

## Formulae for converting to and from astronomy-relevant units

$$\begin{aligned} 1 \text{ candela/m}^2 &: \\ &= 0.0001 \text{ Stilb} \\ &= 0.3142 \text{ MilliLambert} \\ &= 0.2919 \text{ Footlambert} \\ &= 12.58 \text{ magnitudes/arcsec}^2 \end{aligned}$$

$$\begin{aligned} &\text{From candela/m}^2 \rightarrow \text{magnitudes/arcsec}^2 \\ B &= -2.5 \text{Log}(C/108000) \text{ or } 12.58 - 2.5 \text{Log}(C) \end{aligned}$$

$$\begin{aligned} &\text{From magnitudes/arcsec}^2 \rightarrow \text{candela/m}^2 \\ C &= 108000 * 10^{-0.4B} \text{ or } 10^{(12.58-B)/2.5} \end{aligned}$$

$$\begin{aligned} 1 \text{ Lux} &: \\ &= 0.093 \text{ Footcandles} \\ &= -14.18 \text{ Stellar magnitudes}^* \end{aligned}$$

$$\begin{aligned} &\text{From Lux} \rightarrow \text{stellar magnitude} \\ M_v &= -14.18 - 2.5 \text{Log}(L) \end{aligned}$$

$$\begin{aligned} &\text{From stellar magnitude} \rightarrow \text{Lux} \\ &10^{(-14.18 - M_v)/2.5} \end{aligned}$$

$$\begin{aligned} &\text{From footcandles} \rightarrow \text{stellar magnitudes} \\ &-16.8 - 2.5 \text{Log}(F_c) \end{aligned}$$

$$\begin{aligned} &\text{From stellar magnitudes} \rightarrow \text{footcandles} \\ &10^{(-16.8 - M_v)/2.5} \end{aligned}$$

$$\begin{aligned} 1 \text{ footLambert} & \\ &= 11.25 \text{ magnitudes/arcsec}^2 \end{aligned}$$

$$\begin{aligned} &\text{From footLambert} \rightarrow \text{magnitudes/arcsec}^2 \\ M_v &= 11.25 - 2.5 \text{Log}(F) \end{aligned}$$

$$\begin{aligned} &\text{From magnitudes/arcsec}^2 \rightarrow \text{footLambert} \\ &10^{(11.25 - M_v)/2.5} \end{aligned}$$

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

From millimicroLambert (nanoLambert)  $\rightarrow$  magnitudes/arcsec<sup>2</sup>

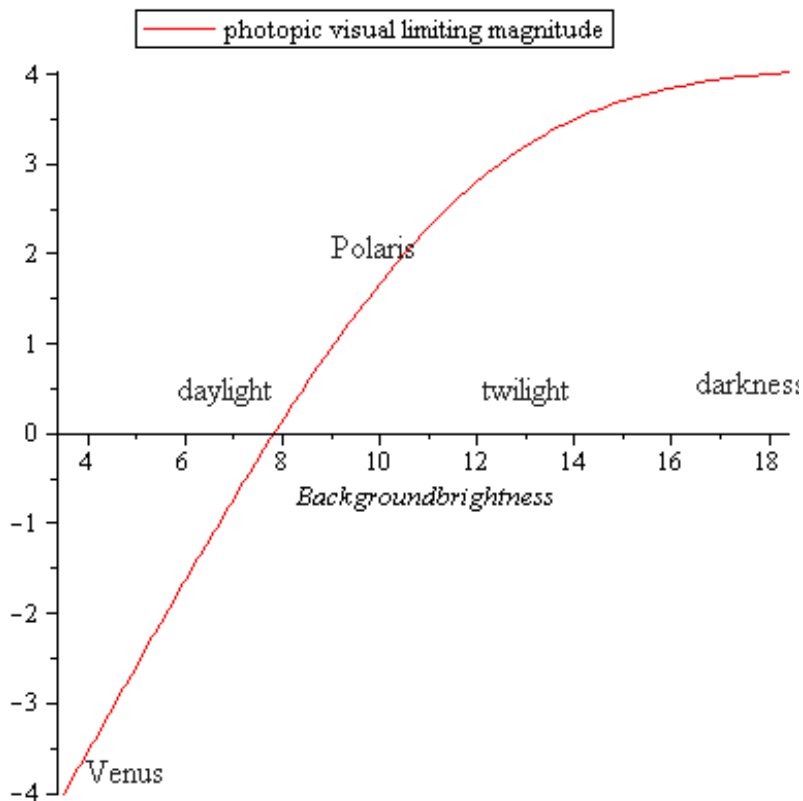
$$B = 26.33 - 2.5 \text{Log}(M)$$

From magnitudes/arcsec<sup>2</sup>  $\rightarrow$  millimicroLambert (nanoLambert)

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

Limiting vis. magnitude for background brightness in magnitudes/arcsec<sup>2</sup>  $\leq 18.4$  (= photopic)

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



Background Brightness in magnitudes/arcsec<sup>2</sup> photopic vision (for  $Mv \leq 4.00$ )

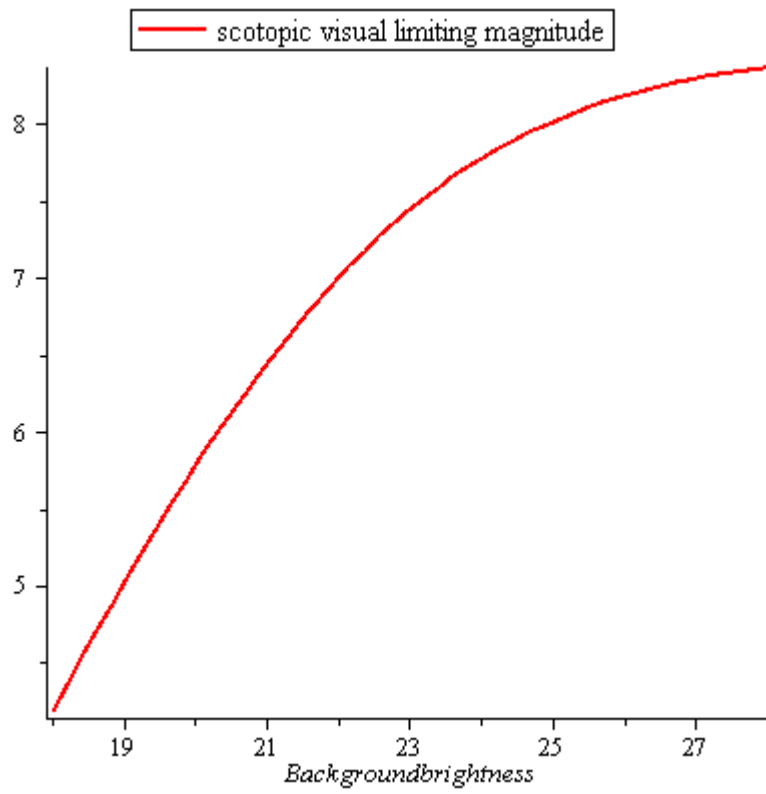
$$B = 11.58 - 5 \text{Log}(10^{0.822 - Mv/5} - 1)$$

Background Brightness in magnitudes/arcsec<sup>2</sup> 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/arcsec<sup>2</sup>

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

Limiting vis. magnitude for background brightness in magnitudes/arcsec<sup>2</sup> for scotopic vision (idem, Nils Olof Carlin)

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



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*B = Background brightness (BB) in magnitudes/arcsec<sup>2</sup>*

*M = BB in nanoLambert*

*M<sub>v</sub> = visual limiting magnitude*

*C = candela's*

*L = Lux*

*F = footLambert*

*F<sub>c</sub> = 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*