# the ASTROGRAPH

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# the ASTROGRAPH

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COVER PHOTOGRAPH

Object..........M82 and M81
Photographer..........Robert C. Price
Instrument..........TOA150 (6 inch F/7.3 refractor)
Exposure..........three 20 minutes exposures at 200ASA
Camera..........Hutech modified Canon 40D
Date..........21 March 2009
Location..........farm just south of BlueKnob State Park, PA


**VOLUME 40 No. 6**
EDITOR..........Robert C. Price
CONTRIBUTING EDITOR..........Ralph Proctor
PROOFING CONTRIBUTOR..........Linda Miller
CONTRIBUTORS..........Lee C. Coombs


## Features



## Departments




**The ASTROGRAPH** is published in Adobe PDF format six times a year as follows: No. 1, August/March, No. 2 December/March, No. 3 December/March, No. 4 February/March, No. 5 June/July, No. 6 June/July.


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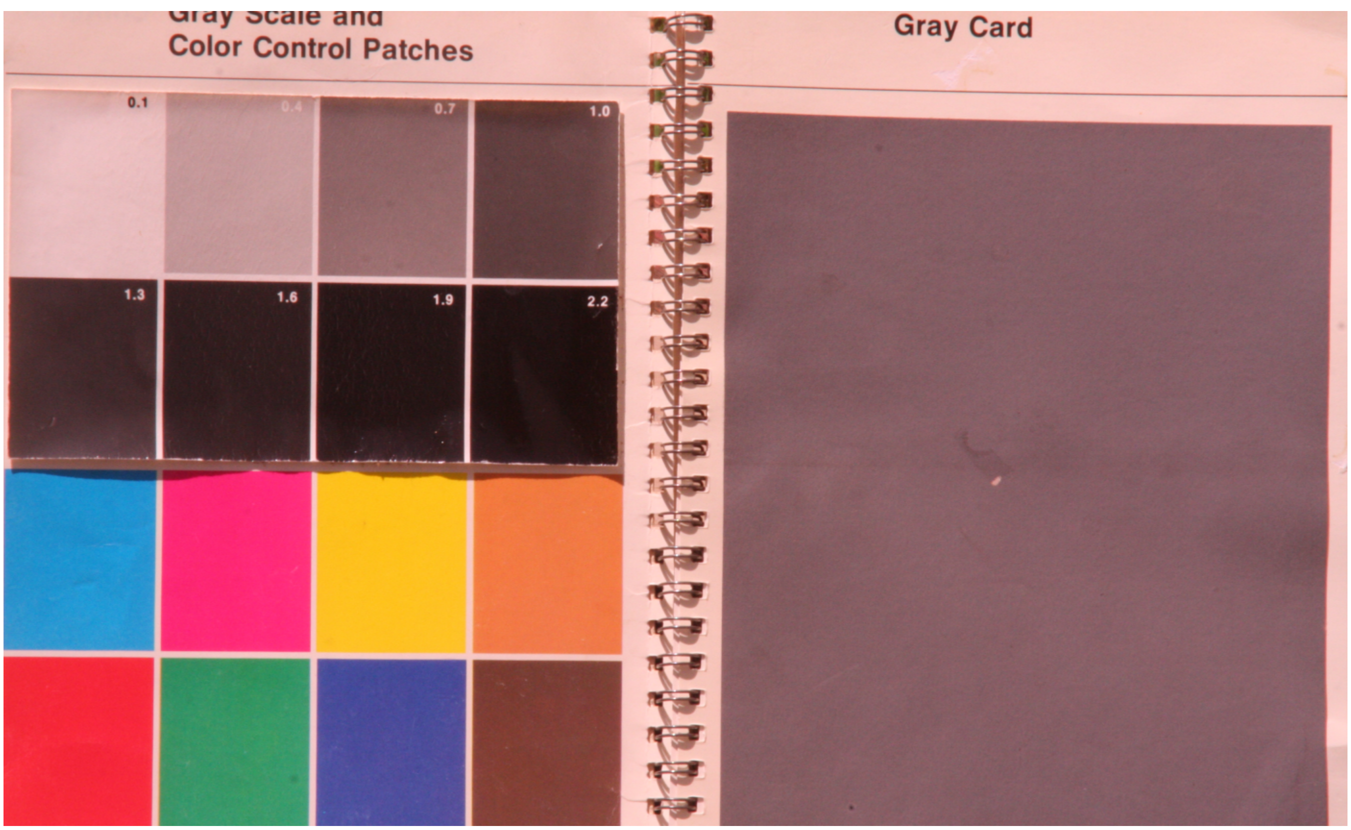
## Color Correction for Modified DSLR Cameras

*by*

Robert C. Price

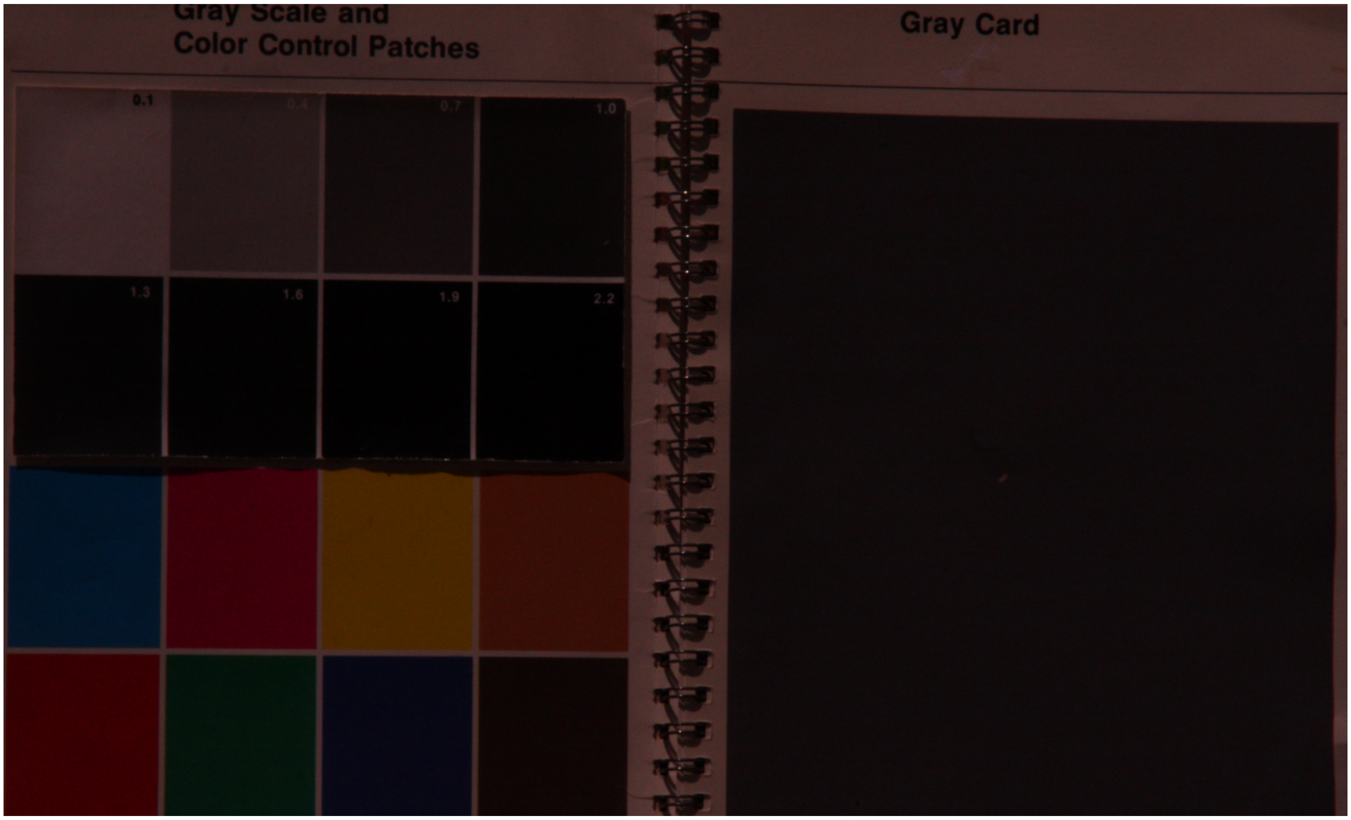
The modification to a DSLR camera to make it more suitable for astronomical photography consists of replacing the camera's normal infrared blocking filter with an infrared cut-off filter that passes the hydrogen alpha wavelength of light at 656 nanometers. The red color of emission nebula is primarily caused by hydrogen alpha light. By passing this light at 656 nanometers, more red light is allowed into the camera. As a result, the color of the nebula comes through much better in images taken with such modified cameras. This additional red light changes the camera's normal color balance. Images taken using such modified DSLR cameras take on a red hue. Figure 1 shows this red hue when a gray card/color chart is photographed with a modified camera. Figure 2 shows the same card taken with the same camera but using a custom color balance that allows the camera to take daylight pictures that look like normal daylight balanced images. When used for long exposure astronomical photography the normal camera color balance is utilized in order to allow the maximum amount of hydrogen alpha light into the camera. Typically several exposures are taken and then added or stacked to reduce background noise caused by the long astronomical exposure which typically take from 3 to 20 minutes. The red hue typical of modified cameras is present in each of the images that make up the final long exposure image. In order to faithfully reproduce the color of stars and nebula this red hue must be eliminated or stars and nebula will take on a false color. To determine how best to tackle the elimination of this red hue the author took 10 daylight images of a color card using a Hutech modified Canon 40D with an exposure that was 1/10 of a normal exposure. The 10 images were each taken in direct sunlight as were the images in Figure1 and Figure 2. Each of the 10 underexposed images was taken using an exposure of 1/2500 second at F/36 and 800ASA. The normal daylight image in Figure 1 and Figure 2 was taken at 1/250 second at F/36 and 800ASA. Figure 3 shows



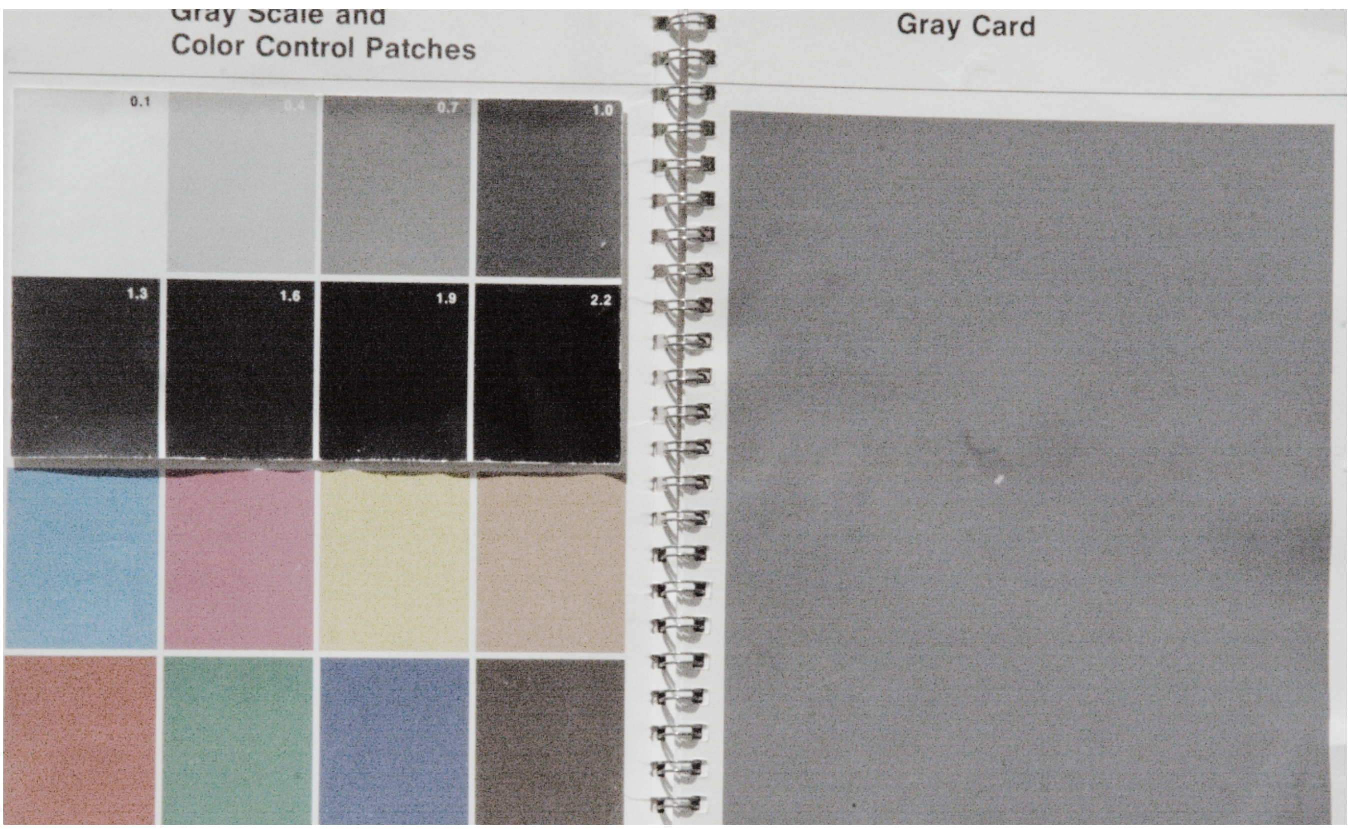

Above: Figure 1, gray card photographed in daylight using a Hutech modified Canon 40D camera at 800ASA. Exposure was 1/250 second at F/36.

the raw unprocessed appearance of one of these underexposed images. The 10 underexposed images were stacked in the program Deep Sky Stacker just as they would be if they were long exposure astronomical photography. Figure 4 shows the 10 images after being stacked using RAW camera files from a Hutech modified Canon 40D camera. Deep Sky Stacker allows control of each of the RGB color channels within the image processing of the final image. After a little trial and error it was found that aligning the RGB channels as shown in Figure 5 would achieve the same color balance that a normal daylight image obtained. The stacked image produced by the Deep Sky Stacker program was very flat and lacked color intensity. Figure 6 shows this image after the color intensity was increased in Adobe Photoshop. After color correcting stacked underexposed images of a color card from a Hutech modified Canon 40D to achieve good daylight color balance, the next step was to use actual long exposure astronomical images and compare the final result with the image obtained from an unmodified Canon 40D. Figure 7 shows a raw unprocessed image of a 20 minute exposure of M33 taken with a Hutech modified Canon 40D at 100ASA. Three identical images to Figure 7 were stacked using Deep Sky Stacker and the RGB channels were aligned to overlap each other as closely as possible. Figure 8 shows the computer screen as it appeared after the 3 images were stacked and the RGB channels aligned. Note that the image in Figure 8 is very flat and lacks color. Images from Deep Sky Stacker typically require an image processing program such as Adobe Photoshop to increase color saturation and to adjust levels to darken the sky background. Figure 9 shows the result of increasing the color saturation on the image in Figure 8 as well as using levels on Adobe Photoshop to achieve a good black sky background. Figure 9 shows the result of using the previously described image processing steps on three 20 minute exposures of M33 taken with a Hutech modified Canon 40D and TeleVue NP-127 5 inch refractor. Figure 10 shows a 20 minute exposure of M33 taken with an unmodified Canon 40D at 400ASA and with this same 5 inch refractor. The image was processed without any attempt to color balance the image since with an unmodified camera color balance should be natural. Both images are similar in color balance. Note that the the modified camera brings out the hydrogen alpha nebulae.

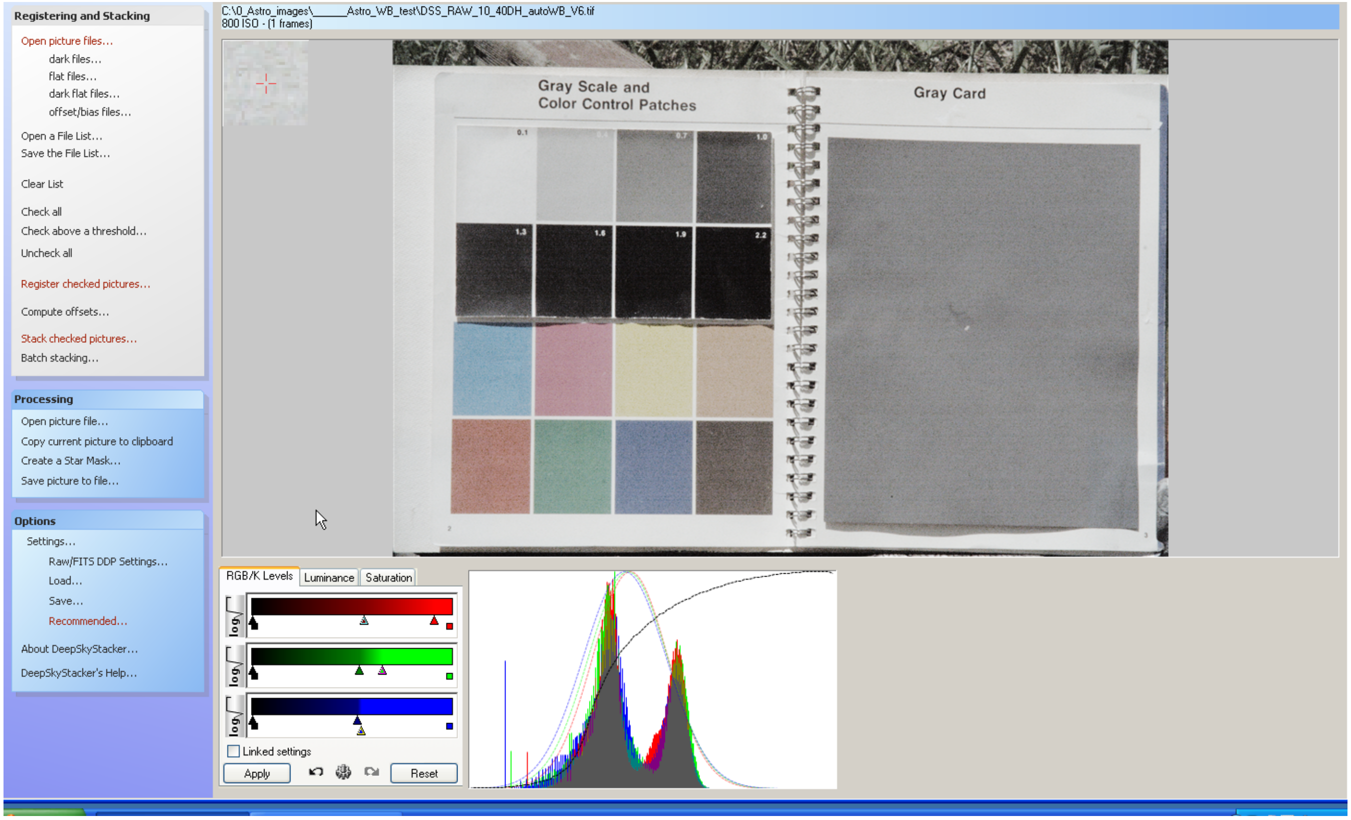

Above: Figure 2, gray card photographed in daylight using a Hutech modified Canon 40D camera at 800ASA. Exposure was 1/250 second at F/36. Custom white balance was used to give a daylight color balance.



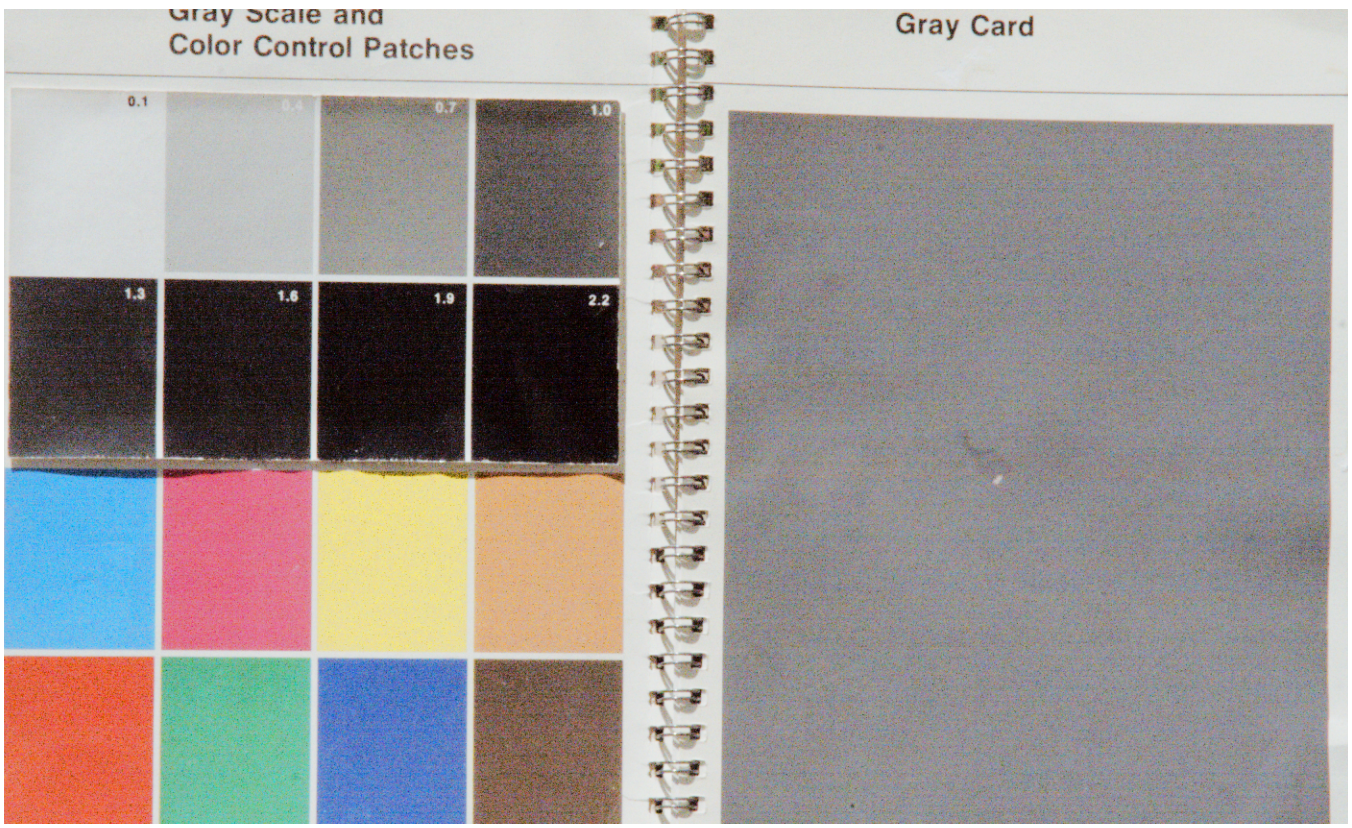

Above: Figure 3, raw unprocessed image of a gray card photographed in daylight using a Hutech modified Canon 40D camera at 800ASA. Exposure was 1/2500 second at F/36. Image was underexposed by a factor of 10.




Above: Figure 4, resulting image from ten images identical to Figure 3 stacked using Deep Sky Stacker. Note both the lack of color and image noise in the stacked image.

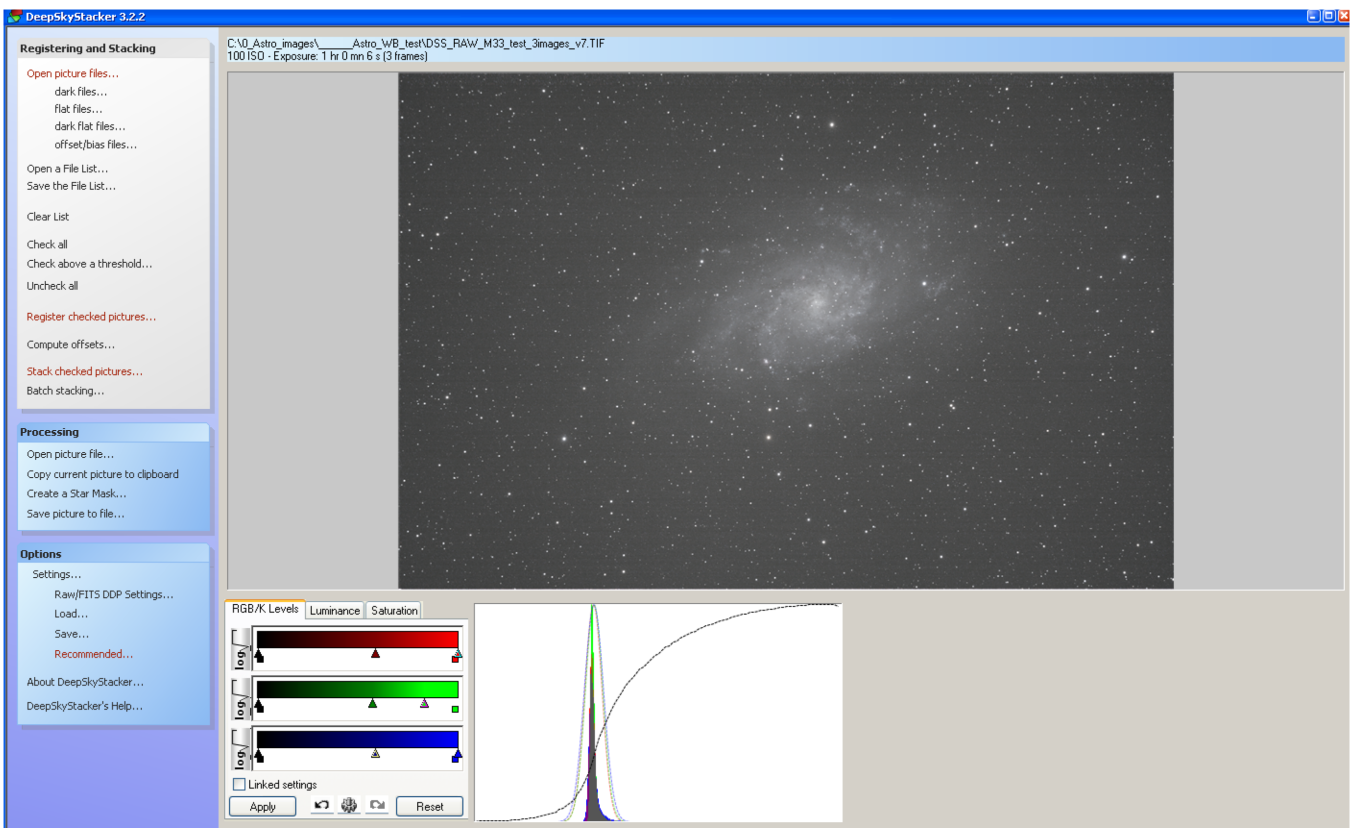



Above: Figure 5, computer screen from Deep Sky Stacker that produced Figure 4. Image shows how the RGB channels were aligned to produce a stacked image with daylight color balance.




Above: Figure 6, image in Figure 4 after additional processing in Adobe Photoshop to intensify the colors. Note there is still a large amount of image noise.

Above: Figure 7, raw unprocessed image of M33 photographed using a Hutech modified Canon 40D camera at 100ASA. Exposure was 20 minutes using a TeleVue NP-127 5 inch refractor.




Above: Figure 8, computer screen of Deep Sky Stacker showing 3 stacked images of M33 identical to that of Figure 7. Also shown is the RGB channel alignment used to obtain a neutral sky background.

Above: Figure 9, the image shown in Figure 8 after additional processing in Adobe Photoshop to intensify the colors and adjust the levels to produce a dark sky background.

Above: Figure 10, image of M33 taken with an unmodified Canon 40D camera at 400ASA. This single exposure was 20 minutes using a TeleVue NP-127 5 inch refractor. Image processing was limited to level adjustments. No adjustments were made to change the color balance. Note that this image is similar in color balance to Figure 9.

## Astrophotography for June and July

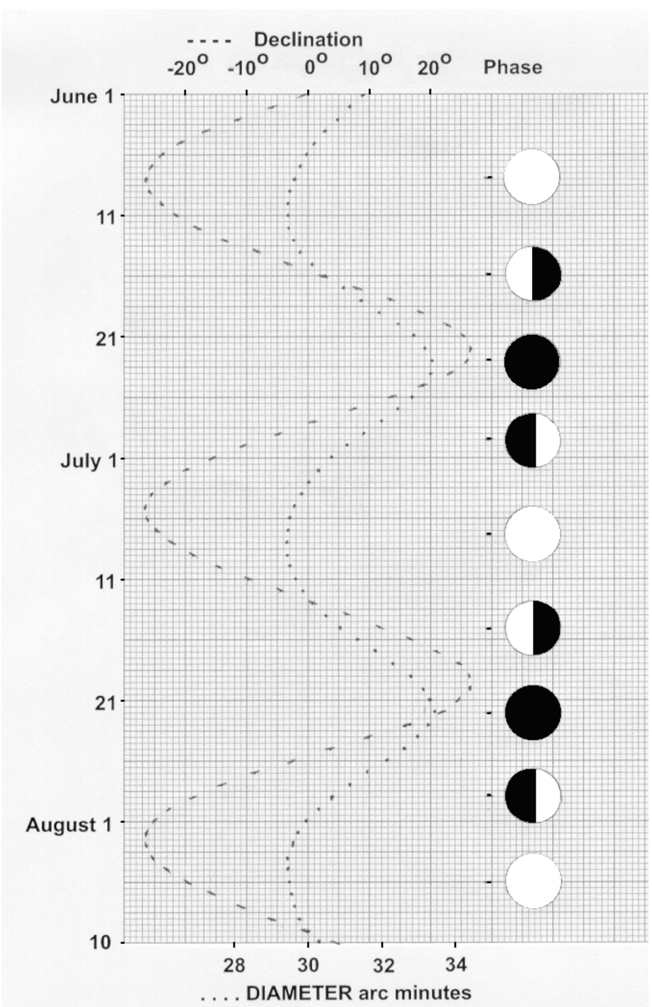
*by*

Ralph Proctor

**Mercury** begins June as a morning object low in the eastern sky. Mercury moves higher in the eastern sky and reaches a greatest western elongation of 23 degrees on 13 June when it will be in poor photographic position with a declination of minus 20 degrees. During the remainder of June Mercury moves lower in the eastern sky and by the first week in July disappears into the Sun's glare.

**Venus** begins June as a morning object high in the eastern sky. Venus reaches a greatest western elongation of 46 degrees on 5 June when it will be in good photographic position with a declination of plus 9 degrees. During June and July Venus remains a morning object high in the eastern sky.

**Lunar Declination and Diameter:**




**The Moon's** waning crescent phases will be located high on the ecliptic and in excellent photographic position during June (June 22 and July (July 19), with an apparent declination of up to +26 degrees.

**Mars** begins June as a morning object low in the eastern sky in the constellation Sagittarius. During June and July Mars moves higher in the eastern sky, increases in brightness from magnitude +1.2 to +1.1, and increases in diameter from 4.7 to 5.3 arc seconds.

**Jupiter** begins June as a morning object in the eastern sky in the constellation Capricornus. During June and July Jupiter moves higher in the eastern sky, increases in brightness from magnitude -2.5 to -2.8, and increases in diameter from 41.8 to 48.6 arc seconds.

**Saturn** begins June as an evening object in the western sky in the constellation Leo. During June and July Saturn moves lower in the eastern sky, decreases in brightness from magnitude +0.9 to +1.1, and decreases in diameter from 17.9 to16.3 arc seconds.

**Uranus** begins June as a morning object low in the eastern sky in the constellation Aquarius. During June and July Uranus moves higher in the eastern sky, increases in brightness from magnitude +5.9 to +5.8, and increases in diameter from 3.46 to 3.63 arc seconds. Uranus is located at R.A. 23 hours 48.5 minutes declination -02 degrees 05 minutes on 15 June and at R.A. 23 hours 48.5 minutes declination -02 degrees 05 minutes on 15 July.

**Neptune** begins as a morning object high in the eastern sky in the constellation Capricornus. During June and July Uranus moves higher in the eastern sky, increases in brightness from magnitude +7.9 to +7.8, and increases in diameter from 2.29 to 2.35 arc seconds. Neptune is located at R.A. 21 hours 55.1 minutes declination -13 degrees 06 minutes on 15 June and at R.A. 21 hours 53.2 minutes declination -13 degrees 16 minutes on 15 July.

**Pluto** begins June as an evening object high in the western sky in the constellation Sagittarius. Pluto reaches opposition with the Sun on June 23 when it will be in poor photographic position with a declination of minus 18 degrees. During June and July Pluto remains constant in brightness at magnitude +13.9. Pluto is located at R.A. 18 hours 08.5 minutes declination -17 degrees 39 minutes on 15 June and at R.A. 18 hours 05.4 minutes declination -17 degrees 43 minutes on 15 July.

**Events:**

**Antares** will be occulted by the Moon on 7 June (04 hours universal time) for all North America except Canada, the northern part of South America, the northern part of the Atlantic Ocean, and the northwestern portion of Africa; on 4 July (10 hours universal time) for Japan, Guam, the Marshall Islands, the Kiribati Republic, and the Hawaiian Islands; and on 31 July (16 hours universal time) for northeastern Africa, southeastern Europe, the Middle East, Arabia, India, southern China, southeastern Asia, and the northern Philippines.

**Juno** will be occulted by the Moon on 15 June (23 hours universal time) for the southern Indian Ocean, northwestern Australia, Malaysia, New Guinea, and Melanesia.

**The Sun** will undergo a total eclipse on 21-22 July 2009 for India, southern and eastern Asia, Japan, northern Indonesia, the Philippines, and the western and central portion of the Pacific Ocean. The eclipse begins at 23 hours 58.3 minutes universal time 21 July and ends at 05 hours 12.4 minutes universal time 22 July. Central eclipse at local apparent noon occurs at 02 hours 33.0 minutes universal time 22 July. The shadow of the total eclipse begins in the central Pacific Ocean, travels across Asia, and ends off the eastern coast of India.

**The Moon** will undergo a penumbral eclipse on 7 July 2009 for North, Central and South America, the Pacific Ocean including the Hawaiian Islands and Australia. The eclipse begins (Penumbra contact) at 8 hours 32.8 minutes and ends at 10 hours 44.4 minutes universal time. Mid-eclipse occurs at 9 hours 38.6 minutes universal time.

## MINOR PLANETS

| | | position | | | |
|---|---|---|---|---|---|
| | | 15 June | | 15 July | |
| Planet | Magnitude | R.A. | Decl. | R.A. | Decl. |
| Ceres | 08.4 - 08.8 | 11 hr 08.5 min | +16 deg 33 min | 11 hr 45.2 min | +11 deg 00 min |
| Pallas | 09.0 - 09.0 | 08 hr 18.3 min | +05 deg 06 min | 09 hr 21.2 min | +05 deg 32 min |
| Juno | 10.2 - 09.0 | 23 hr 34.5 min | +02 deg 29 min | 00 hr 01.4 min | +04 deg 00 min |
| Vesta | 08.3 - 08.4 | 05 hr 27.8 min | +22 deg 09 min | 06 hr 49.2 min | +22 deg 17 min |

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Volume No. 7 issue 5 and 6
Volume No. 8 issue 11, 3, 4, and 5
Volume No. 9 issue 1, 4, 5, and 6
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Volume No. 11 issue 1, 2, 3[1], 4, 5, and 6
Volume No. 12 issue 1, 2, 3, 4, 5, and 6
Volume No. 13 issue 1, 2, 3, 4, 5, and 6
Volume No. 14 issue 1, 2, 3, 4, 5, and 6
Volume No. 15 issue 1, 2, 3, 4, 5, and 6
Volume No. 16 issue 1, 2, 3, 4, 5, and 6
Volume No. 17 issue 1, 2, 3[2], 4, 5, and 6
Volume No. 18 issue 1, 4, 5, and 6
Volume No. 19 issue 1, 2, 3, 4, 5, and 6
Volume No. 20 issue 1, 2, 3[1], 4, 5, and 6
Volume No. 21 issue 1, 2, 3, 4, 5, and 6
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Volume No. 23 issue 4 and 5
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Volume No. 27 issue 2, 3, 4, 5, and 6
Volume No. 28 issue 5 and 6
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**Product Evaluation: Takahashi TOA-150**

*by*

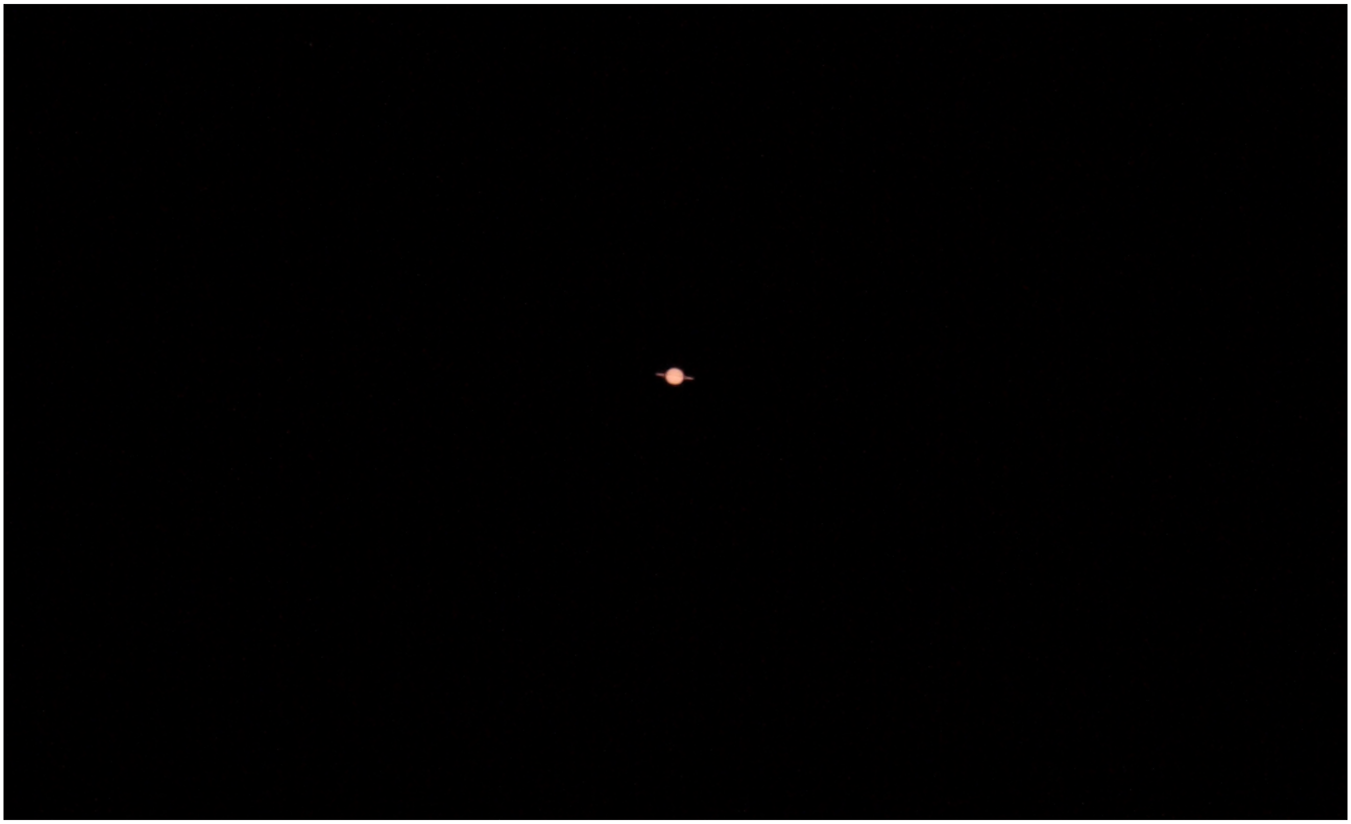
Robert C. Price

The product being evaluated is a Takahashi TOA-150 refractor telescope. The TOA-150 is an air spaced triplet ortho apochromat telescope with an effective aperture of 150mm and a focal length of 1100mm. The main tube has a diameter of 179mm and a length of 990mm. The TOA-150 has a retractable dew shield. Weight of the optical tube is 33 pounds without the 10 pound tube counter-weight. The TOA-150 has a 4 inch draw tube with a micro edge 10 to 1 focuser and a built-in camera angle adjuster. Both the focuser and camera angle adjuster are very smooth with positive locking mechanisms that do not disturb the focus or image position. The TOA-150 comes with extension tubes and adapters for 1.25 and 2 inch eyepieces. Camera adapters are optional items, but the 2 inch eyepiece holder will accommodate a standard 2 inch T-ring camera adapter. Figure 1 shows the TOA-150 with a Canon camera attached by means of the CA-35 camera adapter. The TOA-150, when used photographically, needs a field flattened even for APS-C size (22mm by 15mm) CCDs or DSLRs. The Takahashi 67 flattener does an excellent job even for 35mm size chips. Figure 2 is an image of the center portion of a 10 minute exposure of M57. Star images are small and color free. Figure 3 is the corner of the image in Figure 2. It is difficult to determine which corner the image is from. Stars at the edge and corner of this 35mm size image remain very sharp. Figure 4 is an image of Saturn at prime focus. Note how well the almost edge-on rings are resolved. Figure 5 is a prime focus image of NGC2392 and shows some of the smaller features of this small planetary nebula. Figure 6 is an image of M100 showing numerous smaller galaxies in the field. In summary, beside being built like a tank, the Takahashi TOA-150 is a superb optical instrument that delivers pinpoint color-free star images.


Above: Figure 1, Takahashi TOA-150 6 inch refractor with Canon camera and parallax rings attached.

Above: Figure 2, M57 taken at the prime focus of a Takahashi TOA-150. Exposure was 10 minutes using a Hutech modified Canon 5D mark II camera at 200ASA.. Image is unprocessed.

Above: Figure 3, corner of image frame from the same image as figure 2. Takahashi 67 field flattener was in used with the TOA-150. Note this is the corner of a 35mm size frame.



Above:   Figure 4, Saturn take at the prime focus of a Takahashi TOA-150.  Exposure was 1/100 second using a Hutech modified Canon 40D camera at 800ASA..

Above:   Figure 5,  NGC2392 taken at the prime focus of a Takahashi TOA-150.  Exposure was 20 minutes using a Hutech modified Canon 40D camera at 100ASA.

Above: Figure 6, M100 and numerous small galaxies photographed by Robert Price on 17 April 2009 using a TOA-150 6 inch refractor at F/7.3. Image consists of twelve 5 minute exposures taken with a Hutech modified Canon 40D camera at 800ASA.

Above: The Orion Nebula, M42 photographed by Lee C. Coombs on 12 March 2004 using a 10 inch F/5 Newtonian. Exposure was 35 minutes on Kodak Ektachrome Professional 200.