Polarizing Filters and Nebulae
by Jim Thompson, P.Eng
Test Report – January 21st, 2015

Objectives:
It was recently reported by a user on the Mallincam Yahoo technical group that they perceived a marked improvement in the appearance of deepsky objects in their astro-video camera under light polluted skies when they added a variable polarizing filter. Variable polarizing filters function like neutral density filters (ND) with user adjustable optical density. Since the ND response of these filters does not favour the emissions from nebulae any differently than light pollution, one would not expect them to do anything to help improve the appearance of deepsky objects. Figure 1 illustrates the light spectrum for a number of different sources, both wanted and unwanted, and Figure 2 shows the measured spectral response of a typical variable polarizer. To confirm whether or not polarizing filters do anything to improve the view of deepsky objects, I have selected to test their performance against that of no filter and a typical broad band LP filter. The results of this test are summarized in this report.

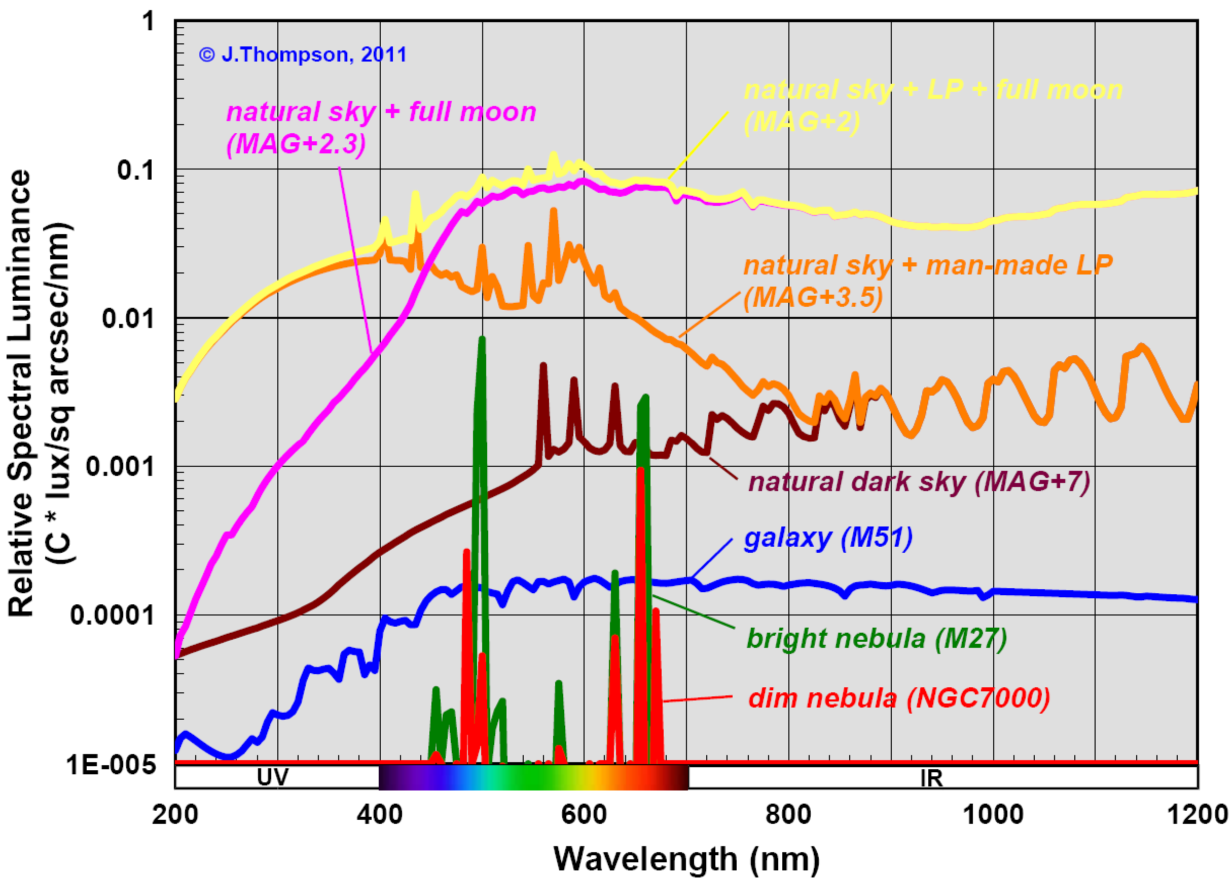


Figure 1 LP & DSO Emission Spectra in Absolute Scalar Units

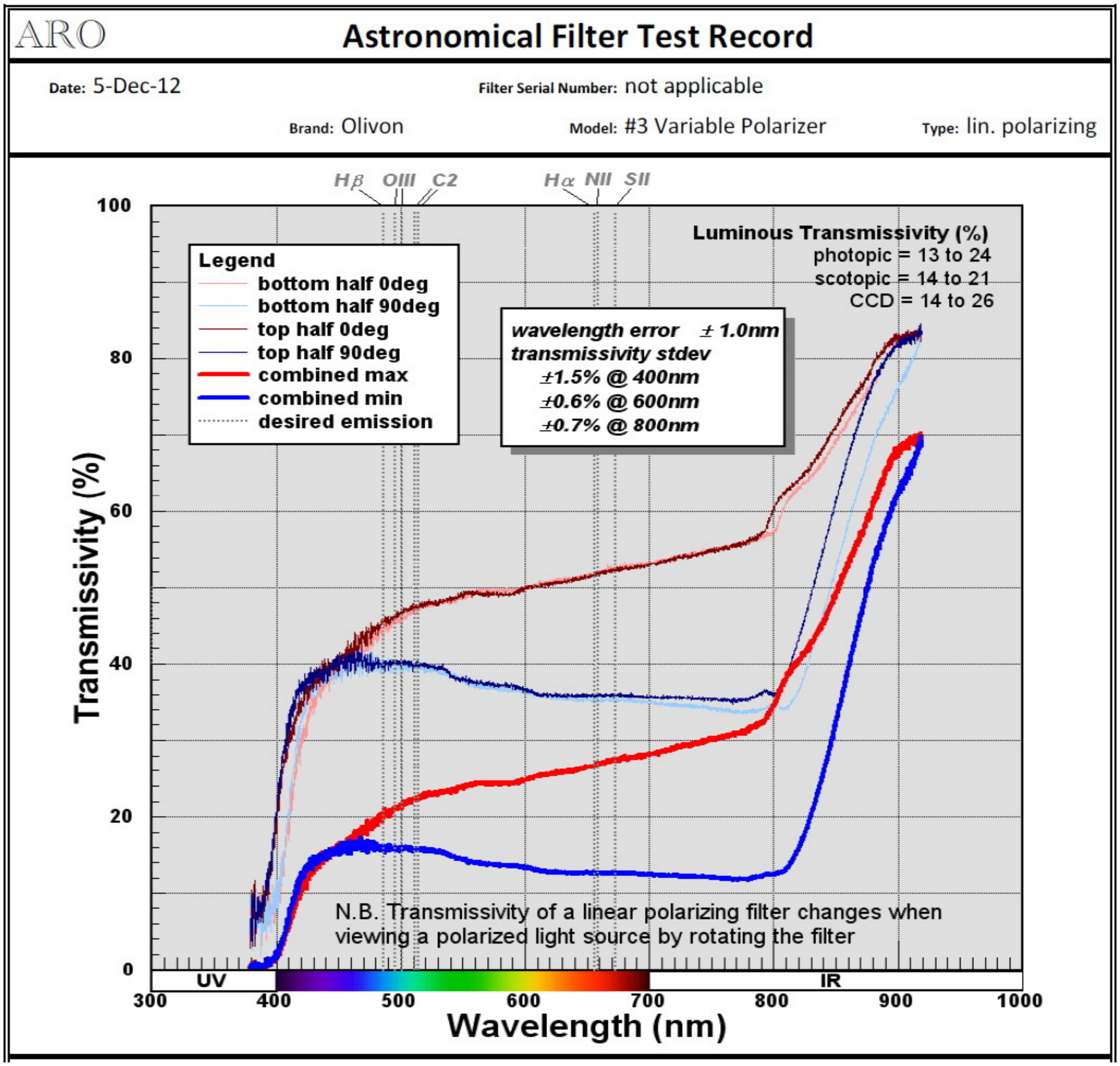


Figure 2 Measured Spectral Response of a Typical Variable Polarizing Filter

Methodology:

The methodology of this test is simple: look at the same object with the same telescope with and without the polarizing filter under light polluted skies. I collected my observations from a single session occurring on the evening of January 20th, 2015. Conditions during the testing were 100% clear with average transparency and seeing, and temperatures were cold at around -17°C. Light pollution in my area results in a limiting visual magnitude of approximately +3.5. No Moon was visible in the sky for the duration of the testing. Testing was performed using a Williams Optics FLT98 triplet refractor held on an Orion Atlas EQ/G mount, located on a pier in my backyard in central Ottawa, Canada. I used a Sony ICX828 sensor based camera, remotely operated from inside my house. Installed on the camera was a MFR5 focal reducer which provided an overall focal ratio of approximately f/3.

Four filter configurations were tested:

A. no filter
B. 1/2 of variable polarizing filter (single linear polarizer)
C. complete variable polarizing filter (oriented for max transmission)
D. Meade Broadband Nebula filter

The Meade Broadband filter is nothing special, but is representative of any number of typical cheap broadband LP filters that people may happen to have in their astronomy kit.

For the test I chose M42 The Orion Nebula as my deepsky target. During the testing the object travelled from being on the meridian (due south) to approximately 25° west of the meridian. Data consisted of taking a screen capture of the object from the video camera using each of the filter configurations listed above. A reference exposure of 15sec was selected as this was the longest exposure I could achieve with no filter without overexposing the background. The exact same software settings used to capture the reference no filter image were used for all the other filters. I varied the exposure time in each case in order to achieve the same apparent image brightness. I also collected images using a fixed exposure time of 15sec, and adjusted the histogram black and white set points in the camera software to achieve the same apparent image brightness. The results are presented below.

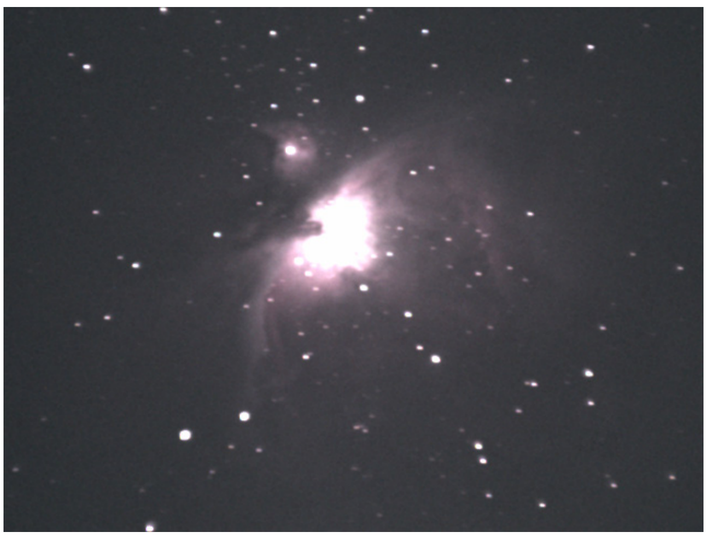
Results:

The 15sec exposure no filter capture is typical of observing with light pollution; the image has a orangish-pink colour cast and exposure is limited by the brightness of the sky background. With all of the other camera and software settings fixed to the same as the no filter shot, adding the single linear polarizer filter required 47sec of exposure to achieve the same image brightness. Adding the full variable polarizing filter resulted in the need for 75sec of exposure to achieve the same image brightness. In both cases, with the longer exposure time, there was no noticeable improvement in the overall image quality. In fact the full variable polarizing filter image appeared to lose some of its colour compared to the no filter image, perhaps due to the linear polarizing filter favouring IR somewhat over light in the visual band. In comparison, the Meade LP filter required 42sec of exposure to achieve the same image brightness, but the image quality is clearly much better than the no filter image.

Similar results were observed when the exposure time was fixed at 15sec. When the single linear polarizer image had its histogram black and white points adjusted to give the same image brightness as the no filter image, the result was a noisier and less defined image; simply an image with less accumulated light/data. The 15sec image with the Meade LP filter instead looks much smoother and shows a much blacker looking background. No data was collected at 15sec exposure with the full variable polarizer filter.

no filter (15sec)

single linear polarizer (47sec)



full variable polarizer - max trans (75sec)

Meade Broadband (42sec)

Figure 3 Test Images - Fixed Camera/Software Settings

no filter (15sec)

single linear polarizer (15sec)

Meade Broadband (15sec)

Figure 4 Test Images - Vary Histogram Black & White Set Point

Conclusions:

Based on the small amount of testing I have done, my observations are consistent with what I expected: adding a polarizing filter simply dims the entire scene. No advantage was observed using a polarizing filter on this deepsky object. If you have any questions, please feel free to contact me at: karmalimbo@yahoo.ca

Cheers,

Jim Thompson
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