H alpha Imaging of the Moon at the Campus Observatory

By Fred Ringwald

Frenso State's Campus Observatory has a 16-inch Meade LX 200 telescope, which at f/10 gives spectacular eyepiece images of the Moon. When my students and I first tried to get images of it with our Santa Barbara Instruments Group (SBIG) ST-8 CCD camera, however, we found that even with the shortest allowed exposure time, 0.11 seconds, the CCD gave an image that was too bright. Every pixel read 65,535 counts, the maximum possible number for this digital imaging device. The result was a useless, uniformly white, "saturated" image, showing no detail. We tried several solutions to this problem. Using the CCD through a filter for eyepiece observing of the Moon gave weird moiré patterns, reminiscent of 1960s pop art. Imaging with the focus mask on the telescope didn't cut the light down enough. Putting a dark piece of window glass over the front of the telescope proved too difficult to use. Blocking moonlight by turning the dome proved too time-variable and unwieldy. One solution that did work was to go back to using old-fashioned film, which is not as sensitive as a CCD, and so wasn't overwhelmed by the Moon's brightness.

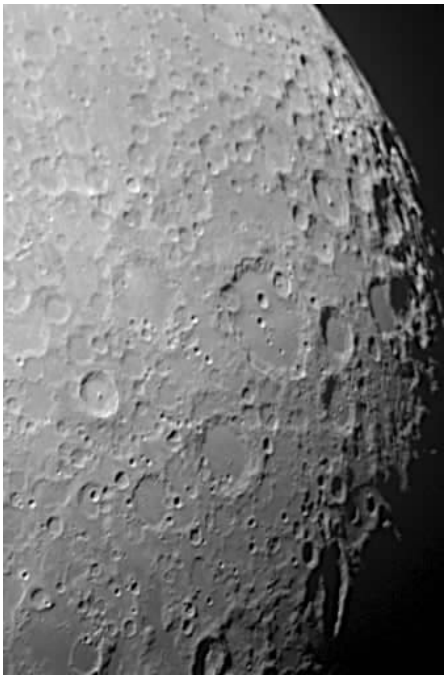
We now have a definitive solution to CCD imaging of the Moon, and by luck, it gives stunning images of the Moon, in its own right. The trick is to use the observatory's Custom Scientific H alpha (Hα) filter. I have it installed it into the color filter wheel (CFW-8), where it is labeled as a "Lunar" filter—partly because that's what it is.

This filter passes only a narrow range of wavelengths of light, only 4.5 nanometers (nm) wide. It's centered on the rest wavelength of the hydrogen alpha line, at 656.3 nm. This is in the red part of the spectrum: Hα light is scarlet, the color of fresh blood. This light is the brightest line the unaided eye can see that is emitted by hydrogen gas, the most common element in the Universe. Filters that pass only Hα light are therefore useful for obtaining high-contrast images of nebulae, or clouds of gas in the space between the stars. Nebulae are mostly hydrogen, and often emit nearly all their visible light in the Hα line. This is why nebulae often look red in color images: nearly all that light is Hα. At the same time, an Hα filter makes the sky background black, making it possible to take fine images of nebulae even in the middle of the city.

A filter that passes only Hα attenuates moonlight enough so we can take pictures of the Moon with our CCDs. It turns out that Moon rocks also have high contrast in Hα. This therefore enhances the contrast of Moon images, as you can see here.

Plato and the Caucasus Mountains

Alphonsus and the Straight Wall



The Southern Highlands

More detail about these images, and more images of the Moon, are on the Campus Observatory's Moon gallery page, at: `http://zimmer.csufresno.edu/~fringwal/moon-gallery.html`.