

Mysteries of Photography #17: Diffraction

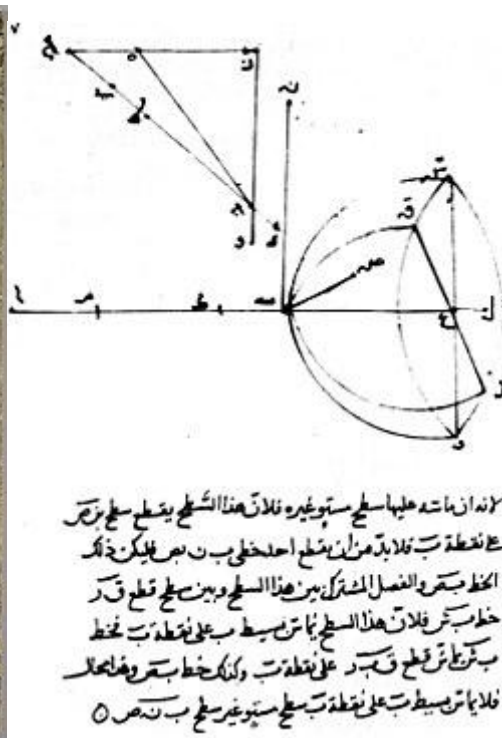
Photography as we know it depends on use of lenses to focus light on a sensor whether this be chemical sensitivity (silver halide) or a digital medium. In a typical lens, we have light interaction with carefully curved transparent medium. However, to understand what is going on, let's think about a simpler system where we have light interacting with a straight edge.



(All illustrations from Wikipedia)

Here we have a beam of light hitting the edge of a transparent block. The light no longer goes in a completely straight line but bends at an angle at the edge (and at the other edge when it exits the material. What's going on?

Our understanding of this goes back to the 2nd century with Ptolemy of Egypt but a more rigorous derivation had to wait until the 10th century with the Persian mathematician Ibn Sahl.



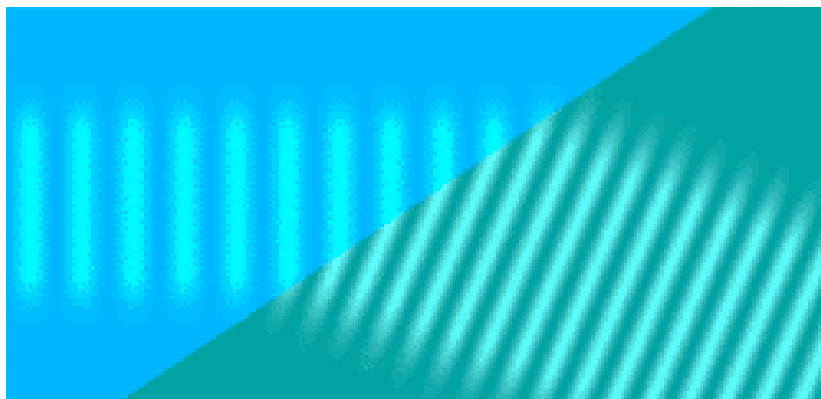
Ptolemy (left) and an illustration the Ibn Sahl manuscript (right)

Like a lot of ancient knowledge, this was independently rediscovered in the West and is commonly attributed to Willebrord Snellius in the 17th century but this was independently derived and published by René Descartes (below left) although a more correct derivation was published at about the same time by another French mathematician Pierre de Fermat (below right).



Fermat's derivation was based on the speed of light being slower in the denser medium which really is the key to it all.

To understand what's happening without going into the maths, we have to remember light is a wave. When the wave front hits the denser medium at an angle, it slows down compressing the wave front as the light slows. Hence the light beam changes direction.



Remember that light interacting with a straight edge is a special case. When we throw curved surfaces into the mix then it becomes more interesting!

Some prescribed reading for next time: "On the burning instruments" by Ibn Sahl, Baghdad 984

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