*Appendix X

From Æther Tension to Planck's Constant and the Bohr Radius

X.1 Setup and Notation

We recall three VAM primitives:

$$\begin{aligned} F_{\max} &: \text{maximum æther tension (N)}, \\ r_c &: \text{vortex-core radius (m)}, \\ C_e &: \text{core swirl speed (m s}^{-1}\text{)}. \end{aligned}$$

The electron Compton data are

$$\lambda_C = \frac{h}{m_e c}, \qquad v_e = \frac{c}{\lambda_C}, \qquad \omega_e = 2\pi v_e.$$

The photon wrap number (half-wavelength segments on the core) is an integer n; empirical fitting of atomic masses fixes $n = 2$ throughout this appendix.

X.2 Maxwell Hookean Model for the Electron Core

VAM treats the electron's internal vortex as an n-segment linear spring:

$$K_e = \frac{F_{\max}}{n r_c}, \qquad \omega_c = \sqrt{\frac{K_e}{m_e}} = \sqrt{\frac{F_{\max}}{n m_e r_c}}.$$

The photon–electron swirl matching condition

$$\omega_e R = \omega_c r_c$$

relates the photon radius R (centreline of its vorticity tube) to the core.

X.3 Deriving Planck's Constant

Insert ω_c into the matching relation and solve for $F_{\max}$, then eliminate R with $R = C_e/(2\pi v_e)$:

$$\begin{aligned} F_{\max} &= \frac{(2\pi v_e)^2 m_e R^2}{n r_c} \\ &= \frac{4\pi^2 v_e^2 m_e}{n r_c} \left(\frac{C_e}{2\pi v_e}\right)^2 \\ &\Longrightarrow \boxed{h = \frac{4\pi F_{\max} r_c^2}{C_e}}. \end{aligned} \tag{X.1}$$

Equation (X.1) shows that h is not fundamental but set by the æther tension acting over the core cross-section at speed C_e.

Numerically,

$$h_{\mathrm{VAM}} = \frac{4\pi\,(29.053507\,\mathrm{N})\,(1.40897 \times 10^{-15}\,\mathrm{m})^2}{1.093846 \times 10^6\,\mathrm{m\ s^{-1}}} = 6.62 \times 10^{-34}\ \mathrm{J\ s},$$

within 0.2% of the CODATA value.

X.4 Photon Swirl Radius and the Bohr Ground State

Define the photon swirl radius for *any* frequency ν as

$$R_\gamma(\nu) = \frac{C_e}{2\pi\nu}.$$

For a photon of Compton frequency v_e we obtain the fundamental radius

$$R_0 \equiv R_\gamma(v_e) = \frac{C_e}{2\pi v_e} = \frac{\lambda_C}{2\pi}.$$

Re-express the Bohr radius using the VAM identity $\alpha = 2C_e/c$:

$$a_0 = \frac{\hbar}{m_e c\alpha} = \frac{1}{\alpha}\left(\frac{\lambda_C}{2\pi}\right) = \frac{R_0}{\alpha}. \tag{X.2}$$

Thus *one Compton-frequency photon swirl, scaled up by* $1/\alpha \approx 137$*, lands exactly on the textbook ground-state radius.*

X.5 Resonant Capture Probability

The æther-vorticity overlap integral governing photon absorption,

$$\Sigma(\nu) = \int \rho_{æ}(r)\, |\omega_\gamma(R_\gamma)|\, |\omega_e(r)|\, d^3r,$$

peaks when the vorticity tube of width R_γ matches the electron's most probable radius.

Because $R_\gamma = a_0/\alpha$ *precisely* at $\nu = v_e$, the 1s radial capture probability is maximised—recovering the ordinary quantum-mechanical statement that hydrogen absorbs most strongly near its ground-state radius.

X.6 Hierarchy of Constants from One Tension Scale

Collecting results:

$$F_{\max} \xrightarrow{r_c,\,C_e} \boxed{h} \xrightarrow{m_e} \lambda_C \xrightarrow{\alpha} a_0.$$

All central quantum and atomic scales thus descend from a single mechanical ceiling $F_{\max}$ applied over a geometrically fixed core.

X.7 Implications and Tests

- Precision linkage. Any future refinement of $F_{\max}$ or r_c will propagate into h and a_0; high-precision atomic spectroscopy can therefore constrain æther-tension parameters.

- Resonance width. A finite core viscosity would broaden the overlap peak; its measurement via line-shape analysis could set bounds on æther dissipation.