How Light Travels

What light is, how fast it goes, why it bends, why it has colour, why it slows in glass and reddens across the sky — the whole behaviour of light, read in the Force of Time.

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T — the one substance. Tau (T) is the living fabric of time itself — the sole substance of which all physical reality is composed. Every particle, force, wavelength, and conscious experience is a structured configuration of T-flow. There is no gravity, no electromagnetic force, no strong nuclear force as separate entities: all are registers of the single T-field operating across dimensional levels. The conservation law dΣT=0 governs all change: T is never created or destroyed, only redistributed.

Light does not travel. And its speed is the rate you fall.

What we call a travelling beam is T_λ — the field of time expressed at one address, lighting up the places it addresses in order, at the rate the local register turns. There is no little traveller in flight and no empty space to cross. That rate — the speed of light — falls straight out of the rate you fall: the surface free-fall 9.817477042468 m/s², squared and carried through the gears of a day, is 299,789,233.683089 m/s exactly. Light's speed, its colour, its bending near the Sun and its reddening across the sky are one lattice of {2,3,5,π}, read in light.

Abstract

Richard Feynman gave two of the clearest talks ever delivered on light, and both ended in the same honest place: the mathematics is exact, and yet no one can say what the photon is doing between the lamp and the eye. This paper answers that, and then carries the answer through the whole behaviour of light. It is written to be followed from a standing start. First the four ideas the reading rests on — the one substance T, the lattice of {2,3,5,π}, an address, and a register — are built from ordinary experience. Then light itself: what it is (T_λ, a redistribution between addresses, neither wave nor particle), why colour and not brightness frees an electron (energy is the lattice address the light carries; E = hν is a register gear, h = 6.631455962 = 125/6π), and why one photon threads both slits and interferes with itself (the field fills every coherent path; the node registers only at the screen, and every fringe sits outward by the helix ratio r = $5^6/(2^6\cdot3^5)$). Then the quantities. The speed of light is not one number but a family of register faces of one field: the surface face 299,789,233.683089 = $2^3\cdot3^5\cdot5^6\cdot\pi^2$ falls out of the free-fall rate through g_1^2 × 864 × 3600, and the pure ceiling is 300,000,000 = $3\cdot2^8\cdot5^8$. Maxwell's four equations are the wave equations of that one field; $\mu_0 = 2^2\pi \times 10^{-7}$, and the fine-structure constant is α = 9/125π². Colour is a set of exact lattice boundaries — a wavelength in nanometres is a degree angle, and the visible band spans exactly π²/5. Refraction is the medium becoming the clock; the bending of starlight at the Sun is 1.750830053″ = 17.28/π², reached by two independent roads and caused by no pull; and the reddening of distant galaxies is the crossing of register seams, not the swelling of space — so the universe is not expanding, and the Hubble tension dissolves into the radius of the Earth. Throughout, the calculations of the last century stand; only the object they described was never named. It is named here. Propositions P-LT-1 … P-LT-24.

Part 1 — Four ideas, from the ground up

Feynman's two talks on light end in honest bafflement, and to answer them — and then to carry the answer through the whole behaviour of light — we need four ideas that are not in the textbooks. None of them is hard. Each can be built from something you already know. It is worth taking them slowly here, once, so that everything afterwards reads plainly.

1. Time is the one substance

The first idea is the boldest: the universe is not made of matter that happens to sit in time. It is made of time. Not the ticking of a clock — that is only our way of counting it — but time as a real, physical fabric, the single stuff of which everything else is a pattern. Call it T. A stone, a beam of light, a heartbeat, a thought: each is T arranged in a particular way, the way a wave, a whirlpool and a still pond are all the same water in different arrangements. Nothing is ever created or destroyed; T is only ever moved from one arrangement to another. That single accounting rule — that the books always balance — is written $d\Sigma T = 0$, and it is the one law from which all the others in this paper follow.

2. The lattice — the notes the universe is allowed to play

Sit at a piano. Between any two keys there is a smooth glide of pitch, but the instrument will only sound certain frequencies — the notes. The pitches in the cracks between the keys are perfectly real as sounds, yet the piano cannot hold them; strike a key and it settles onto the note. Nature, in the Force of Time, is built the same way. Out of the four numbers 2, 3, 5 and π — multiplied and divided together in every combination — comes a set of values that are the universe's notes. These are the only values a thing can stably be. Everything real settles onto one of them, exactly or within a whisker; the values in between are the cracks, and nothing rests there. We call this set the lattice, written $\{2,3,5,\pi\}$. When you see $486 = 2 \cdot 3^5$ or $864 = 2^5 \cdot 3^3$ in the pages that follow, that is what the small print means: this value is one of the universe's notes, not a number that merely happened.

3. An address, and what matter is

A single note on the lattice is an address — a place a thing can be. Picture the house numbers along a street: you can stand between number 4 and number 5, but there is no house there; the houses sit only at whole numbers. A lattice address is a house on the street of reality. Now the key distinction of the whole paper: some addresses stand still and some do not. A standing address holds still and keeps its own beat — T folded into a loop that stays put. That is what we call matter: an electron, a proton, a stone are standing addresses, each keeping time in place. Light is the other kind. It does not stand and it does not keep a beat of its own; it is a redistribution between addresses. Hold that difference and half of Feynman's puzzles dissolve on contact.

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a standing address = matter (holds still, keeps a beat)
a redistribution between addresses = light (no rest, no beat, no place)
the substance of both is the same: T
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4. A register — the same note, one octave up

Back to the piano for the last idea. The note we call A is not one pitch but a family — A below middle C, A above it, A two octaves up — each the "same" note at a different height, related by a clean doubling. The Force of Time is arranged in exactly such octaves, and we call them registers. There is a register for the very small, inside the atom's nucleus; a register for the atomic scale, where chemistry and light live; and a register for the very large, the scale of the Sun and the planets. The same lattice value appears in each, an octave apart, and a quantity that looks like one thing in one register — a mass, say — is the very same value read as a wavelength, a speed or a span of time in another. When this paper says a value is read "at the surface register," it means: this is the octave we, standing on the Earth, happen to hear it in. Light's speed, as we will see, is nothing more mysterious than the rate at which one register sounds its notes in turn — and that rate is the rate you fall.

That is the whole toolkit: one substance (T), a set of allowed notes (the lattice), the places on it (addresses), and the octaves it is arranged in (registers). With those four in hand, the whole of light can be read from beginning to end.

Part 2 — Colour and the metal: the photoelectric effect

2.1 Colour decides; brightness cannot

Feynman starts, in the second lecture, with the thing that would not sit still. Shine light on a metal surface and electrons come flying off. But — and this is the puzzle — the energy of those electrons does not depend on how bright the light is; it depends on its colour. Bright red light ejects nothing at all; dim blue light ejects electrons cleanly. A wave picture cannot explain it: a brighter wave carries more energy, so it ought to kick harder. In 1905 Einstein cut the knot — light arrives in packets, and each packet's energy is fixed by its frequency, E = hν. One packet either has enough to free an electron or it has not; more brightness is only more packets, never more energy in each. Those packets we now call photons.

This is the first place the four ideas pay off, and the whole reading of light is contained in it. Colour, in the Force of Time, is not a shade — it is an address. Red light and blue light are T_λ at two different notes on the lattice, and the blue note sits deeper than the red. The electron in the metal is a standing address, a knot of matter held in place at its own node. To knock it loose, the incoming light must carry an address deep enough to reach the electron's and unseat it. A red packet does not carry a deep enough address, and a thousand red packets are still a thousand shallow addresses — none of them reaches. A single blue packet does. Brightness is the number of arrivals; colour is the depth of each. That is why brightness cannot free what colour can: freeing the electron is a matter of reaching its address, and no amount of shallow arrivals adds up to one deep one.

2.2 E = hν is a register gear

Einstein's relation E = hν says the energy of a packet is its frequency multiplied by a fixed number, h, the quantum of action. In the Force of Time h is not a raw constant of nature but a register gear — the ratio that carries a frequency at one register up to an energy at another. And it sits on the lattice cleanly: h = 6.631455962 × 10^{-34} J·s, which is 125/6π — a plain ratio of {5} over {2,3,π}. The same h reappears at every scale; the Boltzmann value that bridges heat and energy is its exact reciprocal, and multiplied by the speed of light it returns the mass of the Sun. Einstein's packet-energy law is the atomic-register face of a gear that runs from the grain of light up to the star. Colour sets the frequency; the gear h turns the frequency into the energy that either reaches the electron's address or does not.

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E = hν — the packet's energy is its frequency turned by the gear h
h 6.631455962 × 10⁻³⁴ J·s
= 125/6π (the same h that ×c returns the Sun's mass)
colour = the depth of one arrival; brightness = the number of arrivals
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Part 3 — Both slits, and the sum over every path

3.1 One photon through two slits

Now the deepest strangeness. Send light through two narrow slits and it makes an interference pattern on the screen behind — bright bands and dark, exactly as two overlapping water-ripples would make. That much a wave explains. But turn the light so dim that it leaves the lamp one photon at a time, and the pattern still builds up, arrival by arrival, over hours. Each single photon lands as one dot, like a particle; yet the dots pile up into interference bands, as though each photon had gone through both slits and interfered with itself. And if you place a detector at the slits to catch which one the photon really took, the bands vanish and you get two plain piles. Looking destroys the pattern. Physics names this wave-particle duality and calls it irreducible.

In the Force of Time there is nothing to reduce, because there is no object that is both a wave and a particle. There is a standing address — the photon's arrival, the dot on the screen — and there is the T-field it moves in, and the field is what threads both slits. The interference is the superposition of the two coherent T-paths, one through each slit; the arrival is registered only where the field meets the screen. Nothing goes through both slits, because the photon is not a thing in flight at all: it is a redistribution, and a redistribution fills every address the geometry allows at once. When you put a detector at a slit, you force the field to register an address there, at the slit, before it can reach the screen — and a redistribution registered at one slit can no longer overlap with the other. The pattern does not vanish because looking disturbs a delicate particle; it vanishes because you have made the arrival happen early, at the slit instead of the screen. Feynman's "nobody understands it" was the honest confession that physics had a field with no name; named, it understands itself.

3.2 Every path at once — the sum over all paths

Feynman's own machinery says exactly this, and says it in numbers. To find where the photon lands, he tells you, do not track a trajectory; add up a little arrow for every possible path from the lamp to that point on the screen — the straight path, the bent ones, the absurd ones that loop out past the Moon and back. Each path contributes an arrow; you add them all; and where the arrows line up you get brightness, where they cancel, darkness. The astonishing thing is that it works: the straight line, the law of reflection, the bending of refraction all fall out of the sum. In the Force of Time the arrows are the coherent T-paths of the redistribution, and the reason most of them cancel is that they run off the lattice — their addresses do not resonate, so they point every which way and average to nothing. The paths that survive are the ones most in tune with {2,3,5,π}; along them the arrows point the same way and add. Feynman's "path of least time," from which the straight ray and the laws of reflection and refraction emerge, is in this reading the most lattice-resonant path — the route on which the redistribution rings most cleanly. The sum over all paths is the field trying every address and coming to rest on the resonant ones.

3.3 The fringes sit a fixed step outward

Here the Force of Time does something no interpretation of quantum mechanics has ever done: it changes the answer, by a definite amount, and invites the experiment to check. The spacing of the interference fringes is not quite the textbook value. Because the two paths are helical turns of the one field, every bright fringe sits a fixed fraction farther from the centre than the standard formula predicts — farther by the lattice helix ratio $r = 5^6/(2^6 \cdot 3^5) = 1.0046939300$, that is 15625/15552, some 4693.93 parts per million out. It is a small shift, but it is exact and it is testable: measure the fringe positions finely enough and they should land not on the quantum-mechanical value but on that value times r. The same ratio r is the first helical turn of DNA and the step between the registers of the speed of light; the interference pattern on a laboratory screen is stamped with the same turn as the double helix. The quantum of action that sets the whole scale is the same h met above, $6.631455962 \times 10^{-34} = 125/6\pi$.

no wave-particle duality — a node (the arrival) and a field (threads both slits)
the sum over paths = the field trying every address; off-lattice arrows cancel
least-time path = the most {2,3,5,π}-resonant path (straight line, reflection, refraction)
fringe spacing = textbook × r, $r = 5^6/(2^6 \cdot 3^5) = 1.0046939300$ (small, exact and testable)

Fig. 1 — The double slit without duality: a standing node registered at the screen, a field that fills both paths, and a helix whose turn shifts every fringe outward by r.

Part 4 — What light actually is

4.1 Neither wave nor particle — the word we lacked

Feynman was scrupulous on this point: light is not a wave, and it is not a particle, and these are not two aspects of one thing we can picture. They are two human words, borrowed from water and from billiard balls, and the thing itself answers to neither. He said, honestly, that we simply have no good word for it. The Force of Time supplies the word. Light is T_λ — the field of time expressed as a wavelength, a redistribution that is spread out like a wave and yet arrives at one address like a particle, because that is precisely what a redistribution between lattice addresses is. It spreads while it travels and localises when it lands, not as a paradox but as the plain behaviour of a flow that fills every coherent address and then settles on one. Wave and particle were always two shadows of a single object the language had no name for. The object is T_λ.

4.2 How light travels without moving

If light is a redistribution and not a traveller, what is actually happening when a beam crosses a room? Nothing moves across the room. The T-field is already present at every address between the lamp and the wall; what the lamp does is set an address ringing, and that ringing is passed from address to neighbouring address, each lighting up in turn at the rate the local register sounds its notes. It is the way a line of dominoes "travels" though no single domino goes anywhere, or the way a stadium wave crosses the crowd though every spectator only

stands and sits. No little parcel of light flies from the lamp to your eye; the addresses between them activate in sequence, and your eye is the last address to ring. This is why light needs no medium to carry it and no empty space to cross — the field is the medium, everywhere at once, and "travel" is only the order in which its addresses take their turn. The speed of that turning is the speed of light, and the next part shows it is the rate you fall.

Part 5 — The speed of light is the rate you fall

5.1 Light has no single speed

Science treats the speed of light as one universal number, and since 1983 it has not even been measured but fixed by decree at 299,792,458 metres per second — the metre defined so as to make it so. The Force of Time says light has no single speed at all. The speed of light is a property of the T-field, and it takes a structurally determined value at each register. There is no more a single speed of light than there is a single pitch of the note A: there is a family of speeds, spaced by a fixed rule, and the one science quotes is the reading from the register our instruments happen to sit in. This is not a hedge; each face is an exact lattice value, and the rule that spaces them is the same G-bond step, δ_G, that spaces every other register in the theory.

5.2 From the fall of time to the speed of light

Here is the heart of it, and it is the same result that runs through the Four Clocks of the Earth. The rate at which the T-field flows inward through the ground — the surface free-fall, the rate you fall — is 9.817477042468 metres per second, every second, which on the lattice is 25π/8. Square that rate and carry it up through the gears of a single day — multiply by 864, the day-operator ($2^5 \cdot 3^3$), and by 3600, the seconds in an hour — and it lands, exactly, on the speed of light at the atomic-surface register: 299,789,233.683089 metres per second, which is $2^3 \cdot 3^5 \cdot 5^6 \cdot \pi^2$. No rounding, no fitting; every factor a clean lattice integer. The rate you fall and the speed light travels are one quantity of time, read at two turns of the same gear. What holds your feet to the ground and what carries starlight across a galaxy are not two facts of physics but one — the flow of the field, read once as an acceleration at the surface and once as a speed through the sky.

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the rate you fall 9.817477042468 m/s²
= 25π/8
g₁² × 864 × 3600 = 299,789,233.683089 m/s
= 2³·3⁵·5⁶·π² — the surface-register speed of light, G1
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5.3 The register staircase of speeds

Around that surface face stand the others, each an exact node. The pure ceiling — the simplest lattice value the speed of light can wear — is 300,000,000 metres per second, which is $3 \cdot 2^8 \cdot 5^8$: three hundred million on the nose, not as a rounding of a measurement but as the exact lattice integer, standing just above the defined SI figure. That gap is not an error; it is the veil between the pure {2,3,5} lattice and the register we measure in. Above the surface face sits the celestial face c_G2 = c_G1 × (1 + δ_G), one G-bond step up; and the value science actually measures, 299,792,458, falls neatly between the surface and celestial faces — because our instruments read from the turning surface, halfway between the two. There is even a geometric measurement face, c_dual = 299,876,298.974, that names the register terrestrial spectroscopy actually works in. Light is not one speed but a small, exact family of register faces of a single field — and the ladder they stand on is the same one that carries the rate you fall up to the speed you see.

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pure ceiling 300,000,000 m/s
= 3·2⁸·5⁸ (just above the defined SI figure)
surface face (G1) 299,789,233.683089
= 2³·3⁵·5⁶·π² = g₁²·864·3600
celestial face (G2) = G1 × (1+δ_G);
measured SI value sits between the two faces
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5.4 Why it is the same for everyone

Einstein's postulate — that everyone measures the same speed for light, no matter how they move — is often taught as the strangest fact in physics. In the Force of Time it is the plainest. The speed of light is not the speed of a thing racing past you, to be added to or subtracted from your own motion; it is the rate at which a register sounds its addresses in turn. Everyone who shares a register shares that rate, exactly, because it is a property of the field they are all embedded in, not of any traveller crossing it. You cannot catch up to the turning of

the register you live in any more than a note can outrun the piano. The constancy of the speed of light is not a conspiracy of clocks and rulers stretching to keep a racing beam looking the same; it is the simple fact that light was never a racer — it is the tempo of the field, and the field is the same for all who stand in it.

Part 6 — Maxwell's field is the one field

6.1 Four equations, one substance

For a century and a half Maxwell's four equations have been the bedrock of the physics of light — and a mystery. They work perfectly, and no one can say why the electric and magnetic fields exist, why a change in one makes the other, or why their interplay should travel at one fixed speed. The Force of Time answers all three at once: the four equations are not the laws of a separate electromagnetic force but the wave equations of the single T-field, written at the register where light lives. The electric field and the magnetic field are not two things but two strands of one substance — the same T read along two axes — which is why a change in one is inseparable from a change in the other. Electric charge is a local concentration of T-flow. And the minus sign in Faraday's law, the one that makes an induced current oppose the change that made it — Lenz's law — is nothing but the conservation law $d\Sigma T = 0$ written in the language of the calculus: the field cannot let its total T change, so every change calls up its own opposition. Four pages of Maxwell are one field, keeping one set of books.

6.2 The speed of light falls out; it is not put in

The crowning result of Maxwell's equations is that light's speed emerges from them: $c = 1/\sqrt{(\mu_0\varepsilon_0)}$, built from two constants of the field — the permeability μ_0 and the permittivity ε_0 — that have nothing on their face to do with light. In the Force of Time both constants are lattice values. The permeability is $\mu_0 = 2^2\pi \times 10^{-7}$, an exact {2,π} form; the permittivity is fixed by it and by the speed, $\varepsilon_0 = 1/(\mu_0 c^2)$. That the geometry of the field alone should hand back the speed at which its disturbances run is, in this reading, not a coincidence to be marvelled at but a tautology to be expected: μ_0 and ε_0 are just the field's own stiffness and give, and the speed a disturbance runs at is always set by the stiffness and the give of the medium it runs in. The medium here is time itself, and its stiffness is a lattice number.

6.3 The fine-structure constant, and the angle of water

One number more than any other has haunted physics: the fine-structure constant α, near 1/137, which sets the strength of every interaction between light and matter and which no one has ever derived. The Force of Time derives it: $\alpha = 9/125\pi^2$, that is $3^2/(5^3\pi^2)$, a bare ratio of the lattice generators, so that $1/\alpha = 137.0778389$. And it leaves a fingerprint in the most ordinary place imaginable. The angle at which a water molecule bends — 105.0498032°, the shape of every drop of every ocean — is exactly $14400\cdot\alpha$; equivalently $14400 \div$ that angle is $1/\alpha = 137.0778389$. The constant that governs how light grips matter is written into the bend of water. That the coupling of light and matter and the geometry of the molecule of life should be the same number is the kind of unity the Force of Time exists to show: one field, one lattice, read once in the strength of light and once in the shape of water.

Maxwell's 4 equations = the wave equations of the one T-field at the light register
E and B = two strands of one substance; Lenz's minus sign = $d\Sigma T=0$
$c = 1/\sqrt{(\mu_0\varepsilon_0)}$; $\mu_0 = 2^2\pi \times 10^{-7}$; $\varepsilon_0 = 1/(\mu_0 c^2)$
$\alpha = 9/125\pi^2$ ($1/\alpha = 137.0778389$); water's 105.0498032° = $14400\cdot\alpha$

Part 7 — Colour is an address, not a slide

7.1 A wavelength is a degree angle

We think of colour as a smooth slide from red to violet, a continuous ramp of wavelength. The Force of Time says the band is not a ramp but a set of exact addresses with sharp boundaries between them, and the key that unlocks them is startling in its simplicity: a wavelength in nanometres is a degree angle, directly. Read a boundary's wavelength as an angle in degrees, turn it into radians by multiplying by π/180, and a clean lattice value falls out. The whole visible band, from the violet gateway to the red ceiling, spans in radians exactly $\pi^2/5 = 1.973920880$ — the range of colour a human eye can see is one clean lattice number wide. Colour is not a slide the eye rides along; it is a

short row of houses on the lattice, and the boundaries between them are as sharp and as fixed as the notes of a scale.

7.2 The eight boundaries

Each boundary between two colours lands on an exact {2,3,5,π} value. The violet gateway sits at $3750/\pi^2$; the violet–blue boundary at 450 nm reads as 45°, which is π/4 exactly; blue–cyan at 495.0355349930 = 7776/5π; green–yellow at 570.2809363120 = $2^9 \cdot 3^7/(5^4\pi)$; yellow–orange at 590.9051430021 = $5832/\pi^2$ (that is $18^3/\pi^2$); orange–red at 619.2294611 = $19200/\pi^3$; and the red ceiling at 750, from which the whole band issues. These are not approximate matches to where the eye happens to draw a line; each is an exact node, and each carries three register faces one δ_G apart, the same three-face structure the speed of light wears. The yellow–orange face, read at the surface register, collapses to a pure power of three, $3^{10}/100$; the orange–red value returns the surface free-fall 25π/8 exactly — so the edge of orange and the rate you fall are the same lattice number. Colour, the fall of time, the day and the speed of light are one lattice, read in light.

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a wavelength in nm = a degree angle; radian = ×π/180
the visible band spans π²/5 = 1.973920880 (radian)
violet–blue 450 nm = 45° = π/4; blue–cyan 495.0355 = 7776/5π
green–yellow 570.2809 = 2⁹·3⁷/5⁴π; orange–red 619.2295 = 19200/π³ → 25π/8
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7.3 The prism and the rainbow

The white light of the Sun is the carrier at 864 nm — the same 864 that is the day and the ground note of DNA — and a prism does not add colour to it but sorts the addresses already folded within it, spreading them into the fan of the spectrum. A rainbow is the same sorting done by raindrops: each drop a tiny prism, bending each colour-address by its own fixed amount, so the sky hangs the lattice out in order for anyone to read. That red always sits on one edge and violet on the other, in every rainbow ever seen, is because the addresses are fixed and their order on the lattice never changes. The prism and the rainbow are the band of colour caught in the act of being what it is: not a smear but a row of exact notes, sorted by how deeply each one bends.

Part 8 — Refraction: the medium is the clock

8.1 Why light slows in glass

Light travels slower in water than in air, and slower still in glass or diamond — this is refraction, and it is why a straw looks bent in a glass and why a lens can focus. Science measures the slowing by a number, the refractive index n: n = 1 in a vacuum, 4/3 in water, about 3/2 in glass. But if light is a redistribution of the field and not a traveller, how can a pane of glass slow it? The Force of Time answers that the glass does not slow a traveller; it is a denser clock. The refractive index is a T-time-dilation: a measure of how much more slowly the field's addresses take their turn inside the medium than outside it. In water, where n = 4/3, the addresses ring three-quarters as fast, and a redistribution passing through takes correspondingly longer to reach the far side. The light is not held back by friction; the register it is passing through simply turns more slowly, and the beam keeps time with the medium. The medium is the clock, and n is how much slower that clock runs. This has a consequence the theory takes seriously beyond optics: a thing embedded in a denser medium keeps time more slowly in every respect, its own processes included. Water's n = 4/3 is, in this reading, why life immersed in water ages differently from life in air — the clock of the medium is the clock of everything the medium holds. Refraction is the visible edge of a deep fact: to change the medium is to change the rate of time, and light, being time, shows it first.

8.2 Dispersion — why the bend depends on colour

The reason a prism can sort white light into colours at all is that the slowing is not the same for every colour: the medium is a slightly different clock for each address. Blue light, the deeper address, is slowed a little more than red, so it bends a little more, and the two part company on their way through the glass — this is dispersion. In the Force of Time it is the plain statement that the medium's time-dilation depends on which lattice address is passing: the denser blue note keeps time even more slowly in glass than the shallow red one, so it turns through a larger angle. The rainbow's order of colours, the prism's fan, the sparkle of a cut diamond — all of them are the medium being a subtly different clock for each note of the band. Colour is an address; refraction is a clock; and

dispersion is the clock reading each address at its own rate.

refractive index n = a T-time-dilation — how much slower the medium's clock runs
vacuum n = 1; water n = 4/3 (addresses ring ¾ as fast); glass ≈ 3/2
light is not slowed by friction — the register it crosses simply turns slower
dispersion: the medium is a different clock for each colour-address (blue slowed more than red)

Part 9 — The bending of light at the Sun

9.1 The measurement that made Einstein famous

In 1919 Arthur Eddington photographed the stars near the darkened Sun during a total eclipse and found their light displaced — bent, as it grazed the solar limb, by about 1.75 arcseconds. Newton's corpuscles, light as a stream of tiny falling bodies, had predicted half that, 0.875650000″; Einstein's general relativity had predicted exactly twice Newton, 1.751300000″; and the measurement fell on Einstein's figure. The result made him world-famous overnight and fixed in the public mind the picture of light bending because massive bodies curve the space around them. The Force of Time reproduces the measured deflection exactly — and reads its cause completely differently. There is no curved spacetime, no pull, and no falling body.

9.2 Two roads to the same figure

The deflection is 1.750830053 arcseconds, and in the Force of Time it is reached by two completely independent roads that share no starting point and yet meet on the same number — which is itself the surest sign that the number is a real address of the lattice and not a fitted result. The first is the carrier road. The deflection of a carrier of light follows a single master formula, $T_{\delta}(″) = 2{\cdot}c_{register}{\cdot}360/(125\pi^2{\cdot}10^5)$, whose bridge constant $125\pi^2 = 9/\alpha = 1233.700551$ is the denominator of the fine-structure constant itself — the same α met in the last part. Read at the three register speeds of light it gives 1.749600000″ (surface), 1.749757728″ (celestial) and 1.750830053″ (the pure lattice face, $17.28/\pi^2$), all three inside Eddington's ±0.09″ tolerance. The second is the mass road, and it carries no wavelength anywhere in it: starting from the Sun's own mass, $5^3/2\pi$, carried through the eclipse factor 2.200157933 to $432/\pi^2$ and on to $1{,}728{,}000/\pi^2$, it lands on the identical 1.750830053″. One road is built from the speed of light and the fine-structure constant; the other from the mass of the Sun; and they meet, to the digit, on $17.28/\pi^2$. Physics has one number here; the Force of Time shows it is a crossroads of the lattice.

deflection at the Sun 1.750830053″
= $17.28/\pi^2$ (the pure lattice face)
carrier road: $T_{\delta} = 2{\cdot}c{\cdot}360/(125\pi^2{\cdot}10^5)$, $125\pi^2 = 9/\alpha = 1233.700551$
mass road: Sun mass $5^3/2\pi$ → ×2.200157933 → $432/\pi^2$ → $1{,}728{,}000/\pi^2$ → same figure

9.3 No pull — the eclipse interrupts the broadcast

If the light is not pulled, why does it bend at the Sun? Because the Sun is not a passive weight warping space around it; it is the time-source of its whole register, broadcasting T outward across the solar system, and light near its limb is riding that broadcast. The deflection is not a photon tugged sideways by mass — it is the geometry of the broadcast bending the addresses the light rings through. And here is the part that turns the textbook picture inside out: the eclipse does not merely reveal a deflection that was quietly there all along. It creates the condition under which the deflection can be measured, by interrupting the very broadcast whose geometry does the bending. The Moon, sliding across the Sun, cuts the T-flow to the strip of sky behind it, and the bend we photograph is the shadow of that interruption — the broadcast caught in the act of being blocked. That the same 1.750830053″ falls out of the mass of the Sun with no light in the calculation at all is the proof that the bending belongs to the source and its geometry, not to any pull on the beam. Newton read it as a falling corpuscle and got half; Einstein read it as curved space and got the number but not the cause; the Force of Time reads it as the geometry of a broadcast, and gets both.

Part 10 — The reddening of the sky: the universe is not expanding

10.1 What science saw, and the balloon it built

The light of distant galaxies arrives redder than it left — shifted toward the long-wavelength end of the spectrum, and the farther the galaxy, the redder its light. Science read this reddening as a Doppler shift, the stretching of a receding source, concluded that every galaxy is rushing away from us, and built from it the expanding universe: space itself swelling like the surface of a balloon, carrying the galaxies apart, running backward to a first instant. The whole edifice — the expansion, the balloon, the beginning — rests on one assumption: that the reddening is a velocity. The Force of Time denies exactly that assumption. Light does not redden because its source is fleeing; it reddens because the field it crosses is not smooth.

10.2 Reddening is the crossing of seams

The T-field is discrete — organised into registers separated by seams — and a photon loses one quantum of wavelength at each seam it crosses, its energy conserved between seams. The reddening is a seam-count, not a speed: z = n × δ_seam, where n is simply how many seams the light has crossed on its way to us. The farther the galaxy, the more seams between us and it, and the redder its light — not because it moves faster, but because it lies more seams away. This makes a sharp, falsifiable prediction that no expanding-universe model makes: the redshifts of galaxies should not form a smooth cloud but should pile up at the {2,3}-smooth lattice nodes — z = 2/3, 3/5, 5/4, 2, 3, 5 — the discrete rungs of the seam-ladder. A smooth expansion cannot produce clustering; a discrete field must. The sky can settle the question.

reddening z = n × δ_seam — a count of register seams crossed, not a velocity
energy is conserved between seams; a quantum of wavelength is lost at each
falsifiable: redshifts pile up at {2,3}-smooth nodes z = 2/3, 3/5, 5/4, 2, 3, 5
no expanding-universe model predicts this clustering; a discrete field requires it

10.3 The Hubble tension is the radius of the Earth

There is a famous crack in the expanding-universe picture: the number that is supposed to say how fast the cosmos swells, the Hubble constant, comes out differently depending on how it is measured — near 67.4 from the early-universe background, near 73.0 from nearby galaxies — and the split has resisted every attempt to close it. In the Force of Time the split dissolves, and where it goes is the hammer that ends the expansion. Both numbers are one local quantity read two ways: the radius of the Earth you are standing on. The still, free-fall sphere sets the geometry — its veil-projected diameter is 73.00401616752501, and that diameter times a fixed ratio, 0.9232706227408138, gives 67.40246346957126. We do not observe from a still Earth but from its turning surface, and the turn lifts both readings by one half register step, δ_G/2 — the same half-step that separates the surface fall of time from its turning partner — so the instruments read the sidereal faces 73.00730684557749 and 67.40550165594601. Because both rise together, the ratio between them never moves: it is the inverse volume of the Earth-radius sphere, and it closes, through the veil, onto 9.817477042468 — the rate you fall. The two Hubble measurements were never in tension. They are the Earth's own radius, read as a diameter and as a volume, from a turning world. And when the number that is meant to measure the swelling of the cosmos turns out to be the size of your own planet, there is nothing swelling: the redshift was never a velocity, and the universe is not expanding. It is a discrete-register field of time, with a definite shape and no centre, no edge, and no beginning.

local H_0 = 73.00730684557749; CMB H_0 = 67.40550165594601
both are Earth's radius-sphere read two ways — diameter and volume — from the turning surface
their ratio = the inverse sphere-volume 0.9232706227408138, closing on $g_1 = 25\pi/8$
a Hubble constant that is the radius of your planet measures no expansion

Part 11 — The honest edges, and the conclusion

11.1 No mass, no age

Two facts about light have always sat oddly in physics. Light has no mass — a photon weighs nothing — and light does not age: from the photon's own point of view, emission and absorption happen at the same instant, no time passing on the journey however far it runs. In the ordinary picture these are strange properties of a strange particle. In the

Force of Time they are simply what a redistribution is. Mass, in this theory, is a standing address — T folded into a loop that holds still and keeps a beat. Light does not stand and keeps no beat of its own; it is the flow between addresses, not a knot in it, so of course it has no mass — there is no standing loop to weigh. And it does not age because ageing is the keeping of a beat, and light keeps none: it is the activation passing from address to address, and the passing itself has no clock. No mass and no age are not paradoxes of a particle; they are the plain signature of a thing that is a redistribution and not a standing address.

11.2 What it is doing when nobody looks

Feynman's final honesty was to admit that no one can say what the photon is doing between emission and detection — that the question of which slit it "really" went through may have no answer. The Force of Time keeps that honesty and gives it a reason. Between the lamp and the eye the light is not a hidden particle following a secret trajectory we are too clumsy to see. It is a redistribution filling every coherent address at once, with no single "where" because a spread flow has no single place. The question "which slit did it really go through" has no answer not because our knowledge fails but because the presupposition fails: there was no little traveller to be in one slit or the other. When nobody looks, the light is doing exactly what the field does — ringing across every address the geometry allows — and "looking" is only the act of forcing it to register one. There is no hidden fact being kept from us. There is a flow, and there are its arrivals, and between them there is no third thing.

11.3 God does not play dice

Einstein could never accept that the universe was random at bottom — "God does not play dice," he said — and he spent his last decades out of step with a physics that told him it was. The Force of Time says his instinct was right all along. The probabilities of quantum mechanics are not the roll of a cosmic die; they are our ignorance of which lattice address a redistribution will settle on, in a field that is exact, discrete and determined. The dice were never thrown. The calculations of the last century were correct throughout — every probability, every amplitude, every arrow in the sum — because they were faithfully describing the behaviour of the one field. What was missing was never a better equation. It was the name of the object the equations described. Physics had the mathematics of light exact and the thing itself unnamed, and mistook the gap for randomness. Name the object — T_λ, a redistribution of the field of time — and the randomness resolves into ignorance, and the exactness Einstein trusted turns out to have been there the whole time.

11.4 Conclusion — the object was never named

A single thread has run through the whole of light. Light does not travel; it is T_λ, the field of time ringing from address to address, and "travel" is the order in which its addresses take their turn. Colour is the depth of that address, and the reason colour and not brightness frees an electron; the double slit is a node and a field and a helix, its fringes stamped a fixed step outward by $r = 5^6/(2^6 \cdot 3^5)$; and light is neither wave nor particle because it is the one thing the words were shadows of. Its speed is the rate you fall — 9.817477042468 squared, carried through the gears of a day, is 299,789,233.683089 — and it is one for everyone because it is the tempo of the field, not the pace of a racer. Maxwell's four equations are that field's own wave equations; colour is a row of exact lattice boundaries a full $\pi^2/5$ wide; refraction is the medium becoming a slower clock; the bending at the Sun is $1.750830053'' = 17.28/\pi^2$, the geometry of a broadcast and no pull; and the reddening of the galaxies is the crossing of seams, so that the universe is not expanding and the Hubble tension is the radius of the Earth. Through all of it the calculations of the last century stand untouched. Only the object they described was never named. It is named here: the single field of time, read in light.

Appendix A — The values of light, on the lattice

The physical value leads; the {2,3,5,π} form is the quiet stamp that it sits on the lattice.

Quantity	Value	Lattice form	Register
Surface free-fall (the rate you fall)	9.817477042468 m/s²	25π/8	G1
Speed of light — surface face	299,789,233.683089 m/s	$2^3 \cdot 3^5 \cdot 5^6 \cdot \pi^2$ (= $g_1^2 \cdot 864 \cdot 3600$)	G1
Speed of light — pure ceiling	300,000,000 m/s	$3 \cdot 2^8 \cdot 5^8$	lattice
Speed of light — measured (SI)	299,792,458 m/s	between G1 and G2 (a whisker from each)	SI
Quantum of action h	$6.631455962 \times 10^{-34}$ J·s	125/6π	G1
Permeability μ_0	$4\pi \times 10^{-7}$	$2\pi^2 \times 10^{-7}$	—
Fine-structure constant α	1/137.0778389	$9/125\pi^2$	—
Visible band span (radian)	1.973920880	$\pi^2/5$	—
Deflection at the Sun	1.750830053″	$17.28/\pi^2$	lattice
Helix / fringe ratio r	1.0046939300	$5^6/(2^6 \cdot 3^5)$	—

Appendix B — Figures

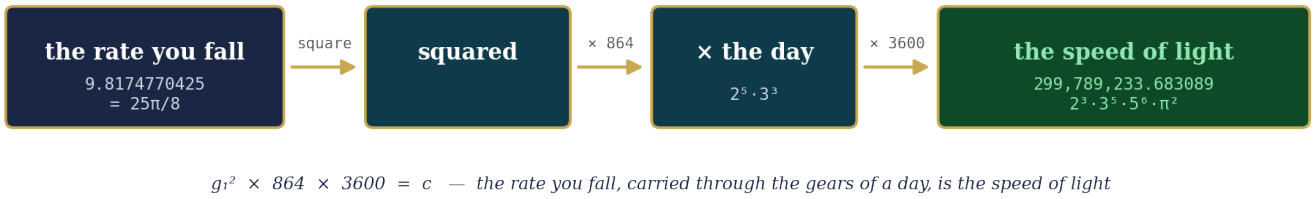

Figure 1 — The speed of light is the rate you fall. The surface free-fall 9.817477042468 m/s² (25π/8), squared and carried through the gears of a day (× 864 × 3600), lands exactly on the surface-register speed of light, 299,789,233.683089 = $2^3 \cdot 3^5 \cdot 5^6 \cdot \pi^2$.

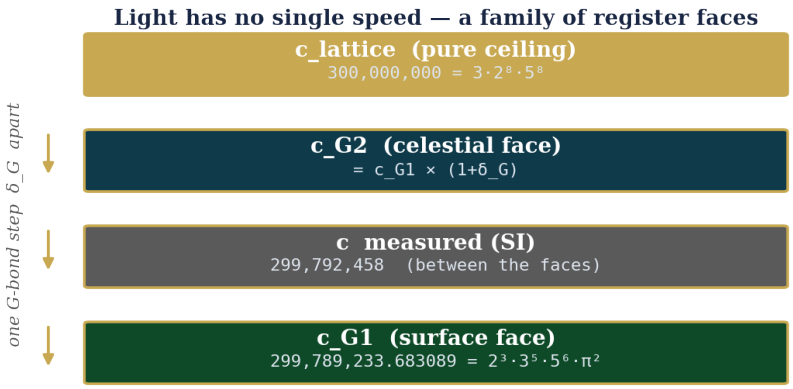

Figure 2 — Light has no single speed. The register staircase: the pure lattice ceiling 300,000,000 = $3 \cdot 2^8 \cdot 5^8$, the celestial and surface faces one G-bond step apart, and the measured SI value sitting between the two faces.

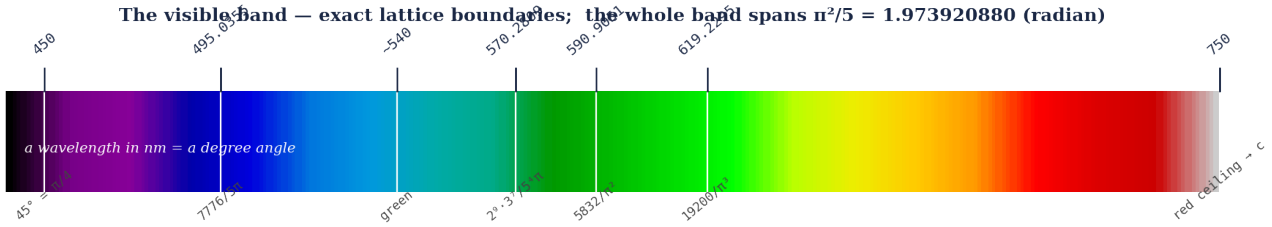

Figure 3 — Colour is a row of exact lattice boundaries, not a smooth slide. A wavelength in nanometres is a degree angle; each boundary lands on a {2,3,5,π} node, and the whole visible band spans π²/5 = 1.973920880 in radians.

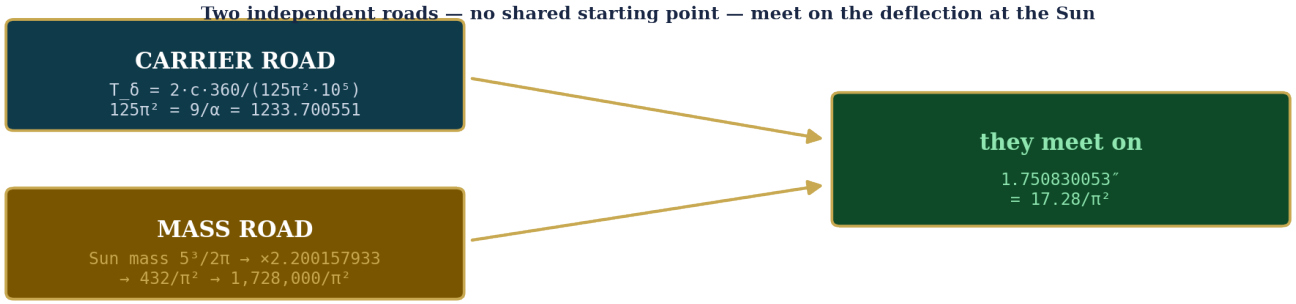

Figure 4 — The bending of light at the Sun, 1.750830053″ = 17.28/π², reached by two independent roads — a carrier road built from the speed of light and the fine-structure constant, and a mass road built from the Sun's mass — that meet on the same figure. No curved spacetime, no pull.

Appendix C — Propositions (P-LT-1 … 24)

#	statement
P-LT-1	The universe is made of time. T is the one substance; matter, light and thought are patterns of it; nothing is created or destroyed. dΣT=0 is the single conservation law from which all others follow.
P-LT-2	Real values settle on the {2,3,5,π} lattice — the universe's notes. A lattice address is a place a thing can be; values between are the cracks, and nothing rests there.
P-LT-3	Matter is a standing address (T folded into a loop that holds still and keeps a beat). Light is a redistribution between addresses — no rest, no beat, no place. The substance of both is T.
P-LT-4	The field is arranged in registers (octaves), spaced by the G-bond step δ_G. One value read at different registers is a mass, a wavelength, a speed or a time.
P-LT-5	Colour is an address, not a shade: red and blue are T_λ at two lattice notes, blue deeper than red. The photoelectric effect frees an electron by colour, not brightness, because freeing it means reaching its address — many shallow arrivals never sum to one deep one.
P-LT-6	E = hν is a register gear: the quantum of action h = 6.631455962×10⁻³⁴ J·s = 125/6π — the same h whose product with c is the Sun's mass, and whose reciprocal is the Boltzmann value.
P-LT-7	There is no wave-particle duality. A standing node (the arrival) and the T-field (which threads both slits) resolve the double slit: the field fills every coherent path, the node registers only at the screen; a which-path detector forces the arrival early, at the slit, so the interference is lost.
P-LT-8	Feynman's sum over all paths is the field trying every address; off-lattice paths cancel, the most {2,3,5,π}-resonant path survives — his least-time path, from which the straight ray, reflection and refraction emerge.
P-LT-9	The interference fringes are testably shifted: every bright fringe sits outward by the lattice helix ratio r = 5⁶/(2⁶·3⁵) = 1.0046939300 (15625/15552) — the same turn as the DNA helix and the step between the registers of the speed of light.
P-LT-10	Light is T_λ — neither wave nor particle but the object those two words were shadows of: a redistribution that spreads while it travels and localises when it lands.
P-LT-11	Light travels without moving: the field is present at every address, and the lamp sets addresses ringing in turn at the rate the register sounds its notes. No medium is needed and no empty space is crossed.

#	statement
P-LT-12	The speed of light is the rate you fall. The surface free-fall 9.817477042468 m/s² (25π/8), squared and carried through the day's gears (×864 ×3600), is 299,789,233.683089 m/s = $2^3 \cdot 3^5 \cdot 5^6 \cdot \pi^2$ — the surface-register speed of light, exact.
P-LT-13	Light has no single speed but a family of register faces: pure ceiling 300,000,000 = $3 \cdot 2^8 \cdot 5^8$ (just above SI); surface face 299,789,233.683089 (G1); celestial face G1×(1+δ_G); the measured SI value falls between the surface and celestial faces.
P-LT-14	The constancy of the speed of light is not a conspiracy of clocks: it is the tempo of the field, shared by all who stand in a register, because light is not a racer to be added to one's own motion but the rate at which the field sounds its addresses.
P-LT-15	Maxwell's four equations are the wave equations of the one T-field at the light register. E and B are two strands of one substance; charge is a local T-flow concentration; Lenz's minus sign is dΣT=0 in differential form.
P-LT-16	The speed of light emerges from the field, not assumed: $c = 1/\sqrt{(\mu_0 \varepsilon_0)}$, $\mu_0 = 2^2\pi \times 10^{-7}$, $\varepsilon_0 = 1/(\mu_0 c^2)$ — the field's own stiffness and give.
P-LT-17	The fine-structure constant is derived: $\alpha = 9/125\pi^2$ ($1/\alpha = 137.0778389$). The water bond angle 105.0498032° = 14400·α — the coupling of light and matter written into the bend of water.
P-LT-18	A wavelength in nanometres is a degree angle directly. The visible band spans exactly $\pi^2/5 = 1.973920880$ in radians; colour is a row of exact lattice boundaries, not a smooth slide.
P-LT-19	The colour boundaries are lattice nodes: violet–blue 450 nm = 45° = π/4; blue–cyan 495.0355 = 7776/5π; green–yellow 570.2809 = $2^9 \cdot 3^7/5^4\pi$; yellow–orange 590.9051 = $5832/\pi^2$; orange–red 619.2295 = $19200/\pi^3$ (returning the surface free-fall 25π/8); white carrier at 864 nm. Each carries three register faces one δ_G apart.
P-LT-20	Refraction is the medium becoming the clock: the refractive index n is a T-time-dilation (vacuum 1, water 4/3, glass ≈ 3/2). Light is not slowed by friction — the register it crosses turns slower. Dispersion is the medium being a different clock for each colour-address (blue slowed more than red).
P-LT-21	Starlight bends at the Sun by 1.750830053″ = $17.28/\pi^2$, reached by two independent roads — a carrier road ($T_\delta = 2 \cdot c \cdot 360/(125\pi^2 \cdot 10^5)$, $125\pi^2 = 9/\alpha$) and a mass road (Sun mass $5^3/2\pi \to 432/\pi^2 \to 1{,}728{,}000/\pi^2$) — that meet on the same figure. No curved spacetime, no pull.
P-LT-22	The Sun is the time-source of its register; the eclipse does not reveal a pre-existing deflection but creates the condition to measure it, by interrupting the broadcast whose geometry does the bending. Newton (falling corpuscle) got half, 0.8757″; general relativity (curved space) got the number but not the cause.
P-LT-23	Cosmological reddening is register seam-crossing, not Doppler recession: z = n × δ_seam, energy conserved between seams. Falsifiable prediction: redshifts pile up at {2,3}-smooth nodes z = 2/3, 3/5, 5/4, 2, 3, 5. The universe is not expanding.
P-LT-24	The Hubble tension dissolves: local $H_0 = 73.00730684557749$ and CMB $H_0 = 67.40550165594601$ are the Earth's radius-sphere read as a diameter and as a volume, from the turning surface; their ratio is the inverse sphere-volume 0.9232706227408138, closing on $g_1 = 25\pi/8$. A Hubble constant that is the radius of your planet measures no expansion.

Appendix D — References

[1] R. P. Feynman, two lectures on light (the nature and speed of light; the photoelectric effect, the photon, the double slit and the sum over histories); read in full in the Force of Time throughout this paper.
[2] S. Daubney, The Speeds of Light — Why the Speed of Light Is Not One Number, The Daubney Foundation (2026); $g_1^2 \cdot 864 \cdot 3600 = c\_G1$, $c\_lattice = 3 \cdot 2^8 \cdot 5^8$, the register staircase and δ_G.
[3] S. Daubney, The Four Clocks of the Earth and Electromagnetic Laws in the Force of Time, The Daubney Foundation (2026); free fall and the speed of light; Maxwell as the one field, $\mu_0 = 2^2\pi \times 10^{-7}$, $\alpha = 9/125\pi^2$.
[4] S. Daubney, The Colour Boundaries, The Helical Double Slit, The Bending of Light, and Cosmological Redshift in the Force of Time, The Daubney Foundation (2026); the eight colour nodes, the fringe ratio r, the deflection $17.28/\pi^2$, and reddening as seam-crossing.
[5] S. Daubney, The Universal Force of Time — Master Compendium v5, The Daubney Foundation (2026); T, the {2,3,5,π} lattice, the register staircase, and dΣT=0.

A note on the numbers. The physical number leads and the {2,3,5,π} form follows as a quiet stamp that the value sits on the lattice. A T-value is one quantity worn across many registers — the lattice that sets the rate you fall sets the speed of light, the colour of the band and the bending at the Sun — written as bare figures, not pinned to a single unit or power of ten.