



*Effect on Shading of Position of Exit Pupil*

bottom. We are accustomed to seeing the blue sky at the top of the frame and the green grass at the bottom of the frame so shading in these areas of the frame goes unnoticed. If the shading errors were left to right, they would be glaringly obvious.

### Color Shading of Out Of Focus Images:

when you operate a lens at full aperture, it goes without saying that there is a corresponding shallow depth of field. This presents a problem when a subject has depth but a portion of the subject is out of focus. The colorimetry of the out of focus portion becomes shaded in the vertical direction. This manifests the opposites of the color shading that we are used to. Magenta shading is reversed, it

appears at the bottom of the frame instead of the top and likewise for the green shading. Why, you ask? This is due to the differing spectral characteristics of changing the angle of incidence of light striking the dichroic layers. Thus, it becomes quite apparent that a shallow depth of field at full aperture is fraught with a host of optical perils. Almost all optical parameters degrade to some extent at full or near full aperture, as light travels through the optical system.

There is a set of five optical aberrations that impinge on the performance of the optical system. These aberrations are included here to provide insight into how they affect optical reproduction characteristics.

**Siedel's Five Aberrations:** these terms which apply to lens optics are appropriately named after the researcher who classified these optical aberrations. Descriptions and diagrams of each have been included as an aid for troubleshooting.

- **Longitudinal Chromatic Aberration** occurs because light rays are handled in a different manner within the lens depending on their wavelength. For our purposes, it is important to point out that the three primary colors do not focus on the same plane. This aberration precipitates a loss of detail and if it is present in significant quantity it results in color fringing. This form of chromatic aberration focusses different wavelengths on different planes, appearing as tracking error. It is a fluid defect, varying as the lens is zoomed in or out. *Note:* If a large aberration of this type were left in the lens, one would get tracking error, since the different wavelengths (colors) would be focussed on several planes with the resultant color blurring in spite of optimized tracking adjustment. This aberration can be minimized by stopping down the lens to a point 2 or 3 stops past full aperture.
- **Lateral Chromatic Aberration** causes the three primary colors to form three separate images of different sizes. This aberration arises because of the property of optical glass wherein the refractive