

## PHOTOGRAPHIC OBJECTIVES #1: THE NORMAL LENS

The lens that typically comes with the camera is called the normal lens. Optically it is deemed normal because it is the shortest focal length that will fill the dimensions of the film size.

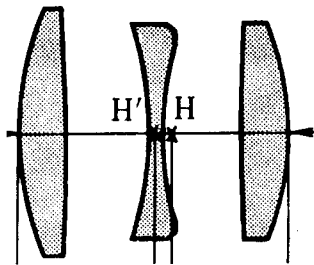
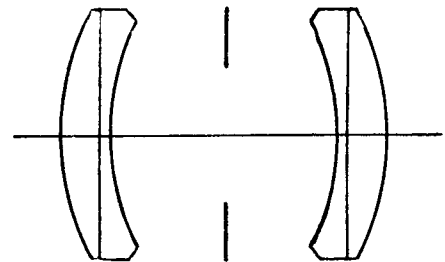
A simple positive lens will project a real image of a faraway scene one focal length away from the image plane in a circle approximately one focal length in diameter. Recall the In-Class Demonstration. To fully cover the rectangular format of the film requires a lens whose image diameter = the diagonal of the film format.

On the next page are some contemporary film formats and their horizontal, vertical, and diagonal dimensions. Notice how the focal length of the normal lens shipped with the camera is in close agreement with the diagonal dimension.

But more importantly, the perspective it affords is similar to that of the human eye regarding the same scene. A good test of this concept is to look through the viewfinder of a 35mm SLR camera equipped with a 50mm focal length lens, (the focal length normally supplied with the camera) and open the other eye. The views are similar, although the camera view will probably be slightly larger.

### THE COOKE TRIPLET

Overcoming astigmatism was the Holy Grail of 19th century optical engineers, which they accomplished with lenses they christened anastigmats. (A - Stigmatism means without a crossing; to make a negative of this negative adds another a- prefix, which converts to ana.) These designs were based on a symmetric pairing of achromats.

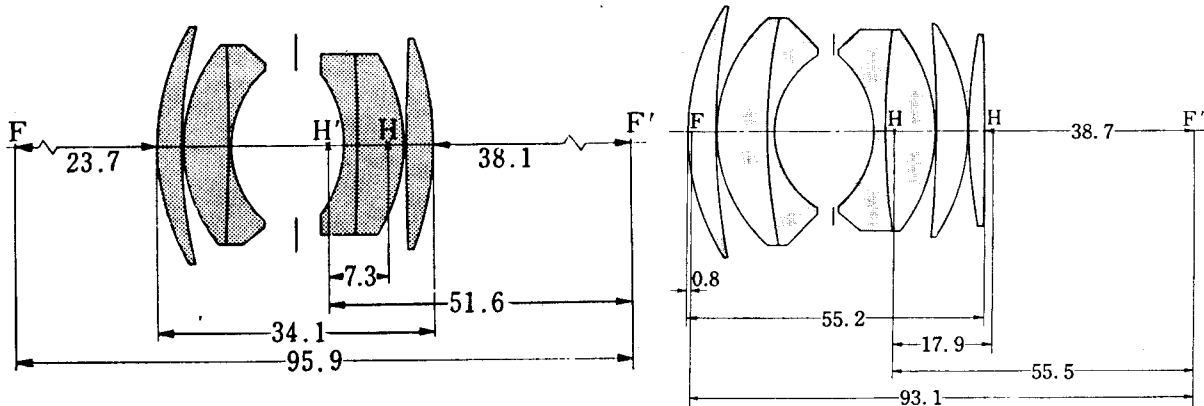


A pair of achromats means that there are four lenses to be ground, two of high index, and two of low index glass, with a high and low index face getting glued together. It is the beauty of the three element design of H. Dennis Taylor where a high index lens fits between two lower index glasses to become an achromatic system, with enough degrees of freedom in shaping the curvature of the six lens surfaces to guarantee elimination of the other aberrations.

This design is named not after its inventor but for the optical shop that Taylor worked

for, Cooke of York in England. Although invented on their premises, they had no wish to manufacture it, so production was undertaken by the firm of Taylor, Taylor, and Hobson in Leicester but named in deference to its birthplace.

The drawback to the early Triplets was a relatively high f/number, like 3.5 and on up. But modern calculations have made this design speedier by splitting up the duties of each of the original three elements between 2 or 3 elements apiece, like the 50 mm f/2 and the 55 mm f/1.2 shown below. Modern day anti-reflection coatings allow the use of the extra glass surfaces without flaring out the image.



**Optical formula of Nikkor-H Auto 1:2 f=50mm.**

**Optical formula of Nikkor-S Auto 1:1.2 f=55mm.**

Although the 21<sup>st</sup> century normal lenses have autofocus motors embedded in their housings, the optical formula is a 19<sup>th</sup> century design tweaked to perfection! Some of the better brands are capable of 100 line pairs per millimeter of resolution!