Deviation of light by a prism

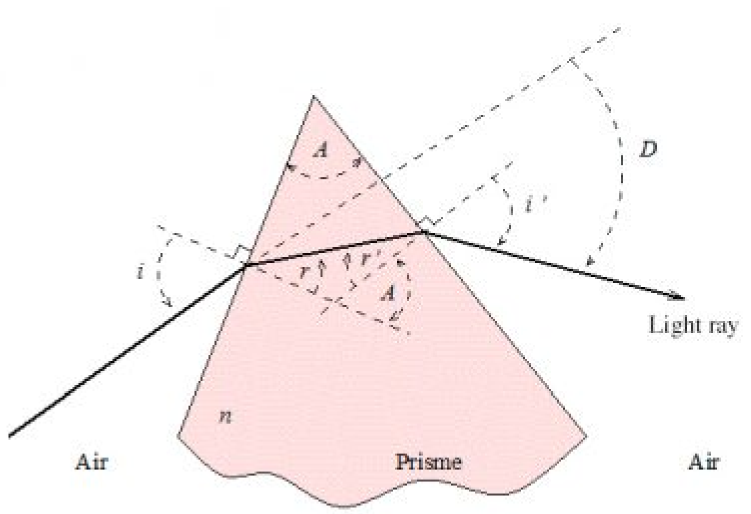

Figure 1. Deviation of a light beam by a prism of angle at vertex A and refractive index n.

A prism of angle at the apex A and index n - *the* air, of unit index, surrounds the prism - deflects a light beam, whose angle of incidence on one of the lateral surfaces of the prism is i, according to the laws of Snell-Descartes of geometric optics: sin $i = n$ sin r and n sin $r' =$ sin i' (Figure 1 for the notations). The angle of deflection $D = i + i' - A$, with $A = r + r'$.

The light beam can only emerge from the prism if $A < 2$ a sin(1/n) *;* for ice n = 1.31, hence A < 99.5^0. If we trace the deviation D as a function of i, we see that it decreases rapidly, reaches a minimum *minimorum* corresponding to a symmetrical crossing of the prism $(i = i')$, then increases slowly. The minimum is very flattened, so that a change in the angle of incidence around the incidence that corresponds to this minimum does not significantly change its value; it results in an accumulation of light and therefore a high luminosity around this minimum. For $A = 60^0$, the minimum is 22^0; if $A = 90^0$, it is 46^0 (Figure 2). Figure 3 shows the value of this minimum for the different values of A allowed: it increases with A.

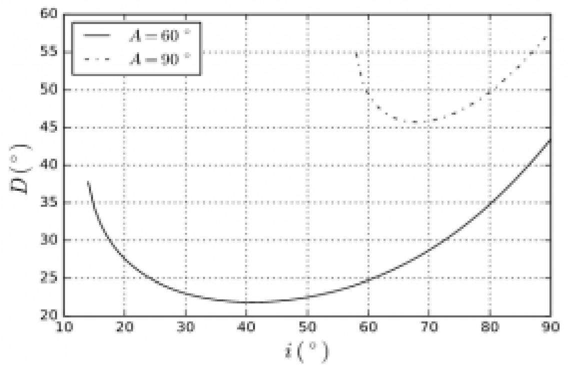

Figure 2. Deviation D as a function of the angle of incidence i on a prism of angle A = 60^0 and angle A = 90^0.

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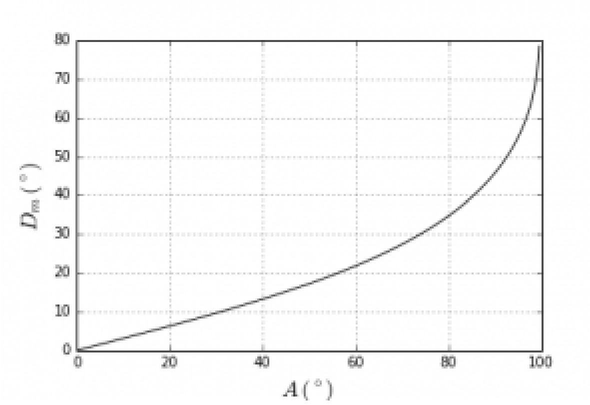

Figure 3. Minimum deviation Dm as a function of the angle A of a prism.

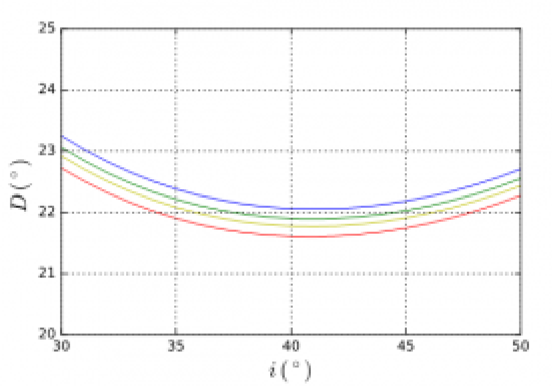

Figure 4. Deviation D for an angle prism A = 60^0 depending on the colour of the incident light. Each of the four curves is colored according to the color it represents.

In addition, since the index *n* depends on the colour of the incident radiation, the minimum also depends on it; a prism breaks down white light into its various monochromatic components. This explains the iridescence of halos obtained by refraction. For $A = 60^0$, we have a minimum close to 22^0 that grows from red to blue (Figure 4).

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References and notes

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