

Formulae for converting to and from astronomy-relevant units

(meaning of abbreviations below)

1 candela/m² :

$$= 0.0001 \text{ Stilb}$$

$$= 0.3142 \text{ MilliLambert}$$

$$= 0.2919 \text{ Footlambert}$$

$$= 12.58 \text{ magnitudes/arcsec}^2$$

From candela/m² → magnitudes/arcsec²

$$B = -2.5 \text{Log}(C/108000) \text{ or } 12.58 - 2.5 \text{Log}(C)$$

From magnitudes/arcsec² → candela/m²

$$C = 108000 * 10^{-0.4B} \text{ or } 10^{(12.58 - B)/2.5}$$

1Lux :

= intensity of 1 candela on surface orthogonal to the light ray's of the source,
at 1 meter distance from the source

$$= 1 \text{ lumen/area (m}^2\text{)}$$

$$= 0.093 \text{ Footcandles}$$

$$= -14.18 \text{ Stellar magnitudes*}$$

From Lux → stellar magnitude

$$M_v = -14.18 - 2.5 \text{Log}(L)$$

From stellar magnitude → Lux

$$10^{(-14.18 - M_v)/2.5}$$

From footcandles → stellar magnitudes

$$-16.8 - 2.5 \text{Log}(F_c)$$

From stellar magnitudes → footcandles

$$10^{(-16.8 - M_v)/2.5}$$

1 footLambert

$$= 11.25 \text{ magnitudes/arcsec}^2$$

From footLambert → magnitudes/arcsec²

$$M_v = 11.25 - 2.5 \text{Log}(F)$$

From magnitudes/arcsec² → footLambert

$$10^{(11.25 - M_v)/2.5}$$

Formulae derived from Schaefer 1989, formulae 2,16, 17

From millimicroLambert (nanoLambert) \rightarrow magnitudes/arcsec²

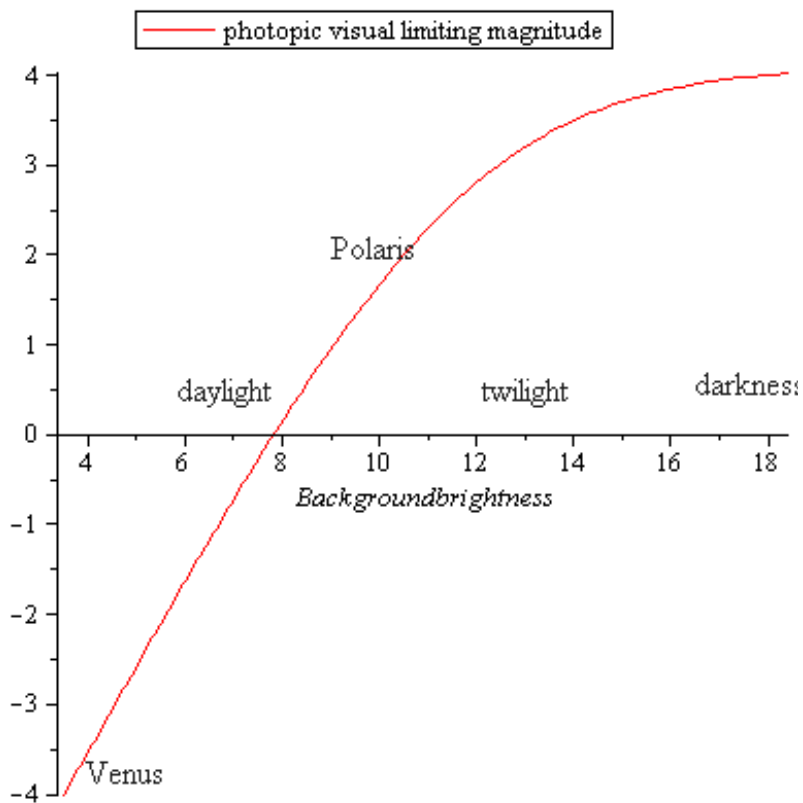
$$B = 26.33 - 2.5 \text{Log}(M)$$

From magnitudes/arcsec² \rightarrow millimicroLambert (nanoLambert)

$$M = 10^{-0.4(B-26.33)}$$

Limiting vis. magnitude for background brightness in magnitudes/arcsec² ≤ 18.4 (= photopic)

$$M_v = 4.11 - 5 \text{Log}(1 + 10^{2.316 - B/5})$$



Background Brightness in magnitudes/arcsec² photopic vision (for $M_v \leq 4.00$)

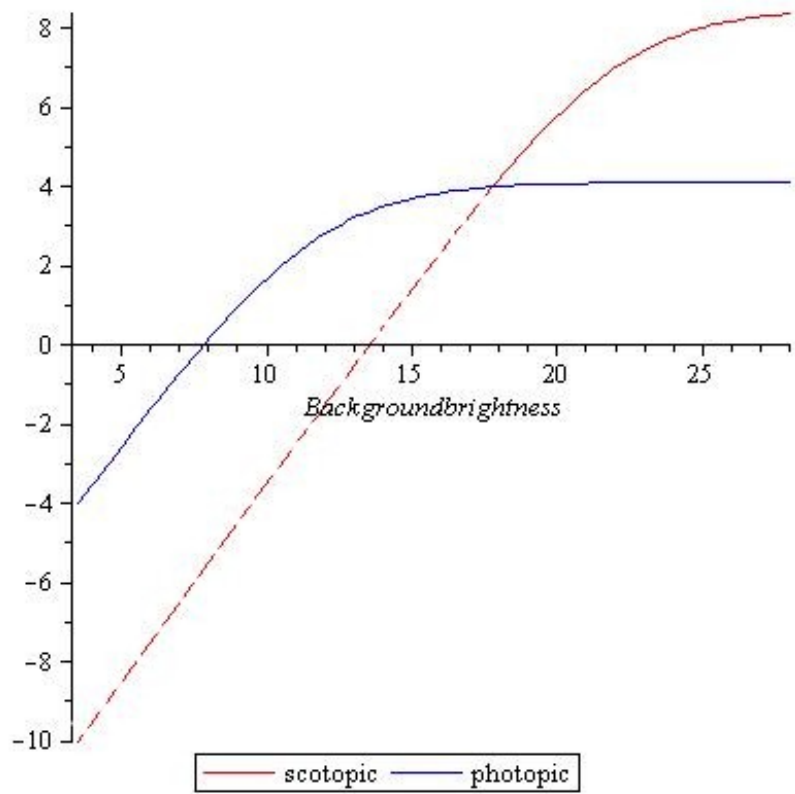
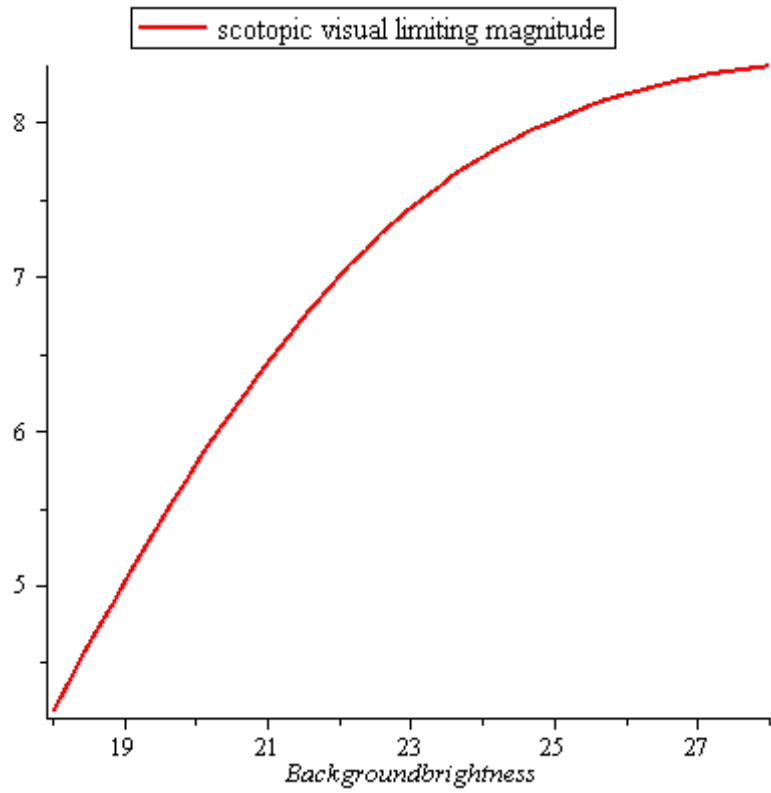
$$B = 11.58 - 5 \text{Log}(10^{0.822 - M_v/5} - 1)$$

Background Brightness in magnitudes/arcsec² for scotopic vision (derived by Nils Olof Carlin, see <http://w1.411.telia.com/~u41105032/visual/Schaefer.htm>) and adapted by myself for a maximum darkness of 22 magnitudes/arcsec²

$$B = 22 - 5 \text{Log}(10^{1.7 - M_v/5} - 1)$$

Limiting vis. magnitude for background brightness in magnitudes/arcsec² for scotopic vision (idem, Nils Olof Carlin)

$$M_v = 8.5 - 5 \text{Log}(1 + 10^{4.4 - B/5})$$



B = Background brightness (BB) in magnitudes/arcsec²

M = BB in nanoLambert

M_v = visual limiting magnitude

C = candela's

L = Lux

F = footLambert

F_c = footcandle

Log has base 10

** -14.18 = magnitude of 1 Lux. Other values: -14.04 or -13.89 (see Martynov, 1959; De Vaucouleurs, 1964)*

(Jan van Gastel, May 2009)

Comments are welcome