PLANCK'S LAW

$$\rho_{\lambda}(\tau) = \frac{3.74 \times 10^{8}}{\lambda^{5}\left[exp\left(\frac{14,400}{\lambda\tau}\right)-1\right]}$$

WIEN'S DISPLACEMENT RULE

$$\lambda_{max} = \frac{2,898}{\tau} \quad \mu m$$

SOLAR DECLINATION ANGLE

$$\delta\big|_{d} = 0.41\ sin\left[\frac{2\pi}{365}(d-81)\right]\ radians$$

SOLAR HOUR ANGLE

$$\theta(h) = \frac{\pi}{12}\ h\ \ radians$$

ALTITUDE ANGLE

$$sin\left(\beta(h)\big|_{d}\right) = cos(\ell)\,cos\left(\delta\big|_{d}\right)\,cos(\theta(h)) + sin(\ell)\,sin\left(\delta\big|_{d}\right)$$

ALTITUDE ANGLE AT SOLAR NOON

$$\beta(0)\big|_{d} = \frac{\pi}{2} - \ell + \delta\big|_{d} \quad radians$$

SOLAR AZIMUTH ANGLE

$$sin\left(\phi(h)\big|_{d}\right) = \frac{cos\left(\delta\big|_{d}\right)\,sin(\theta(h))}{cos\left(\beta(h)\big|_{d}\right)}$$

SUNRISE AND SUNSET ANGLE

$$\kappa_{+}\big|_{d} = cos^{-1}\left(-\,tan(\ell)\,tan\left(\delta\big|_{d}\right)\right)$$

$$\kappa_{-}\big|_{d} = -\,cos^{-1}\left(-\,tan(\ell)\,tan\left(\delta\big|_{d}\right)\right)$$

SOLAR TIME FOR SUNRISE AND SUNSET

$$12:00 - \frac{\kappa_{+}\big|_{d}}{\pi/12} \quad \text{and} \quad 12:00 - \frac{\kappa_{-}\big|_{d}}{\pi/12}$$

SOLAR DAY AND 24h DAY DIFFERENCE

$$e\big|_{d} = 9.87\,sin\left(2(b\big|_{d})\right) - 7.53\,cos(b\big|_{d}) - 1.5\,sin(b\big|_{d}),$$

where,

$$b\big|_{d} = \frac{2\pi}{364}(d-81)\ \ radians$$

CORRECTED SOLAR TIME

$$solar\ time = clock\ time + e\big|_{d} + 4 \times \frac{180}{3.14} \times$$

$$(local\ time\ meridian - local\ longitude)$$