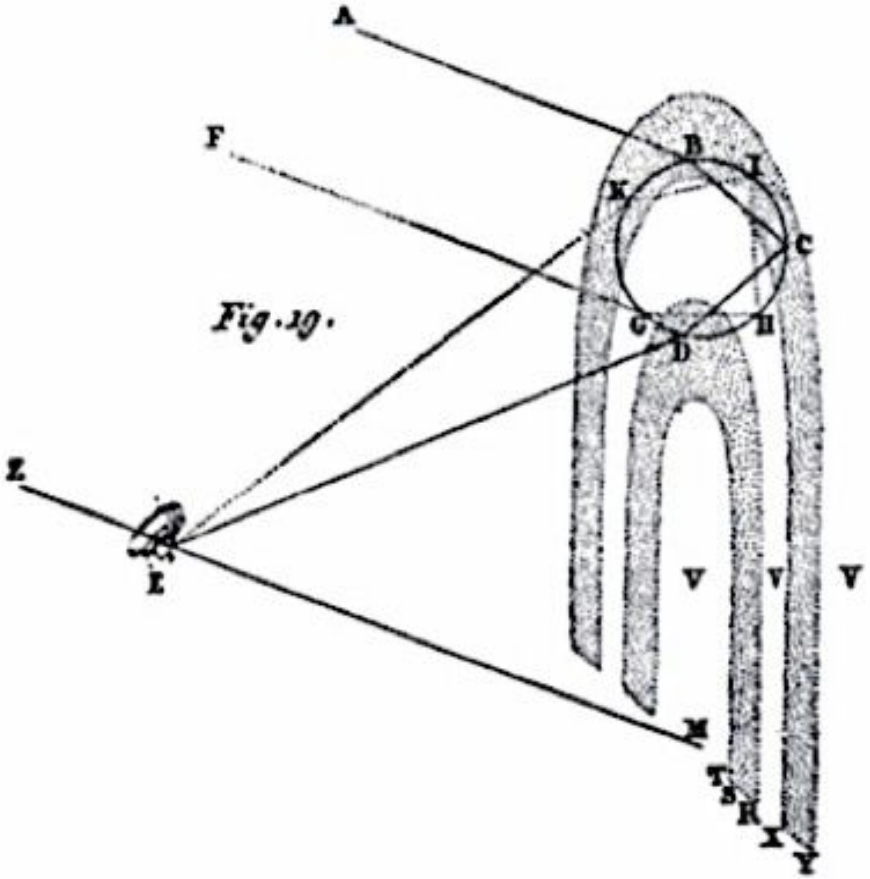
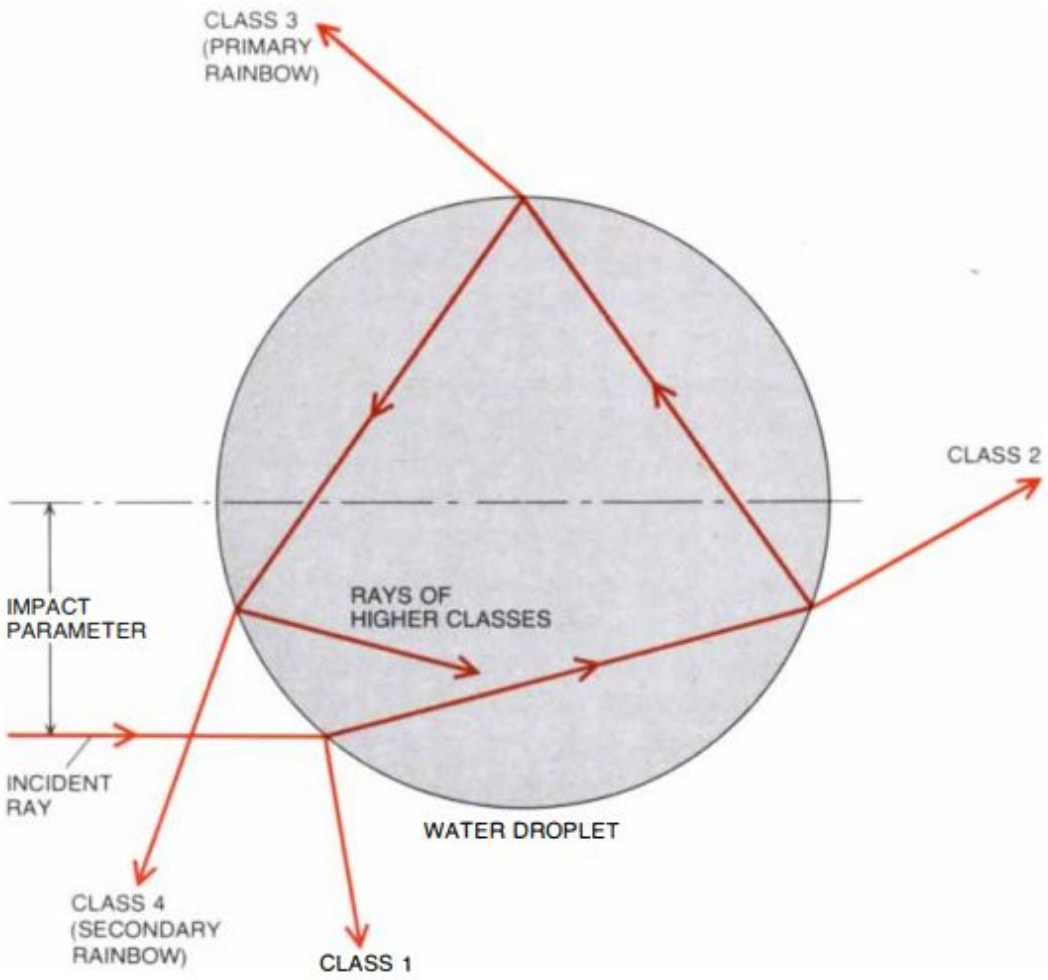
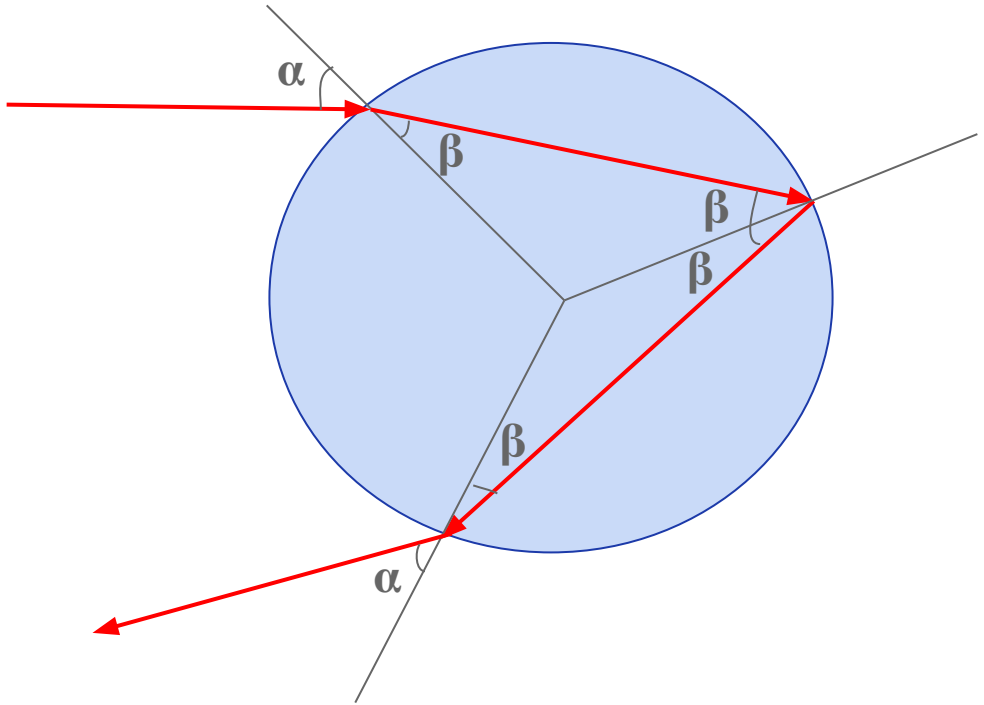
Mie scattering and the first and second rainbow

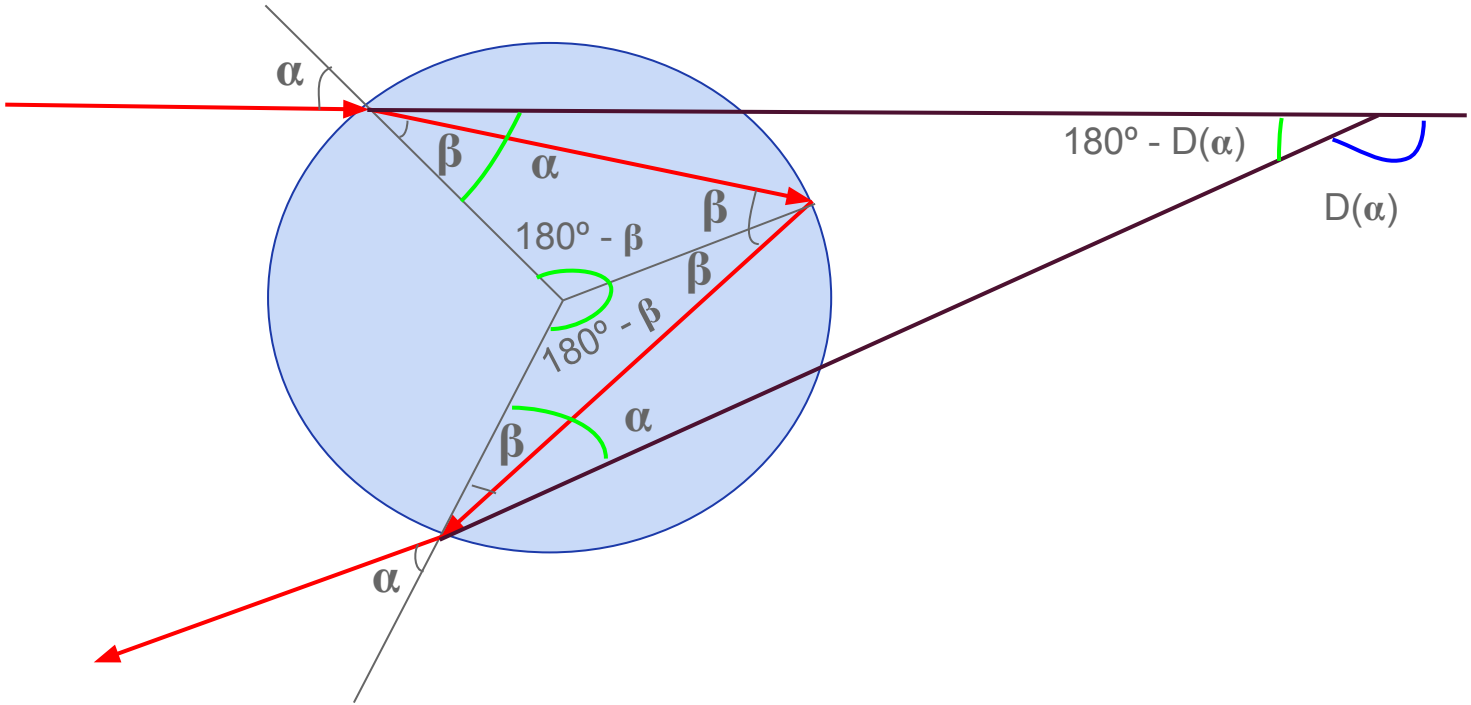
Luis Augusto Pereira

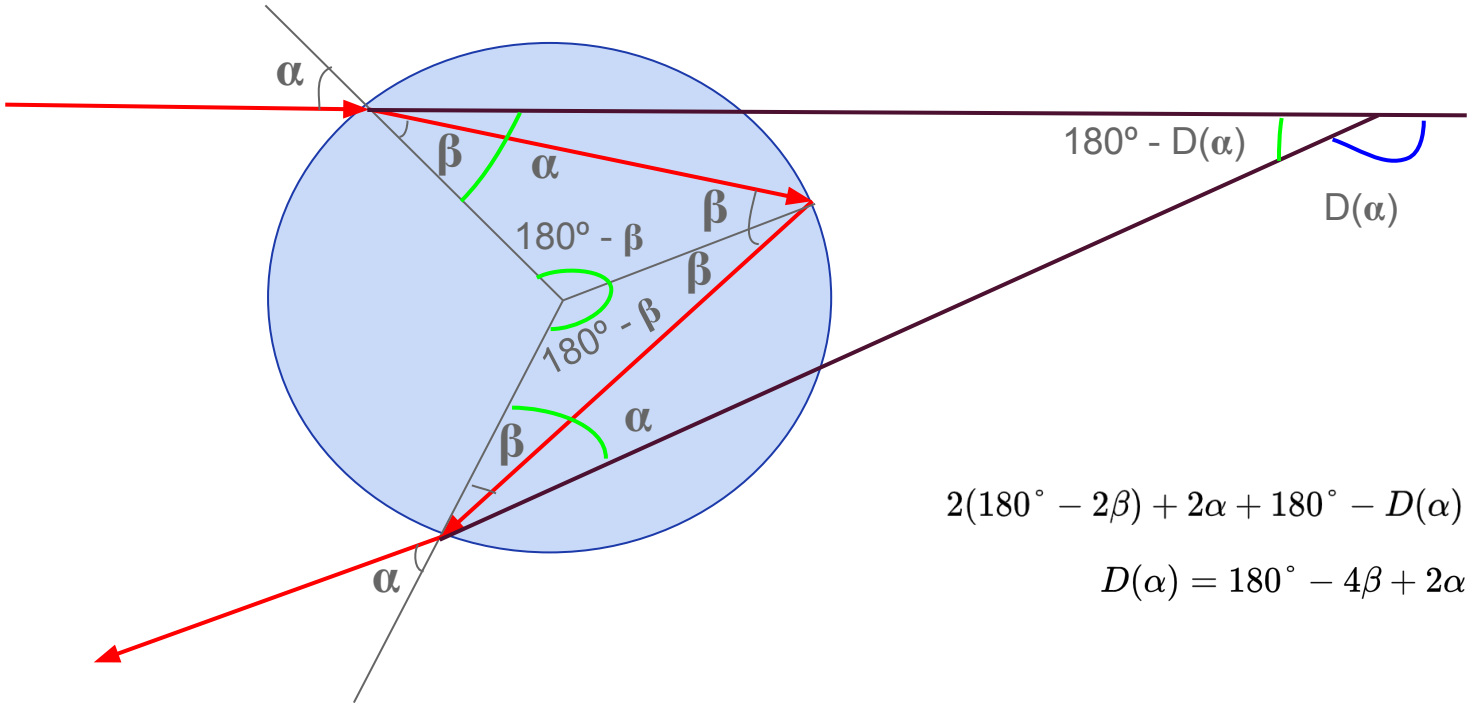
René Descartes (1596-1650)




CLASS 3
(PRIMARY
RAINBOW)
CLASS 2
IMPACT
PARAMETER
RAYS OF
HIGHER CLASSES
INCIDENT
RAY
WATER DROPLET
CLASS 4
(SECONDARY
RAINBOW)
CLASS 1

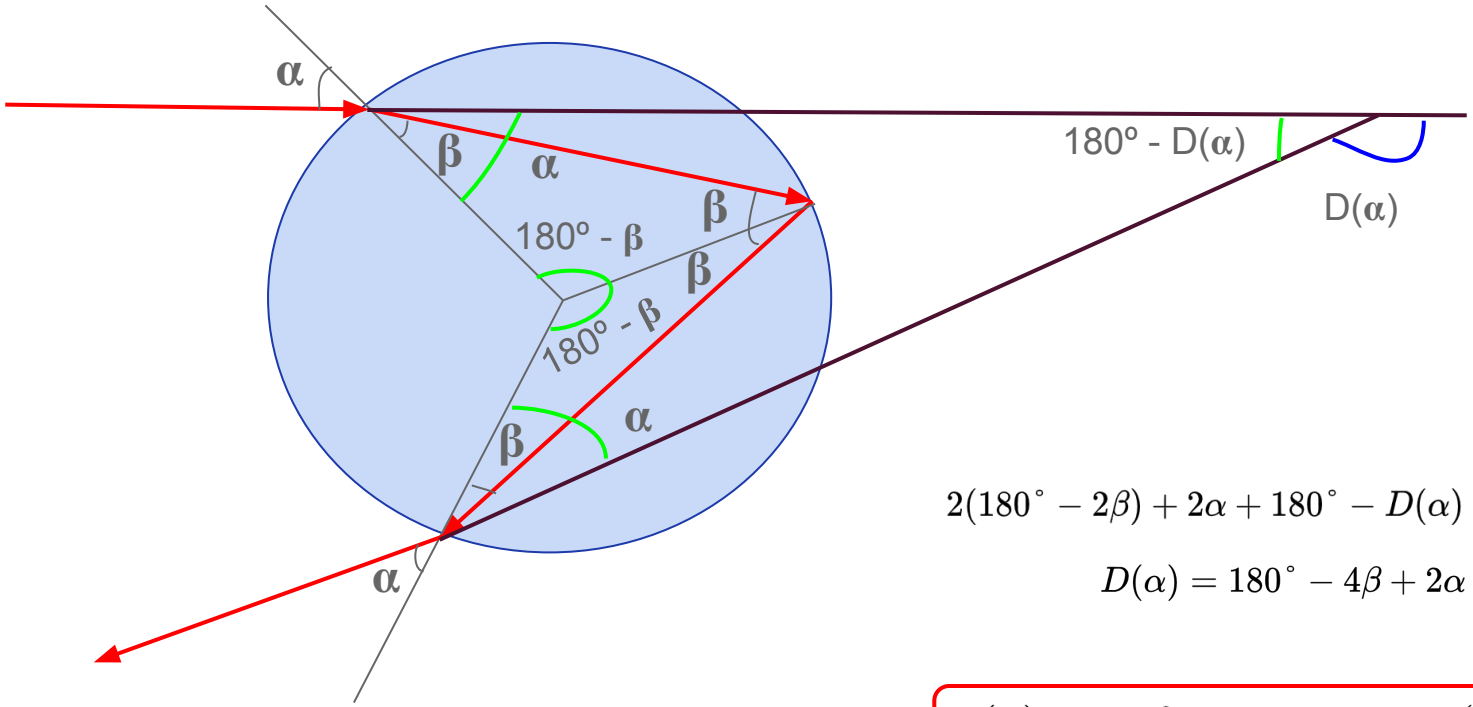

α
β
β
β
β
α


α
β
α
180° - β
β
β
180° - β
α
β
α
180° - D(α)
D(α)



$$2(180^\circ - 2\beta) + 2\alpha + 180^\circ - D(\alpha) = 360^\circ$$

$$D(\alpha) = 180^\circ - 4\beta + 2\alpha$$



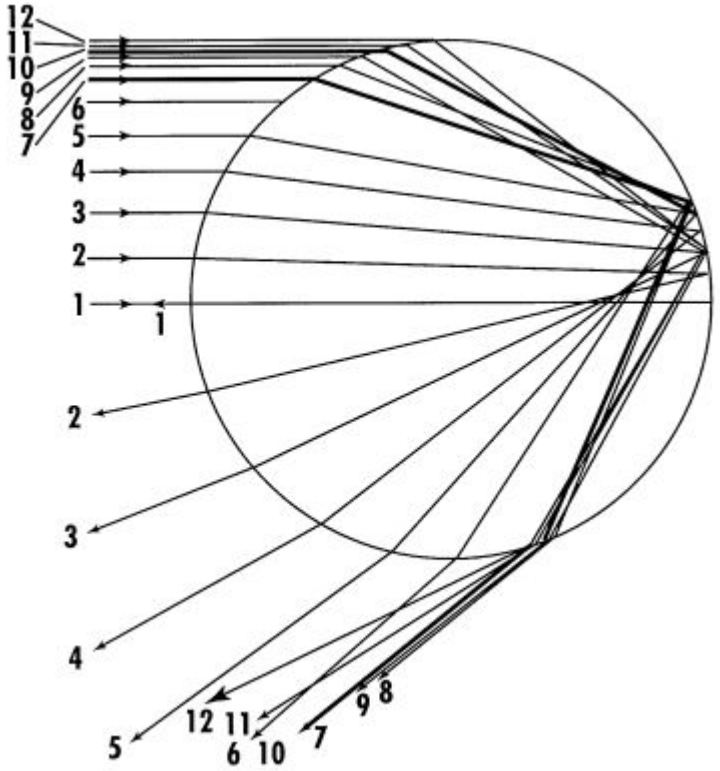
$$2(180^\circ - 2\beta) + 2\alpha + 180^\circ - D(\alpha) = 360^\circ$$

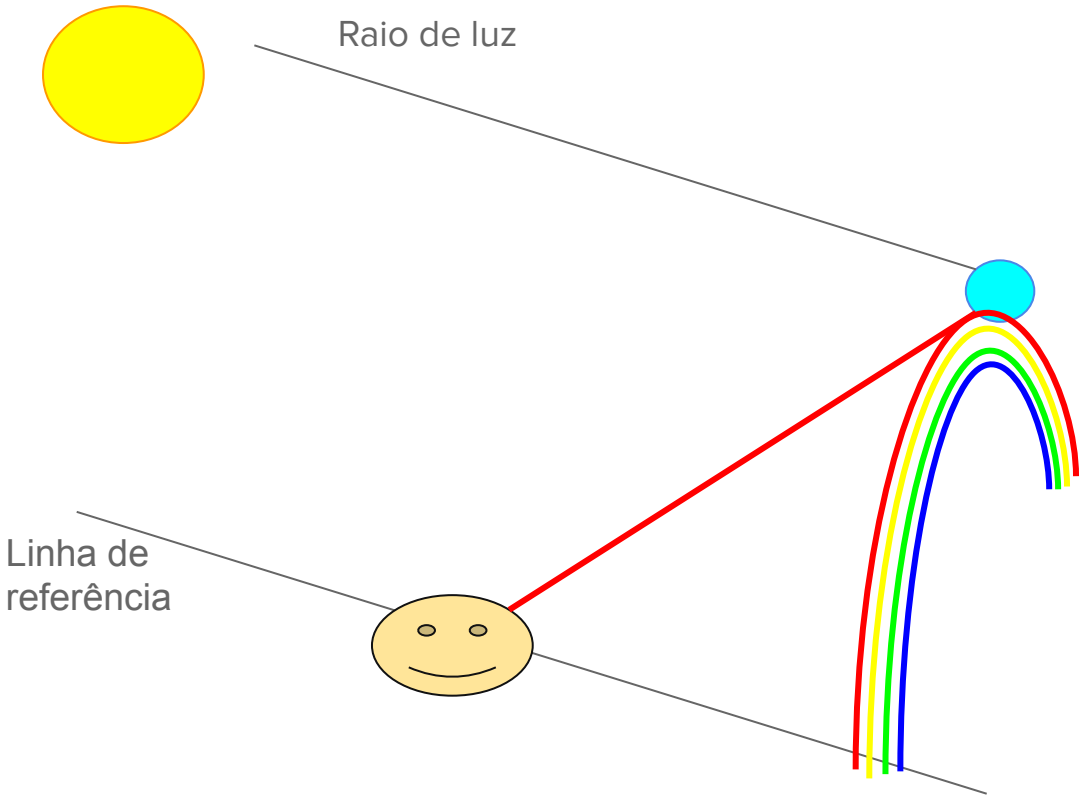
$$D(\alpha) = 180^\circ - 4\beta + 2\alpha$$

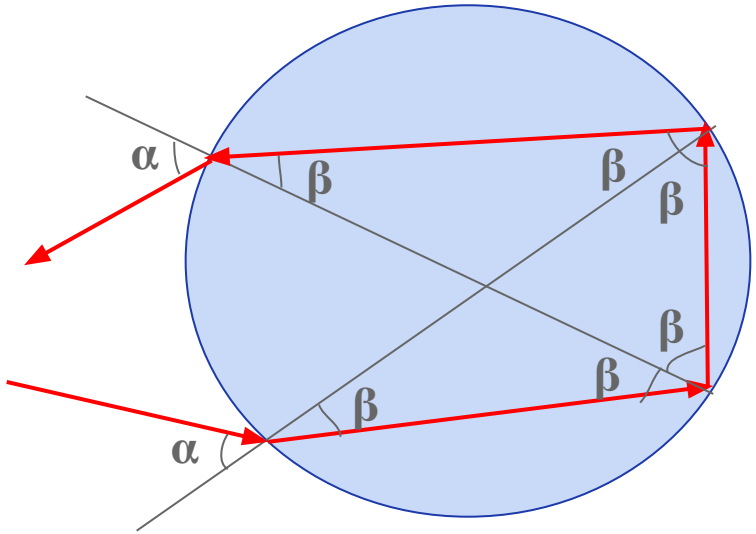
$$D(\alpha) = 180^\circ + 2\alpha - 4\arcsin\left(\frac{\sin(\alpha)}{1.33}\right)$$

$$D(\alpha) = 180^\circ + 2\alpha - 4\arcsin(\frac{\sin(\alpha)}{1.33})$$

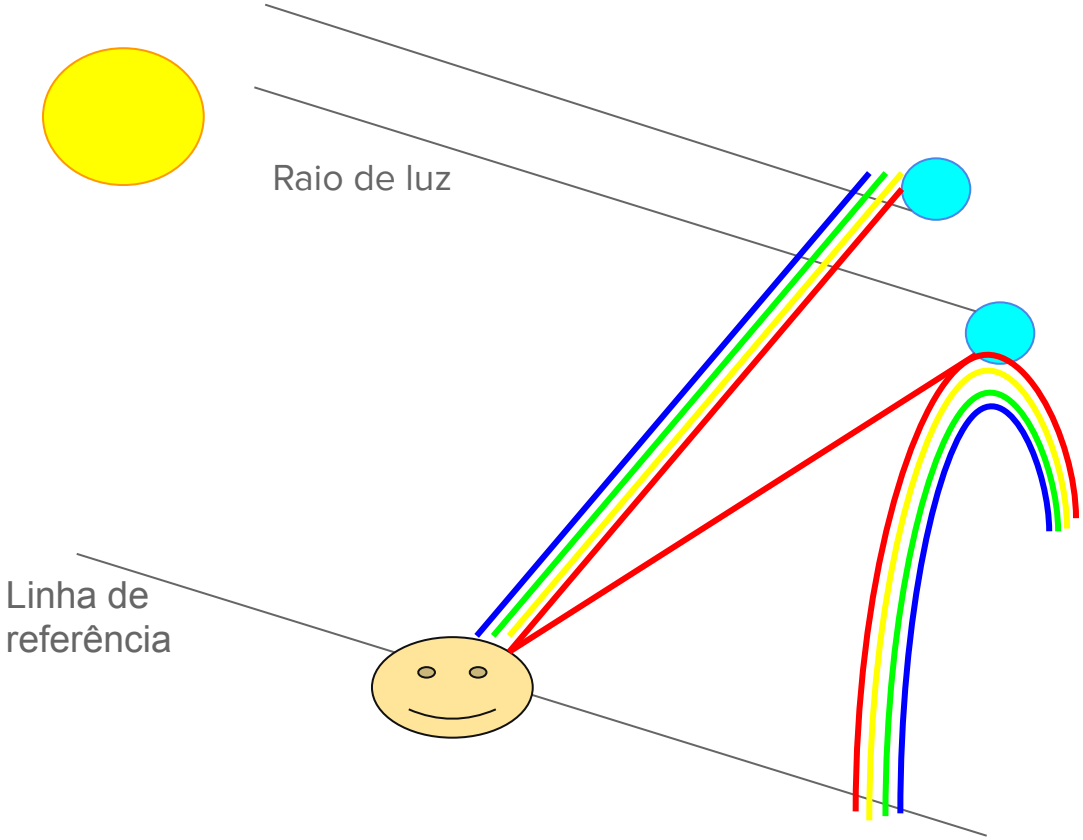
α	$D(\alpha)$
0	180
10	170
20	161
30	152
40	145
50	140
60	138
70	141
80	150




Raio de luz
Linha de
referência



$$D(\alpha) = 2\alpha - 6\beta + 360^\circ$$

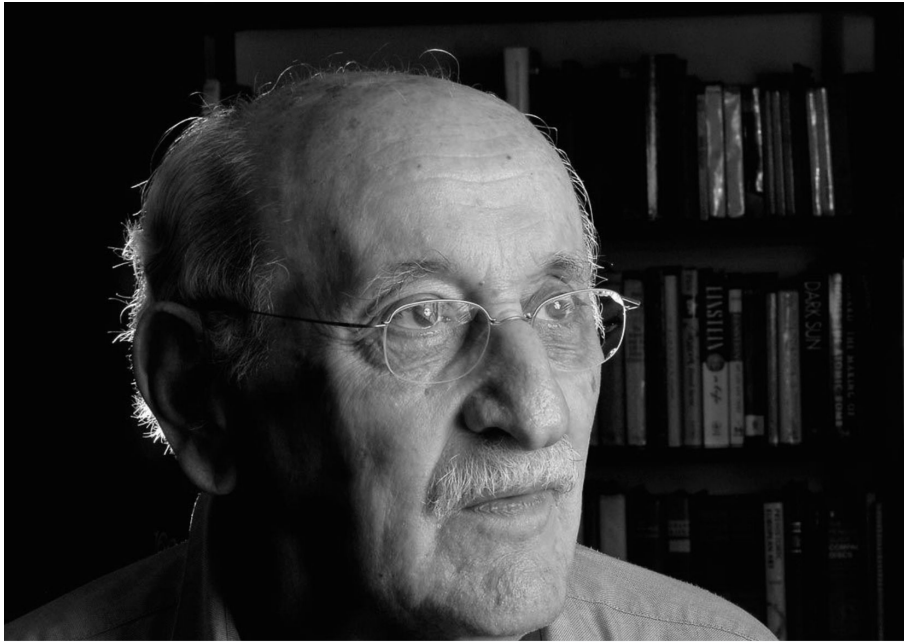

Raio de luz
Linha de
referência

Thomas Young (1773 - 1829)

George Biddell Airy (1801–1892)

Gustav Mie (1868-1957)

George Watson(1886 - 1965)



Herch Moysés Nussenzveig (1933 - 2022)

Referências

[1] Nussenzveig, H. Moys S. "The theory of the rainbow." *Scientific American* 236.4 (1977): 116-128.

[2] Nussenzveig, Herch Moyses. "High-Frequency scattering by a transparent sphere. I. direct reflection and transmission." *Journal of Mathematical Physics* 10.1 (1969): 82-124.

[3] Nussenzveig, H. M. "High-frequency scattering by a transparent sphere. II. Theory of the rainbow and the glory." *Journal of mathematical physics* 10.1 (1969): 125-176.

[4] Adam, John A. "The mathematical physics of rainbows and glories." *Physics reports* 356.4-5 (2002): 229-365.