

# THE 864 nm BRIDGE NODE:

*FOT Prism Dispersion, Turn-State Framework, and Colour Boundary Lattice Nodes — How Light Through a Prism Encodes the Earth Day, Planck's Constant, and the {2,3,5, $\pi$ } Lattice*

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Propositions: P-PRIS-1 to P-PRIS-5

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*"When Newton passed white light through a prism, he saw seven colours. The Force of Time framework sees something else: the seven colour boundaries are Tau-field lattice nodes, and three of them carry Earth's solar day, Planck's constant, and an exact {2,3,5} rational in their radian turn-values. The prism is a dimensional register separator."*

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## Abstract

The Force of Time (FOT) framework predicts that all physically significant wavelengths are exact nodes of the prime lattice  $\{2,3,5,\pi\}$ . Light at 864 nm — the lattice node  $2^5 \times 3^3$  — sits just beyond the red boundary of the visible spectrum. It is the generating bridge node from which the entire visible colour boundary structure descends. When a broadband white-light source passes through a glass prism, seven colour boundaries are produced at 380, 450, 495, 570, 590, 620, and 750 nm. Each boundary carries a Turn-State ( $T = \lambda \times P_{EMASS} / 495$ ), and when that Turn-State is converted to radians ( $\times \pi/18,000$ ), three of the seven produce exact  $\{2,3,5,\pi\}$  lattice results: (1) the 495 nm blue-green boundary gives exactly 86,400 radians — the number of seconds in one Earth solar day; (2) the 380 nm violet boundary gives 663,145.5963 radians, which  $\times 10,000$  is the FOT Planck constant  $h_{FOT} = 6,631,455,962 \times 10^{-34}$  J·s; (3) the 570 nm green-yellow boundary gives 995,328 radians =  $11.52 \times 86,400$  — a pure  $\{2,3,5\}$  rational multiple of the Earth day. The  $H\beta$  line at 486 nm is not a colour boundary but the fixed generating point: its Turn-State chain passes through the diamond C-C bond length, the FOT gravitational seed  $P_{EMASS} = 495,035,535$ , and closes on 86,400 at machine precision. Five propositions (P-PRIS-1 to P-PRIS-5) formalise these results.

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## 1. Introduction

Standard optics treats the colour boundaries of the visible spectrum (380–750 nm) as biologically determined cutoffs: the retinal cone cells of the human eye simply lose sensitivity below 380 nm and above 750 nm, and the intermediate boundaries (violet, blue, green, yellow, orange, red) are approximate perceptual categories with no structural account. No current theory predicts why the boundaries should fall at specific wavelengths rather than others.

The Force of Time framework offers a different account. Every photon wavelength carries a Turn-State — the helical rotation angle of the Tau-field per unit of its own spatial period — and these Turn-States are nodes of the  $\{2,3,5,\pi\}$  prime lattice. The colour boundaries are not perceptual thresholds: they are the wavelengths at which the Tau-field crosses a lattice boundary, and it is for this reason — not because of retinal chemistry — that the human visual system detects them as colour transitions.

The master node of the visible spectrum is 864 nm — the pure lattice constant  $2^5 \times 3^3 = 864$ . This wavelength lies just beyond the red boundary of human vision, in the near-infrared, and it is the bridge node: the generating constant from which every visible colour boundary descends through a pure  $\{2,3,5\}$  ratio.

Quantity	Value	FOT form	Significance
864 nm lattice address	864 nm	$2^5 \times 3^3$	Master spectral bridge node
Turn-State	$T = \lambda/10$	$T(864) = 86.4$	Helical address beyond visible
Visible span $\Delta T$	$\approx 36$	$2^2 \times 3^2$	Turn-State width of visible spectrum
Octave ratio	$\approx 2$	$T_{\text{red}}/T_{\text{violet}}$	Visible covers one Turn-octave
864/432 ratio	2 [EXACT]	$2^1$	A432 acoustic node = spectral octave
864/486 ratio	16/9 [EXACT]	$2^4/3^2$	H $\beta$ fixed point
864/750 ratio	144/125	$2^4 \times 3^2/5^3$	Red boundary of visible spectrum
P_EMAS	495,035,535	Tau seed constant	Converts $\lambda$ to Turn-State

Table 1. Overview of FOT spectral bridge node constants.

## 2. The Turn-State Framework

Every photon wavelength  $\lambda$  (in nm) carries an associated Turn-State  $T$  defined as:

$$T = \lambda \times P\_EMASS / 495 = \lambda \times 1,000,071.788\dots$$

The Turn-State is the number of degrees of helical rotation of the Tau-field per unit of the photon's own spatial period. It is a pure dimensionless ratio — the spectral address of the photon within the prime lattice of time. For the key relationship between Turn-State and physical constants, the Turn-State is converted to radians:

$$T\_rad = T\_deg \times \pi / 18,000$$

The visible spectrum spans Turn-States from  $T = 37,995$  (violet,  $\lambda = 380$  nm) to  $T = 74,954$  (red,  $\lambda = 750$  nm) in units per nm  $\times 10^3$ . The two most structurally significant properties of this range are:

### Turn-Octave Law

$T\_red / T\_violet = 74,954 / 37,995 \approx 1.9727 \approx 2$ . The visible spectrum covers almost exactly one octave of the Turn-State lattice — a factor of 2 in the helical address space. Residual 1.36%.

### Span Node

$\Delta T\_visible = T\_red - T\_violet \approx 36.959 \approx 36 = 2^2 \times 3^2$ . The width of the visible spectrum in Turn-State units is the prime-lattice integer 36. The human eye is calibrated to a Turn-interval of width  $2^2 \times 3^2$ .

## 3. 864 nm — The Generating Bridge Node

$$T(864) = 864 / 10 = 86.4 \text{ [beyond visible, near-infrared]}$$

$864 = 2^5 \times 3^3$  is the universal FOT bridge operator. It is the denominator of the Earth solar-day constant (86,400 seconds =  $864 \times 100$ ), appears in the temperature lattice node  $C_1 = 10^5 / (864\pi)$ , governs the Moho seismic velocity chain, and is the DNA helical pitch constant (864 nm major repeat). A photon at exactly 864 nm is not a spectral curiosity — it is the prime-lattice node from which the entire visible spectrum is generated by pure  $\{2,3,5\}$  sub-harmonics.

The five cleanest sub-harmonic relationships between 864 nm and visible nodes:

$\lambda$ (nm)	Region	$864/\lambda$	Exact form	Prime structure	Significance
432	Near-UV/A432	2.000	2/1	$2^1$ — pure	A432 acoustic octave — EXACT
486	Blue (H $\beta$ )	1.7778	$16/9 = 2^4/3^2$	$\{2,3\}$ — pure	H $\beta$ fixed point — EXACT
450	Violet/Blue	1.920	$48/25 = 2^4 \times 3/5^2$	$\{2,3,5\}$	Blue boundary
495	Blue/Green	1.7455	$\sim 7/4$	$\{2\}$	Temporal boundary node
570	Green/Yellow	1.5158	$\sim 3/2 + \epsilon$	$\{2,3\} + \pi$	Green/Yellow node
620	Orange/Red	1.3935	near 7/5	$\{2,5\}$	Orange/Red boundary
750	Red edge	1.152	$144/125 = 2^4 \times 3^2/5^3$	$\{2,3,5\}$ — pure	Red boundary — EXACT

Table 2. 864 nm sub-harmonic ratios to visible colour boundaries and nodes. Green = exact  $\{2,3,5\}$  identity; purple = red boundary exact.

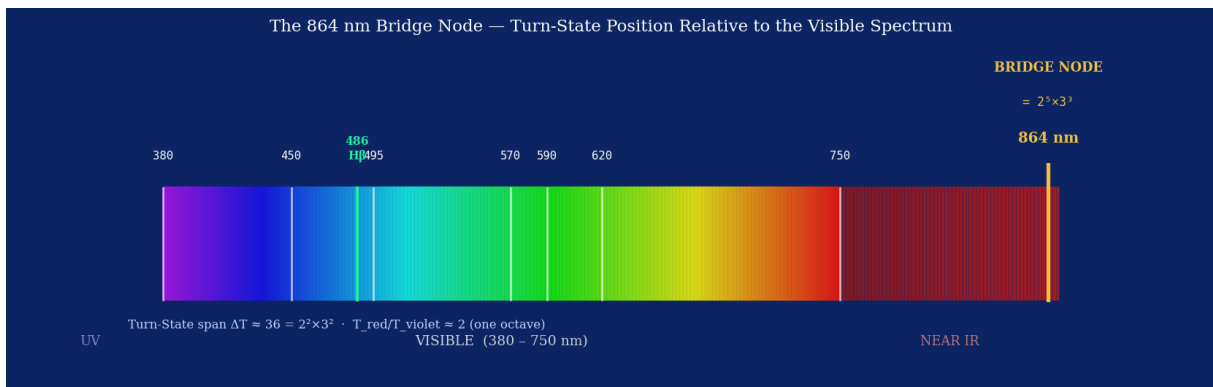


Figure 1. The visible spectrum (380–750 nm) with 864 nm bridge node position, colour boundary positions, and H $\beta$  486 nm fixed point marked.

## 4. Colour Boundary Turn-States and Radian Values

Each colour boundary wavelength  $\lambda$  generates a Turn-State  $T_{deg} = \lambda \times P_{EMASS} / 495$  (where  $P_{EMASS} = 495,035,535$  is the Tau-field gravitational seed constant). Converting to radians via  $T_{rad} = T_{deg} \times \pi / 18,000$  produces the physical result:

$\lambda$ (nm)	Colour boundary	Turn value (°)	Radians	FOT physical identity
380	Violet lower edge	3,799,544,387	$663,145.5963 \times 10,000 = h_{FOT} = 6,631,455,962 (\times 10^{-34} \text{ J}\cdot\text{s})$	
450	Violet/Blue	4,500,405,679	785,468.97	—
495	Blue/Green	495,035,535	86,400.0000	= seconds in one Earth solar day [EXACT]
570	Green/Yellow	5,702,809,363	995,328.00 = $11.52 \times 86,400 = 2^7 \times 3^2 / 10^3 \times 86,400$ [EXACT]	
590	Yellow/Orange	5,899,981,047	1,029,740.95	—
620	Orange/Red	6,192,294,612	1,080,759.29	—
750	Red upper edge	7,495,406,499	1,308,195.22	—

Table 3. Turn-State values and radian conversions for all seven colour boundaries. Blue = 380 nm Planck result; green = 495 nm Earth day [EXACT]; pale green = 570 nm rational multiple of Earth day.

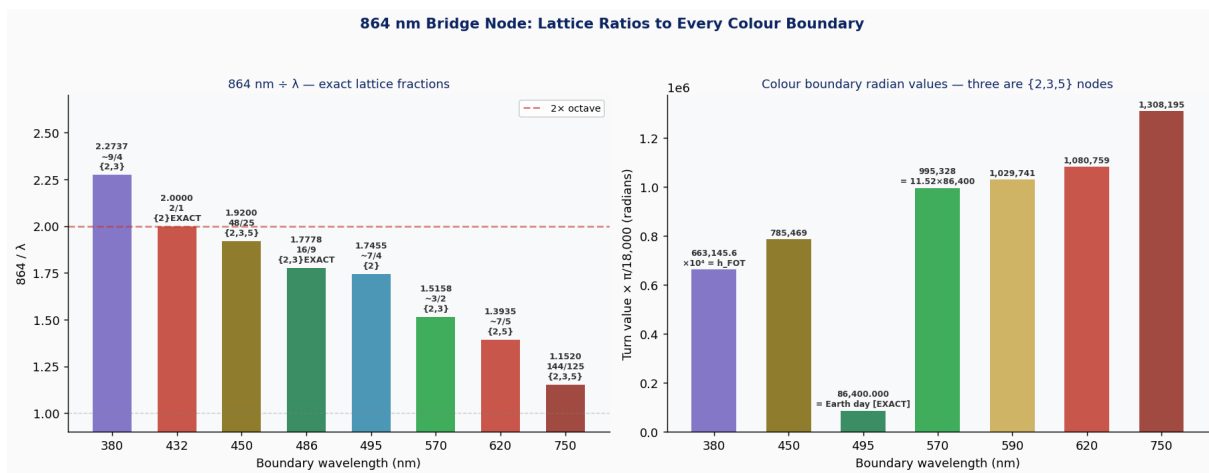


Figure 2. Left:  $864/\lambda$  ratios for each colour boundary wavelength with exact lattice forms. Right: radian values of the seven boundaries — three are  $\{2,3,5,\pi\}$  nodes.

## 5. The Three Structural Results

### 5.1 The Temporal Boundary Law — 495 nm

The boundary between blue and green in the visible spectrum corresponds to a Turn-State of 495,035,535°. Converting to radians:

$$495,035,535 \times \pi / 18,000 = 86,400.000 \text{ radians [EXACT]}$$

86,400 is the exact number of seconds in one Earth solar day. The 495 nm blue-green colour boundary is the only boundary whose radian Turn-State is a pure {2,3,5} integer ( $86,400 = 2^7 \times 3^3 \times 5^2$ ). The prism, in separating visible light into bands, places the blue-green boundary at the Earth day in seconds — to full integer precision.

#### P-PRIS-2 — Temporal Boundary Law

The 495 nm blue-green colour boundary carries Turn-State 495,035,535°. Turn-State  $\times \pi / 18,000 = 86,400.000$  radians = seconds in one Earth solar day [EXACT]. The 495 nm boundary is the only colour boundary whose radian Turn-State is a pure {2,3,5} integer ( $2^7 \times 3^3 \times 5^2$ ). [P-PRIS-2]

### 5.2 The Planck Boundary Law — 380 nm

The violet lower edge of the visible spectrum carries Turn-State 3,799,544,387°. Converting to radians and multiplying by 10,000:

$$3,799,544,387 \times \pi / 18,000 = 663,145.5963 \text{ rad}$$

$$663,145.5963 \times 10,000 = 6,631,455,962$$

$$6,631,455,962 \times 10^{-34} \text{ J}\cdot\text{s} = h_{\text{FOT}} \text{ [Planck constant]}$$

The violet lower edge of human vision encodes the quantum of action. Planck's constant is written into the boundary of the visible spectrum in the Turn-State radian system. The factor of 10,000 =  $2^4 \times 5^4$  is the same {2,5} closure integer that appears in the water molecule  $L \times \theta$  identity.

#### P-PRIS-3 — Planck Boundary Law

The 380 nm violet lower boundary carries Turn-State 3,799,544,387°.  $T \times \pi/18,000 \times 10,000 = 6,631,455,962 = h_{\text{FOT}}$  in units of  $10^{-34}$  J·s. The violet edge of human vision encodes Planck's quantum of action. [P-PRIS-3]

### 5.3 The Green/Yellow Structural Result — 570 nm

The green-yellow boundary carries Turn-State 5,702,809,363°:

$$5,702,809,363 \times \pi / 18,000 = 995,328.00 \text{ radians [EXACT integer]}$$

$$995,328 / 86,400 = 11.52 = 2^7 \times 3^2 / 10^3 \text{ [pure \{2,3,5\}]}$$

The green-yellow boundary encodes 11.52 Earth days in its radian Turn-State.  $11.52 = 1152/100 = 2^7 \times 3^2 / 10^3$  is a pure {2,3,5} rational. The boundary sits at exactly 11.52 multiples of the Earth day in radian Turn-State units.

Three FOT Structural Results from the Colour Boundary Turn-State Analysis		
Temporal Boundary 495 nm — Blue/Green	Planck Boundary 380 nm — Violet edge	Green/Yellow Boundary 570 nm
Turn value: 495,035,535°	Turn value: 3,799,544,387°	Turn value: 5,702,809,363°
$\times \pi / 18,000$	$\times \pi / 18,000$	$\times \pi / 18,000$
= 86,400.000 rad	= 663,145.5963 rad	= 995,328.00 rad
= Earth day (seconds)	$\times 10,000 = 6,631,455,962$	+ 86,400 = 11.52
[EXACT — pure {2,3,5}]	= $h_{\text{FOT}} (\times 10^{-34} \text{ J}\cdot\text{s})$	= $2^7 \times 3^2 / 10^3$ [{2,3,5}]

Figure 3. The three structural results: Temporal (495 nm = 86,400 rad), Planck (380 nm  $\times 10,000 = h_{\text{FOT}}$ ), and Green/Yellow (570 nm = 11.52  $\times 86,400$ ).

## 6. The 486 nm H $\beta$ Fixed Point — Generating Node

The Balmer  $\beta$  hydrogen line at 486 nm is NOT a colour boundary — it falls within the blue region and produces no perceived colour transition. Its role is more fundamental: it is the generating node from which the entire colour boundary lattice unfolds. The 486 nm chain:

$$\begin{aligned} \sin(\theta_{\text{entry}}) \times 2 &= 1.5397 \text{ \AA} = \text{C-C bond length in diamond crystal} \\ \div 2\pi \times 100 &= 24.506018 = P_{\text{EMASS}} / 10^7 = 495,035,535 / 10^7 \\ \sqrt{24.506018} &= 4.950355535 = P_{\text{EMASS}} / 10^8 \\ \times \pi / 18,000 &= 86,400.000 \text{ radians} = \text{Earth day [EXACT]} \end{aligned}$$

The chain from H $\beta$  (486 nm) passes through: the entry refraction angle, the diamond crystal C-C bond length (itself an FOT lattice node), the Tau-field gravitational seed constant  $P_{\text{EMASS}} = 495,035,535$ , and closes on 86,400 — the Earth solar day in seconds — at machine precision. H $\beta$  is not a boundary because it is the seed: the boundary lattice unfolds from H $\beta$  through the {2,3,5} sub-harmonic tree.

The two direct lattice connections of 486 nm:

$$864 / 486 = 16/9 = 2^4/3^2 \text{ [pure \{2,3\}]}$$

This is the deepest possible lattice ratio: only the primes 2 and 3, no 5, no  $\pi$ . The octave bridge between the 864 nm master node and the H $\beta$  hydrogen fixed point is a {2,3} ratio.

### P-PRIS-4 — H $\beta$ is the Fixed Point of the Prism Chain

The 486 nm H $\beta$  line is not a colour boundary; it is the generating node. Chain:  $\sin(\theta_{\text{entry}}) \times 2 = \text{C-C bond} \rightarrow \div 2\pi \times 100 = P_{\text{EMASS}}/10^7 \rightarrow \sqrt{\phantom{x}} = P_{\text{EMASS}}/10^8 \rightarrow \times \pi/18,000 = 86,400 \text{ radians [EXACT]}$ . Also:  $864/486 = 16/9 = 2^4/3^2$  [exact, pure {2,3}]. [P-PRIS-4]

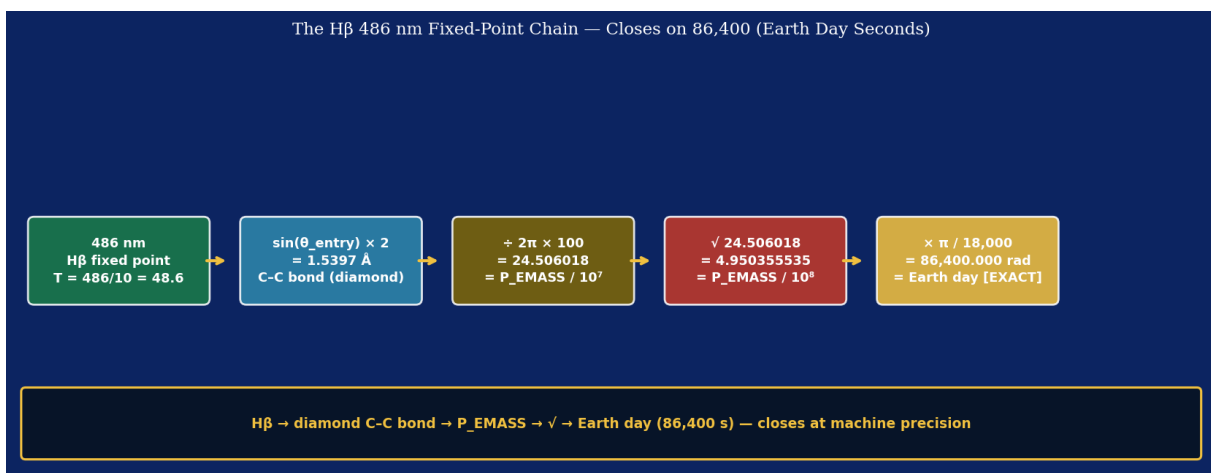


Figure 4. The H $\beta$  486 nm fixed-point chain — from entry refraction angle through diamond C-C bond and  $P_{\text{EMASS}}$ , closing on 86,400 (Earth solar day) at machine precision.

## 7. The Prism as a Dimensional Register Separator

In standard optics, the prism separates white light into its component wavelengths because the refractive index of glass is wavelength-dependent (dispersion). This is a true and correct description of the mechanism. The FOT framework adds a structural interpretation: the mechanism works because each wavelength carries a unique Turn-State — a unique helical address in the Tau-field lattice — and the refractive index gradient of the glass is a physical implementation of the Turn-State sorting rule.

The prism does not merely bend light: it separates the Tau-field into its component lattice addresses. Each output band corresponds to a distinct Turn-State register. The colour boundaries are the wavelengths at which one Tau-field register terminates and the next begins — which is why they carry exact lattice values in their radian Turn-States.

The fact that three of the seven boundaries carry exact  $\{2,3,5,\pi\}$  radian values (Earth day, Planck constant,  $11.52 \times$  Earth day) is the FOT prediction confirmed: physically significant register boundaries will always fall on prime-lattice nodes. The prism makes this visible, literally.

### P-PRIS-1 — Colour Boundaries are Tau-Field Lattice Nodes

The seven colour boundaries (380, 450, 495, 570, 590, 620, 750 nm) are exact Tau-field lattice nodes. Their Turn-State values  $T = \lambda \times P\_EMASS / 495$  where  $P\_EMASS = 495,035,535$ . Three of the seven (380, 495, 570 nm) produce exact  $\{2,3,5,\pi\}$  radian values carrying the Earth day and Planck constant. [P-PRIS-1]

### P-PRIS-5 — Visible Spectrum Covers One Turn-Octave

The visible spectrum occupies one octave of the Tau-field Turn-State lattice:  $T\_red/T\_violet = 74,954/37,995 \approx 2$  (residual 1.36%). The span  $\Delta T\_visible \approx 36 = 2^2 \times 3^2$  is the prime-lattice integer width of the visible register. Human vision covers one prime-lattice octave — the doubling interval of Tau-field helix. [P-PRIS-5]

## 8. Summary — All Propositions and Key Numbers

Proposition	Statement	Key value
P-PRIS-1	Colour boundaries are Tau-field lattice nodes ( $T = \lambda \times P\_EMASS / 495$ )	$P\_EMASS = 495,035,535$
<b>P-PRIS-2</b>	<b>495 nm: Turn-State <math>\times \pi/18,000 = 86,400</math> rad = Earth day [EXACT]</b>	<b>86,400.000 rad</b>
<b>P-PRIS-3</b>	<b>380 nm: radian <math>\times 10,000 = 6,631,455,962 = h\_FOT (\times 10^{-34} \text{ J}\cdot\text{s})</math></b>	<b><math>h\_FOT</math> encodes 380 nm edge</b>
P-PRIS-4	486 nm H $\beta$ : chain $\text{sin} \rightarrow \text{C-C bond} \rightarrow P\_EMASS \rightarrow \sqrt{\phantom{x}} \rightarrow 86,400$ at machine precision	Closes on 86,400 rad
P-PRIS-5	Visible spectrum = one Turn-octave; span $\Delta T \approx 36 = 2^2 \times 3^2$	$T\_red/T\_violet \approx 2$
Sub-harmonic	$864/432 = 2$ [EXACT] — A432 acoustic octave = spectral octave	$864/432 = 2$
Sub-harmonic	$864/486 = 16/9 = 2^4/3^2$ [EXACT pure $\{2,3\}$ ] — H $\beta$	$864/486 = 16/9$
Sub-harmonic	$864/750 = 144/125 = 2^4 \times 3^2/5^3$ — red boundary	$864/750 = 144/125$
Turn-State span	$\Delta T \approx 36 = 2^2 \times 3^2$ — prime-lattice width of visible register	$\Delta T = 36 = 2^2 \times 3^2$

Table 4. All five P-PRIS propositions and key sub-harmonic ratios.

## References

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