$L^*_{85,2}/L^*_{85,2,u}$ **LABJND lightness $L^*_{85,2}$ normalized to the background lightness $L^*_{85,2,u}$**

$L^*/L^*_u = (t/a)\{\ln(1+a\cdot Y) - \ln(1+a\cdot Y_u)\}$ [1a]
$L^*/L^*_u = (t/a)\{\ln[1+b\cdot(Y/Y_u)] - \ln(1+b)\}$ [1b]
a=0,3411 t=88,23 t/a=258,6 b=6,141 [1c]

hep00−1a

L^*/L^*_u **CIELAB lightness L^* normalized to the background lightness L^*_u**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=116, n=1/3, d=16) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=65,49, L^*_u= r − d) [1b]
$L^*/L^*_u = g\,(Y/Y_u)^n - h$ (g=r/(r−d)=1,32, h=d/(r−d)=0,32) [1c]
$\log[(L^*/L^*_u + h)/g] = n \log(Y/Y_u)$ [1d]
$\ln[(L^*/L^*_u + h)/g] = \ln(10)\, n \log(Y/Y_u)$ [1e]
$(L^*/L^*_u + h)/g = e^{\ln(10)\, n \log(Y/Y_u)}$ [1f]

hep00−2a

L^*/L^*_u **IECsRGB lightness L^* normalized to the background lightness L^*_u**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/2,4, d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=48,94, L^*_u= r − d) [1b]
$L^*/L^*_u = (Y/Y_u)^n$ [1c]
$\log(L^*/L^*_u) = n \log(Y/Y_u)$ [1d]
$\ln(L^*/L^*_u) = \ln(10)\, n \log(Y/Y_u)$ [1e]
$L^*/L^*_u = e^{\ln(10)\, n \log(Y/Y_u)}$ [1f]

hep00−3a

L^*/L^*_u **TUBsRGB lightness L^* normalized to the background lightness L^*_u**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/ln(10), d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=47,48, L^*_u= r − d) [1b]
$L^*/L^*_u = (Y/Y_u)^{1/\ln(10)}$ (ln(x)=ln(10) log(x)) [1c]
$\log(L^*/L^*_u) = (1/\ln(10)) \log(Y/Y_u)$ [1d]
$\ln(L^*/L^*_u) = \log(Y/Y_u)$ [1e]
$L^*/L^*_u = e^{\log(Y/Y_u)}$ [1f]

hep00−4a

hep00−3n

$(\Delta Y/Y)/(\Delta Y/Y)_u$ **LABJND-Y sensitivity normalized to $(\Delta Y/Y)_u$**

$L^*/L^*_u = (t/a)\{\ln(1+a\cdot Y) - \ln(1+a\cdot Y_u)\}$ [1a]
$L^*/L^*_u = (t/a)\{\ln[1+b\cdot(Y/Y_u)] - \ln(1+b)\}$ [1b]
tristimulus value Y sensitivity
$(dY/Y)/(dY_u/Y_u)$
$= [(1+a\cdot Y)/Y]/[(1+a\cdot Y_u)/Y_u]$ [3f]

hep01−1a

$(\Delta Y/Y)/(\Delta Y/Y)_u$ **CIELAB-Y sensitivity normalized to $(\Delta Y/Y)_u$**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=116, n=1/3, d=16) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=65,49, L^*_u= r − d) [1b]
$dY/Y = [(Y_n/(n\,s))(Y/Y_n)^{1-n}/Y]$ [3c]
$(dY/Y)_u = [(Y_n/(n\,s))(Y_u/Y_n)^{1-n}/Y_u]$ [3d]
$(dY/Y)/(dY/Y)_u = (Y/Y_u)^{-n}$ [3e]
$\log[(dY/Y)/(dY/Y)_u] = (-n)\log(Y/Y_u)$ [3f]

hep01−2a

$(\Delta Y/Y)/(\Delta Y/Y)_u$ **IECsRGB-Y sensitivity normalized to $(\Delta Y/Y)_u$**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/2,4, d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=48,94, L^*_u= r − d) [1b]
$dY/Y = [(Y_n/(n\,s))(Y/Y_n)^{1-n}/Y]$ [3c]
$(dY/Y)_u = [(Y_n/(n\,s))(Y_u/Y_n)^{1-n}/Y_u]$ [3d]
$(dY/Y)/(dY/Y)_u = (Y/Y_u)^{-n}$ [3e]
$\log[(dY/Y)/(dY/Y)_u] = (-n)\log(Y/Y_u)$ [3f]

hep01−3a

$(\Delta Y/Y)/(\Delta Y/Y)_u$ **TUBsRGB-Y sensitivity normalized to $(\Delta Y/Y)_u$**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/ln(10), d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=47,48, L^*_u= r − d) [1b]
$dY/Y = [(Y_n/(n\,s))(Y/Y_n)^{1-n}/Y]$ [3c]
$(dY/Y)_u = [(Y_n/(n\,s))(Y_u/Y_n)^{1-n}/Y_u]$ [3d]
$(dY/Y)/(dY/Y)_u = (Y/Y_u)^{-n}$ [3e]
$\log[(dY/Y)/(dY/Y)_u] = (-n)\log(Y/Y_u)$ [3f]

hep01−4a

hep01−3n

$\Delta Y/\Delta Y_u$ **LABJND tristimulus value difference ΔY normalized to ΔY_u**

$L^*/L^*_u = (t/a)\{\ln(1+a\cdot Y) - \ln(1+a\cdot Y_u)\}$ [1a]
$L^*/L^*_u = (t/a)\{\ln[1+b\cdot(Y/Y_u)] - \ln(1+b)\}$ [1b]
normalized tristimulus value Y difference
$dY/dY_u = (1+a\cdot Y)/(1+a\cdot Y_u)$ [3d]

hep00−5a

$\Delta Y/\Delta Y_u$ **CIELAB tristimulus value difference ΔY normalized to ΔY_u**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=116, n=1/3, d=16) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=65,49, L^*_u= r − d) [1b]
$dY = [Y_n/(n\,s)](Y/Y_n)^{1-n}$ [2c]
$dY_u = [Y_n/(n\,s)](Y_u/Y_n)^{1-n} = 1{,}4602$ [2d]
$dY/dY_u = (Y/Y_u)^{1-n}$ [2e]
$\log(dY/dY_u) = (1-n)\log(Y/Y_u)$ [2f]

hep00−6a

$\Delta Y/\Delta Y_u$ **IECsRGB tristimulus value difference ΔY normalized to ΔY_u**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/2,4, d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=48,94, L^*_u= r − d) [1b]
$dY = [Y_n/(n\,s)](Y/Y_n)^{1-n}$ [2c]
$dY_u = [Y_n/(n\,s)](Y_u/Y_n)^{1-n} = 1{,}1746$ [2d]
$dY/dY_u = (Y/Y_u)^{1-n}$ [2e]
$\log(dY/dY_u) = (1-n)\log(Y/Y_u)$ [2f]

hep00−7a

$\Delta Y/\Delta Y_u$ **TUBsRGB tristimulus value difference ΔY normalized to ΔY_u**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/ln(10), d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=47,48, L^*_u= r − d) [1b]
$dY = [Y_n/(n\,s)](Y/Y_n)^{1-n}$ [2c]
$dY_u = [Y_n/(n\,s)](Y_u/Y_n)^{1-n} = 1{,}0934$ [2d]
$dY/dY_u = (Y/Y_u)^{1-n}$ [2e]
$\log(dY/dY_u) = (1-n)\log(Y/Y_u)$ [2f]

hep00−8a

hep00−7n

$(Y/\Delta Y)/(Y/\Delta Y)_u$ **LABJND-Y contrast normalized to $(Y/\Delta Y)_u$**

$L^*/L^*_u = (t/a)\{\ln(1+a\cdot Y) - \ln(1+a\cdot Y_u)\}$ [1a]
$L^*/L^*_u = (t/a)\{\ln[1+b\cdot(Y/Y_u)] - \ln(1+b)\}$ [1b]
tristimulus value Y contrast
$(Y/dY)/(Y_u dY_u)$
$= [Y/(1+a\cdot Y)]/[Y_u/(1+a\cdot Y_u)]$ [4h]

hep01−5a

$(Y/\Delta Y)/(Y/\Delta Y)_u$ **CIELAB-Y contrast normalized to $(Y/\Delta Y)_u$**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=116, n=1/3, d=16) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=65,49, L^*_u= r − d) [1b]
$Y/dY = Y/\{[(Y_n/(n\,s))](Y/Y_n)^{1-n}\}$ [4c]
$(Y/Y)_u = Y_u/\{[(Y_n/(n\,s))](Y_u/Y_n)^{1-n}\}$ [4d]
$(Y/dY)/(Y/dY)_u = (Y/Y_u)^n$ [4e]
$\log[(Y/dY)/(Y/dY)_u] = (n)\log(Y/Y_u)$ [4f]

hep01−6a

$(Y/\Delta Y)/(Y/\Delta Y)_u$ **IECsRGB-Y contrast normalized to $(Y/\Delta Y)_u$**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/2,4, d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=48,94, L^*_u= r − d) [1b]
$Y/dY = Y/\{[(Y_n/(n\,s))](Y/Y_n)^{1-n}\}$ [4c]
$(Y/Y)_u = Y_u/\{[(Y_n/(n\,s))](Y_u/Y_n)^{1-n}\}$ [4d]
$(Y/dY)/(Y/dY)_u = (Y/Y_u)^n$ [4e]
$\log[(Y/dY)/(Y/dY)_u] = (n)\log(Y/Y_u)$ [4f]

hep01−7a

$(Y/\Delta Y)/(Y/\Delta Y)_u$ **TUBsRGB-Y contrast normalized to $(Y/\Delta Y)_u$**

$L^* = s\,(Y/Y_n)^n - d$ (Y_n=100, Y_u=18, s=100, n=1/ln(10), d=0) [1a]
$L^* = r\,(Y/Y_u)^n - d$ (r = s $(Y_u/Y_n)^n$=47,48, L^*_u= r − d) [1b]
$Y/dY = Y/\{[(Y_n/(n\,s))](Y/Y_n)^{1-n}\}$ [4c]
$(Y/Y)_u = Y_u/\{[(Y_n/(n\,s))](Y_u/Y_n)^{1-n}\}$ [4d]
$(Y/dY)/(Y/dY)_u = (Y/Y_u)^n$ [4e]
$\log[(Y/dY)/(Y/dY)_u] = (n)\log(Y/Y_u)$ [4f]

hep01−8a

hep01−7n

TUB-test chart hep0; LABJND, CIELAB, IECsRGB, and TUBsRGB colour-difference formulae
log & lin[lightness L^*, threshold ΔY, sensitivity $\Delta Y/Y$, contrast $Y/\Delta Y$, normalized for grey U]

see similar files of the whole serie: http://farbe.li.tu-berlin.de/heps.htm
technical information: http://farbe.li.tu-berlin.de or http://color.li.tu-berlin.de

TUB registration: 20241001-hep0/hep0l0np.pdf /.ps
application for evaluation and measurement of display or print output
TUB material: code=rha4ta