



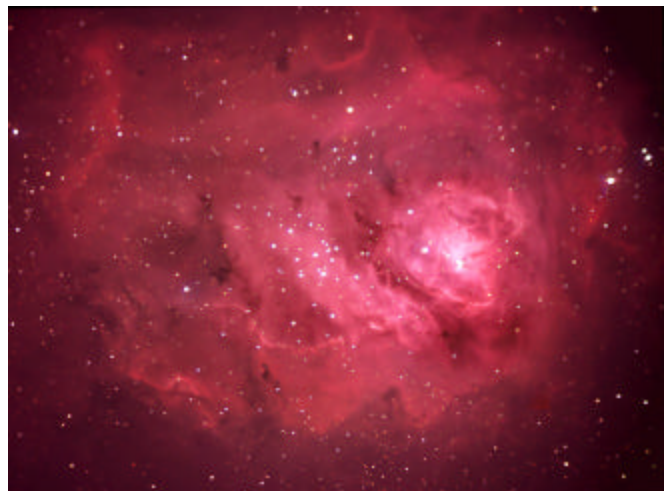
photo courtesy of Garth Buckles

## **Imaging in the Hydrogen Alpha band using a CCD** **By Greg Pyros, OCA Astrolmagers Group Chairman. All photos by the Author**

I started doing deep-space imaging with a Hydrogen-alpha (Ha) filter on my CCD camera earlier this year. When asked to write an article to help others get involved with it, I thought I could easily describe the two simple steps required: 1) get an H-a filter, and 2) take long exposures with it in front of your CCD camera. For some reason still unknown to me, that version of this article lacked the details, so I am hereby expanding upon it.

Let's start with the definition of H-alpha from [www.spaceweather.com](http://www.spaceweather.com) : [H alpha] "The first atomic transition in the hydrogen Balmer series; wavelength = 656.3 nm. This absorption line of neutral hydrogen falls in the red part of the visible spectrum and is convenient for solar observations."

If you don't understand all of that, don't worry, neither do I. All that you really need to get out of it is that the electromagnetic spectrum (from long to short wavelengths) goes like this: gamma ray -> x-ray-> ultraviolet -> visible light -> infrared -> microwave -> radio waves. The visible light portion that we see as light with goes from 410nm (violet) to 680nm (red). 1 nm (nanometer) = 1 billionth of a meter. Or, to really confuse you, 1 nm = 10 Angstroms (Å). So what they are saying is that deep in the red portion of our visible spectrum is a thin line centered at 656.3nm (or 6,563 Å, now that you know the conversion) that we are concerned with.



Ron Wodaski states on his web site: "Many nebulae emit strongly in the wavelength known as Hydrogen alpha. This is the light emitted by the most common type of excited hydrogen atoms. The atom absorbs some energy which kicks the electron to a higher energy level. When the electron falls back to a lower energy, it releases a photon with a wavelength of 656.3nm. Hydrogen alpha is just one such transition; other, less common transitions also result in emissions at specific wavelengths, but they are less common. Since the hydrogen-alpha emission is both common and limited to a single wavelength, narrow-band filters can be used to filter out all other light, and capture just the light resulting from this specific emission from hydrogen atoms."



The Pelican Nebula in Hydrogen Alpha

Now we are getting somewhere. This says that we want to use a filter to get rid of everything both above and below the Hydrogen alpha wavelength of 656.3nm. Various companies make filters to do this, all with slightly different parameters. Most of the differences are in the width of the passband allowed through the filter. The narrower the passband, the more expensive the filter.

The filter I use has a 3nm total passband – this allows only 654.8 to 657.8 through, which is about the narrowest available for deep sky work. Other companies make 10nm and even wider passband filters. The trouble with a wider passband is that since it is allowing a lot of information through that is not Hydrogen-alpha, your CCD chip will start to get saturated with information outside the Ha by the time you get enough Ha data through to record it.

If you just pick up a Ha filter and look through it, most people are surprised to see that it is almost totally opaque. If you remember this, it is not surprising that it takes a minimum of an hour of total CCD exposures to start getting reasonable detail, and often two hours will just barely be enough. I will usually do a series of 5 or 10 minute exposures to reach this amount.



M17- The Swan or Omega Nebula in H-alpha

These H-alpha images are usually beautiful by themselves, or you can then take images through normal R, G, and B filters to add to them by using the H-alpha images as your luminance frames in an LRGB combined color image. (An example is M8, the Lagoon Nebula on the previous page) When you combine images, though, be careful of your focusing. Most Ha filters have different thicknesses compared to standard LRGB filters and you probably will have to refocus between filters.

The other issue that comes up when you have to refocus is that your images may be slightly different scales, and you will need to resize them prior to combining. A program like RegiStar makes this a relatively painless process, but it is another step you will have to go through.

If you have questions on this process and want to learn more about it, or any other types of CCD or film imaging, please feel free to come to our OCA Astromagers group meetings on the third Tuesday of each month, with directions listed on the OCA web site. I hope to see you there.

(more of Greg Pyros' images can be seen on his website at <http://www.gregpyros.com> )