

# CIELAB 1976 $L^*a^*b^*$ color space and CIELAB<sub>u</sub> 2022 $L^*u a^*u b^*u$ color space

$$\begin{aligned}
 L^* &= 116 (Y/Y_n)^{1/3} - 16 & [Y/Y_n]^{1/3} > 24/116 \\
 a^* &= 500 [ (X/X_n)^{1/3} - (Y/Y_n)^{1/3} ] & Y > 0,885 \\
 b^* &= 200 [ (Y/Y_n)^{1/3} - (Z/Z_n)^{1/3} ]
 \end{aligned}$$

$$\begin{aligned}
 L^*u &= 116 c_u (Y/Y_u)^{1/3} - 16 = L^* - 0,49 & Y_u = 18 \\
 a^*u &= 500 c_u [ (X/X_u)^{1/3} - (Y/Y_u)^{1/3} ] = a^* \\
 b^*u &= 200 c_u [ (Y/Y_u)^{1/3} - (Z/Z_u)^{1/3} ] = b^*
 \end{aligned}$$

$$\begin{aligned}
 c_u &= [Y_u/Y_n]^{1/3} = 0,18^{1/3} = 0,5647, \text{ similar for } X, Z \\
 u_L &= 116c_u = 65,51, u_a = 500c_u = 282,35, u_b = 200c_u = 112,94
 \end{aligned}$$