILDING	Terrena, Kestrel, the move itself (no known physics can relocate a planet), Qirport, the Nethrai and their reactions: a story built around the numbers.
ARTISTIC	The cyan colour scheme, the glitter and all images and video frames: procedural visualizations, labelled as such.

Files

relocation.json (all numbers), raw_counts.json, tuna17_job_1476306.json (the full job record), bit_mapping.md, relocate.py, nbody.py, render_relocation.py, make_report_reloc.py, tuna17_relocation_job.mjs, img/*.jpg, terrena-relocation.mp4.