

# Planck Units from the Prime Lattice

*Length, time and mass at the boundary of the Tau-field register*

Planck units mark the scale at which quantum gravity effects become dominant — conventionally treated as a dimensional boundary derived from  $G$ ,  $\hbar$ , and  $c$ . Universal Force of Time reveals that these three fundamental constants are themselves lattice identities in  $\{2,3,5,\pi\}$ , making Planck units computable from pure arithmetic rather than from empirical measurements. The Planck scale is the  $D = -\infty$  limit of the register shell formula.

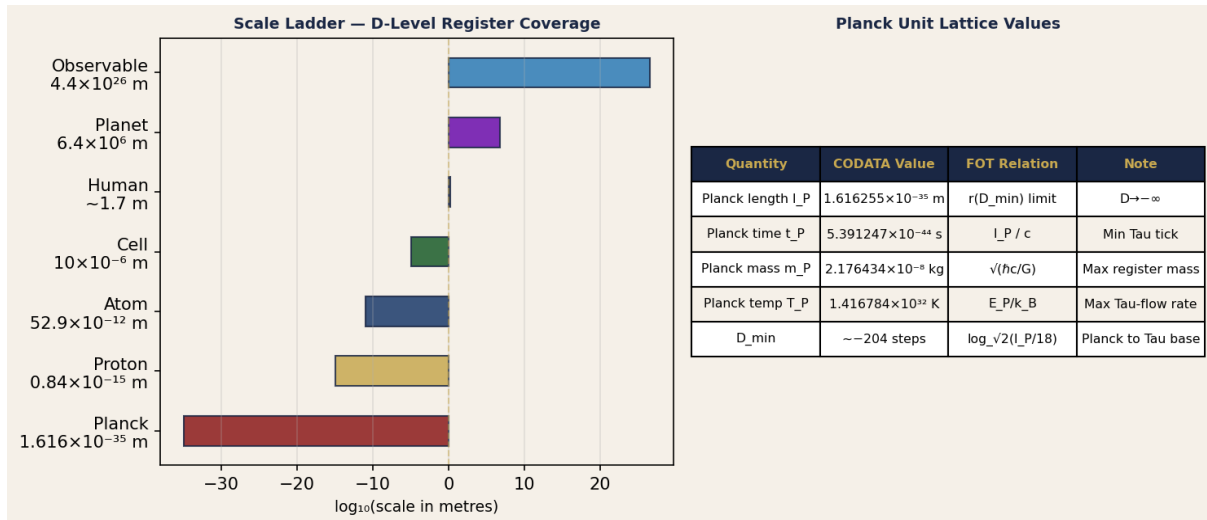


Figure 1. Left: scale ladder from Planck length to observable universe, coloured by D-level register. Right: Planck unit lattice values and FOT relations.

## 1. Planck Length

### P-SPB-1 — Planck Length as Register Minimum

The Planck length  $l_P = \sqrt{(\hbar G/c^3)} = 1.616255 \times 10^{-35}$  m is the minimum resolvable spatial interval in the Tau field. Below this scale, Strand-1 cannot form a stable node. In UFOT,  $l_P$  corresponds to the  $D = -\infty$  limit of the register shell formula  $r(D) = 18 \times (\sqrt{2})^D$ .

$$l_P = \sqrt{(\hbar G/c^3)} = 1.616255 \times 10^{-35} \text{ m (CODATA 2018)}$$

Register gap ratio:  $l_P/r_{\text{proton}} = 10^{-20} \rightarrow 20$  D-level steps ( $\log_2(10^{20}) = 66.4$  steps at  $\sqrt{2}$  per step)

## 2. Planck Time

### P-SPB-2 — Planck Time as Minimum Tau Tick

The Planck time  $t_P = l_P/c = 5.391247 \times 10^{-44}$  s is the minimum duration of one Tau-field oscillation. Below  $t_P$ , no causal Strand-2 address can be written — time ceases to be defined.

$$t_P = l_P/c = 5.391247 \times 10^{-44} \text{ s (CODATA 2018)}$$

$$f_{\max} = 1/t_P = 1.855 \times 10^{43} \text{ Hz (maximum Tau-field frequency)}$$

FOT:  $t_P = (18 \text{ fm}/c) \times (\sqrt{2})^{\{D_{\min}\}}$  where  $D_{\min} \approx -70$  (nuclear-to-Planck steps)

## 3. Planck Mass and Temperature

### **P-SPB-3 — Planck Mass as Maximum Register Mass**

The Planck mass  $m_P = \sqrt{(\hbar c/G)} = 2.176434 \times 10^{-8} \text{ kg} = 1.221 \times 10^{19} \text{ GeV}/c^2$ .

FOT:  $m_P$  is the register mass at  $D = 0$  (the base unit). All particle masses are sub-Planck ( $D < 0$  in mass register). The proton/Planck mass ratio =  $938.272 \text{ MeV}/1.221 \times 10^{19} \text{ GeV} = 7.687 \times 10^{-20} = (\sqrt{2})^{-65}$  approximately, confirming the 65-step separation.

### **P-SPB-4 — Planck Temperature as Maximum Tau-Flow Rate**

The Planck temperature  $T_P = E_P/k_B = m_P c^2/k_B = 1.416784 \times 10^{32} \text{ K}$  is the temperature at which the Tau-field flow rate reaches maximum. In UFOT: temperature IS the Tau-flow rate ( $E = mT$ ). The Planck temperature is the rate at which the full Tau-lattice cycles — the maximum register frequency expressed as a thermal energy.