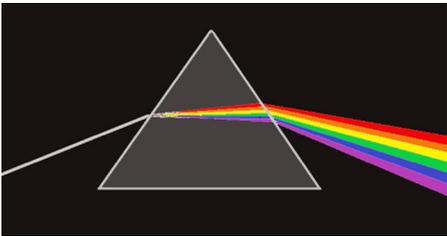


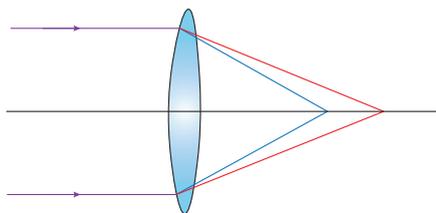
# Light Reading

## #2. CHROMATIC ABERRATION - CORRECTING FOR COLOUR DISTORTION

Around 300 years before Pink Floyd's album cover, Isaac Newton found that light passing through a prism would bend and split into component colours.



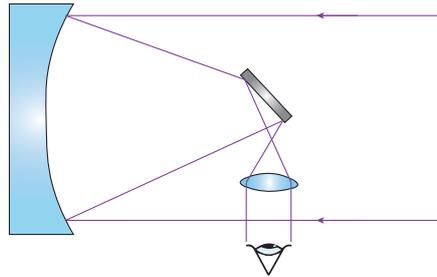
He considered that this refraction was also the cause of the colour distortions found in telescopes; blue light was being refracted more than red light.



**Chromatic aberration**

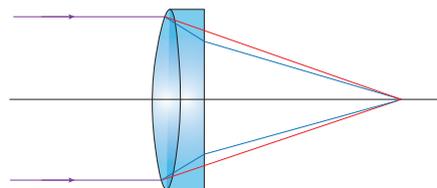
To prove this, he built the first reflecting telescope (in 1668) arguing that, because there was no refraction, there could be no colour distortion.

Despite the success of the experiment, the difficulty in producing high quality and accurately shaped mirrors prevented wider use of the design. Chromatic aberration remained a limitation of refracting telescopes and this was, said Newton, not correctable.



**Newtonian reflecting telescope**

However, in ~1730, an amateur inventor, Chester Moor Hall, devised the achromatic doublet, a two-lens combination that has the same focal point for red and blue light and which largely removed chromatic aberration effects.

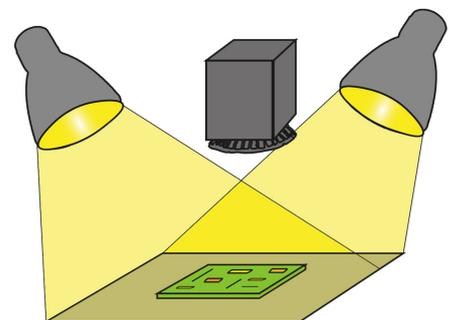


**Achromatic doublet**

To protect his secret, he engaged a different lens maker for each lens. Unfortunately they both subcontracted the work to the same man, George Bass, who realised the significance. But it was not until many years later, when George Bass mentioned it to the optical instrument maker John Dolland, that the achromatic doublet became widely known and used; John Dolland was able to replicate it and he successfully patented it in 1758.

Today optical systems typically have three or more lenses to correct for chromatic aberration. However, in some cases there are simpler solutions. Just as Newton reasoned: 'no refraction = no chromatic aberration', other users have reasoned: 'no colour variation = no chromatic aberration'. For example, if a monochromatic light source can be used in a machine vision application, a sharp image can be obtained without the need to correct for chromatic aberration, thereby dramatically reducing the cost of the camera's optics. Other workers have used a bandpass filter before the camera to limit the detected colour range and so improve the image sharpness.

**Author: Dick Fielding**



**Using monochromatic light avoids chromatic aberration and also simplifies optical requirements**