# the ASTROGRAPH



Volume 37 No. 4 February/March 2006

# the ASTROGRAPH

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COVER PHOTOGRAPH

Object.....the Pleiades, M45

Photographer.....Lee C. Coombs

Instrument.....10 inch F/5 Newtonian

Exposure\Film.....35 minutes/Kodak Ektachrome P200

Date.....13 October 2001

**VOLUME 37 No. 4**

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## Product Evaluation: Canon 300mm Lens

*by*

Robert C. Price

The product being evaluated is a Canon 300mm F/4L IS (image stabilized) lens. For this evaluation the image stabilization was turned off and the lens was focused manually. The Canon 300mm EF lens has automatic focus which includes a manual mode that allows the area for focusing to be confined to the center of the image. The lens and digital camera do have the ability to focus on the Moon, bright planets, and bright stars. Bright stars required several attempts for the automatic focus to successfully achieve focus. The author focused this lens on Saturn and using the image stabilization took exposures of 1/125 second. The resultant images were just able to show that Saturn has rings. The 300mm F/4 lens consists of 15 elements in 11 groups. Two of the elements are ultra-low dispersion glass elements to aid in the reduction of chromatic aberration. The lens is 8.7 inches long and weights 2.6 pounds. The lens comes with a tripod collar which allows attaching the lens to a tripod mount. Shown in Figure 1 is the lens mounted on a Losmandy dovetail plate by means of this tripod collar. This is a very popular lens for wildlife and sports photography because of its stabilization and long focal length. This lens also is available with a focal ratio of F/2.8 at over three times the cost of the F/4 lens. This 300mm lens is a type EF lens for Canon EOS model cameras. The EF lens only fits the newer Canon cameras, designated by the term EOS. Older lenses for film cameras such as the Canon AE-1 are type FD lenses and can fit the Canon EOS cameras with an adapter which contains an optical element that increases the focal length of the lens by about 25 percent. The author's testing indicates that the older Canon FD 300mm F/4 lens with the EOS camera adapter has a considerable amount of chromatic aberration when compared to the Canon EF 300mm F/4L IS lens. The author suspects that large amount of chromatic aberration in the Canon FD 300mm lens and EOS adapter combination is caused by the optical element in the FD to EOS lens adapter. The authors testing consisted of short exposures of the Moon and tree branches against a bright overcast sky. Long exposure testing consists of 1, 5 and 10 minute exposures of M42 and the Horsehead Nebula. The one minute tests consisted of exposures of M42 in focus and slightly out of focus both inside and outside focus.



Above: Figure 1, Canon 300mm F/4L IS lens with Canon 300D camera mounted on a Losmandy dovetail plate. Lens hood is shown retracted. The lens hood can be extented about 3 inches to the right.

The test that consists of photographing tree branches against a bright cloudy sky is a test of how well the lens corrects for chromatic aberration. For this test the exposure was set to the correct exposure for the tree branches and, thus, greatly overexposed for the bright cloud background. Exposure was 1/500 second for both lenses and both lenses were used wide open at F/4. The exposure of 1/500 second for both lenses slightly favored the older FD lens because the EOS adapter increased the focal ratio to about F/5. The images taken with the Canon EF 300mm F/4L lens exposed the background more that those taken with the Canon FD 300mm F/4 lens, which was really a 375mm F/5 lens when used with the EOS adapter. Ideally the edges of the tree branches should have no color other than the color of the background clouds. Out-of-focus tree branches will be more sensitive to this type of test. Even the best lens will show some color that does not exist in the scene, especially at the edges of out-of-focus branches. The Canon EF 300mm F/4L lens showed some minor color at the edges of some tree branches. The older Canon FD 300mm F/4 lens with EOS lens adapter showed colors around almost all tree branches including those in focus. As can be seen in Figures 2 and 3 there is significantly less chromatic aberration in the newer Canon EF 300mm F/4L lens. The images in Figures 2 and 3 are cropped from the original image files. The images are unaltered and the crop was the same amount for each image. Notice that the image, Figure 2, from the FD 300mm lens is larger. This is a result of the EOS adapter increasing the focal length of the lens to about 375mm.

Short exposures of the quarter and gibbous Moon were taken at full aperture. Exposures ranges from 1/500 second to 1/1000 second. Even the sharpest of these Lunar images did not appear to be as sharp as the author thought they should be. The images did however have far less chromatic aberration than the Lunar images taken with the older Canon FD 300mm lens and EOS lens adapter.

Five and ten minute exposures of the Orion Nebula, the Horsehead Nebula, and the Andromeda Galaxy taken with the EF lens showed that image quality, especially at the edge of the frame, was very good. Figure 4 shows what star images look like in the upper left corner of a typical 10 minute exposure. The image of M42 is centered in this frame and the cropped image shown in figure 4 is 1/3 the width of the full frame and 1/7 the height of the full frame. There was really not much difference in quality between star images in the center of the frame and those towards the edge, as can be seen in figures 4 and 6. Figure 5 shows the same upper left corner of an image frame taken with a Canon FD 300mm lens and EOS lens adapter. The corner star images are badly distorted. Figure 7 shows the center of this same image. Note that the faint stars are well focused in the center of the frame despite the bloated images of the brighter stars. Similar exposures with a 480mm focal length F/6 short focus refractor, the Orion Express 80, showed star images at the corner of the frame that were not as well defined as the images from the Canon EF 300mm F/4 lens.

The inside and outside of focus test consisted of 50 second exposures of M42 as shown in Figures 8 and 9. The results are similar to results obtained with the Canon FD lens with EOS lens adapter and two other refractor telescopes the author has tested. Ideally the inside and outside of focus images should look identical, but with refractive optics they do not seem to look identical, but rather are similar to the results depicted in Figures 8 and 9. The images from the Canon EF lens are better defined than the Canon FD lens and also better defined than two other refractors the author has tested in this manner.

In summary the author concludes that this lens is suitable for astrophotography. It is fast and provides sharp, well color-corrected, star images over the field covered by the Canon 300D camera, 15.1mm by 22.7mm.



Above: Canon 300mm F/4L IS lens evaluation. Saturn photographed after autofocus. Exposure was 1/125 seconds at F/4 using a Canon 300D camera at 400ASA.



Above: Figure 2, author's chromatic aberration test using a Canon 300mm F/4L IS lens. Exposure was 1/500 second with a Canon 300D camera. Image shows small amount of coloration at the edge of some tree branches.



Above: Figure 3, author's chromatic aberration test. Shown above is the same test as shown in Figure 2, but using a Canon FD 300mm F/4 lens and EOS lens adapter. Exposure was 1/500 second using a Canon 300D camera. Image shows a large amount of coloration at the edge of most tree branches. Note the difference in image size caused by the EOS camera adapter optical element increasing the focal length of the Canon 300mm FD lens to about 375mm.



Above: Figure 4, Canon 300mm F/4L IS lens evaluation. Shown above is the top left portion of the image. The image is centered on M42, which is not shown. Photographed by Robert C. Price on 22 December 2005. Exposure was 517 seconds using a Canon 300D camera at 400ASA. Above image was cropped but no image processing was used.



Above: Figure 5, lens evaluation showing same top left portion of the image frame, similar to the area shown in Figure 6,but photographed with a Canon FD 300mm lens and EOS lens adapter. Photographed by Robert C. Price on 26 December 2005. Exposure was 632 seconds using a Canon 300D camera at 400ASA. Above image was cropped but no image processing was used. Note the typical digital image defects in both images.



Above: Figure 6, the same image as Figure 4, but centered on the southern edge of M42. The area shown in Figures 4, 5, 6, and 7 is about one third the width and one seventh the height of the full image frame.



Above: Figure 7, the same image as Figure 5, but centered on the southern edge of M42. Note the bloated images of the brighter stars.



Above: Figure 8, Canon 300mm F/4L IS lens evaluation. Image is centered on the southern portion of M42 and was deliberately set inside focus to show the inside focus appearance of the optics. Photographed by Robert C. Price on 22 December 2005. Exposure was 50 seconds using a Canon 300D camera at 400ASA. Above image was cropped but no image processing was used.



Above: Figure 9, Canon 300mm F/4L IS lens evaluation. Image is centered on the southern portion of M42 and was deliberately set outside focus to show the outside focus appearance of the optics. Photographed by Robert C. Price on 22 December 2005. Exposure was 52 seconds using a Canon 300D camera at 400ASA. Above image was cropped but no image processing was used.



Above: Canon 300mm F/4L IS lens evaluation. Full frame centered on M42, the Orion Nebula. Photographed by Robert C. Price on 22 December 2005. Exposure was 517 seconds using a Canon 300D camera at 400ASA. Image processing included level adjustment and background color correction. Processing did not include dark frame subtraction or hot pixel reduction.

## Astrophotography for February and March

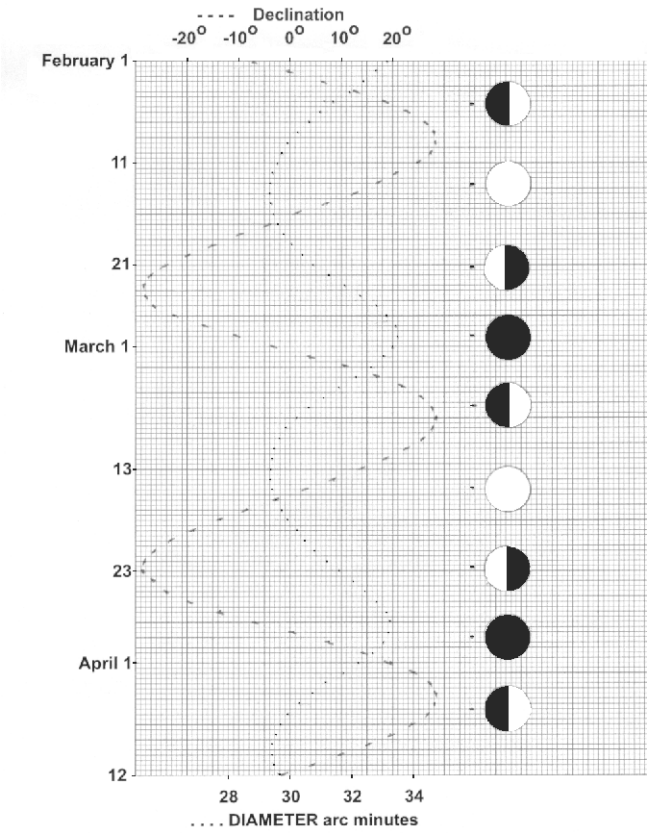
*by*

Ralph Proctor

**Mercur**y begins February lost in the Sun's glare, but emerges from the Sun's glare in early February as an evening object low in the western sky. Mercury moves higher in the western sky and reaches a greatest eastern elongation of 18 degrees on 24 February when it will be in poor photographic position with a declination of minus 1 degree. During March Mercury moves lower in the western sky and disappears into the Sun's glare in early March, reaching superior conjunction on 12 March. Mercury emerges from the Sun's glare in late March as a morning object low in the eastern sky.

**Venus** begins February as a morning object low in the eastern sky. During February and March Venus moves higher in the eastern sky and reaches a greatest western elongation of 47 degrees on 25 March when it will be in poor photographic position with a declination of minus 14 degrees.

**Lunar Declination and Diameter:**




**The Moon's** waxing gibbous phase will be located high on the ecliptic and in excellent photographic position during February (February 9) and March (March 8), with an apparent declination of up to +29 degrees.

**Mars** begins February as an evening object high in the western sky in the constellation Aries but moves into the constellation Taurus in March. During February and March Mars moves lower in the western sky, decreases in brightness from magnitude + 0.2 to + 1.2, and decreases in diameter from 8.9 to 5.8 arc seconds.

**Jupiter** begins February as a morning object high in the eastern sky in the constellation Libra. During February and March Jupiter moves higher in the eastern sky, increases in brightness from magnitude -2.0 to -2.4, and increases in diameter from 36.1 to 42.7 arc seconds.

**Saturn** begins February as an evening object high in the western sky in the constellation Cancer. During February and March Saturn moves lower in the eastern sky, having reached opposition on 27 January. Saturn decreases in brightness from magnitude -0.2 to + 0.1, and decreases in diameter from 20.4 to 19.2 arc seconds.

**Uranus** begins February lost in the Sun's glare, but emerges from the Sun's glare in late March as a morning object low in the eastern sky in the constellation Aquarius. During February and March Uranus moves higher in the eastern sky, remains constant in brightness at magnitude + 5.9, and increases in diameter from 3.36 to 3.37 arc seconds. Uranus is located at R.A. 22 hours 46.8 minutes declination -8 degrees 34 minutes on 14 February and at R.A. 22 hours 52.8 minutes declination -7 degrees 56 minutes on 15 March.

**Neptune** begins February lost in the Sun's glare, but emerges from the Sun's glare in late February as a morning object low in the eastern sky in the constellation Capricornus. During February and March Neptune moves higher in the eastern sky, remains constant in brightness at magnitude +8.0, and increases in diameter from 2.20 to 2.22 arc seconds. Neptune is located at R.A. 21 hours 20.3 minutes declination -15 degrees 43 minutes on 14 February and at R.A. 21 hours 24.4 minutes declination -15 degrees 25 minutes on 15 March.

**Pluto** begins February as a morning object low in the eastern sky. During February and March Pluto moves higher in the eastern sky and increases in brightness from magnitude +14.0 to + 13.9. Pluto is located at R.A. 17 hours 44.3 minutes declination -15 degrees 53 minutes on 15 February and at R.A. 17 hours 46.0 minutes declination -15 degrees 50 minutes on 15 March.

**Events:**

**Uranus** will be occulted by the Moon on 27 March (15 hours Universal Time) for part of Antarctica.
**Spica** will be occulted by the Moon on 18 February (05 hours Universal Time) for the extreme eastern part of North America and central Africa; and on17 March (11 hours Universal Time) for the Hawaiian Islands and the extreme western part of South America.
**Antares** will be occulted by the Moon on 21 February (21 hours Universal Time) for Indonesia, Australia, and all but the northeastern part of New Zealand; and on 21 March (03 hours Universal Time) for the northeastern tip of South America and the southern tip of south Africa.
**Ceres** will be occulted by the Moon on 25 February (10 hours Universal Time) for the southern tip of South America and Antarctica; and on 25 March (12 hours Universal Time) for northwestern South America, central and eastern North America, western Europe, and the British Isles.

**The Sun** will undergo a total eclipse on 29 March 2006. The eclipse starts in eastern Brazil, crosses the Atlantic and continues into Ghana, Togo, Benin, Nigeria, Niger, northwestern Chad, Libya, the northwestern tip of Egypt, Turkey, northwestern Georgia, southwestern Russia, Kazakstan, the southern tip of Russia, and ends in the northern tip of Mongolia. The eclipse begins and ends at 7 hours 36.8 minutes and 12 hours 45.6 minutes Universal Time respectively. Central eclipse at local apparent noon occurs at 10 hours 33.2 minutes Universal Time.
**The Moon** will undergo a penumbral eclipse on 14-15 March 2006 for Africa, Europe, the Middle East, western Russia, and Greenland. Mid-eclipse occurs at 23 hours 47.7 minutes Universal Time.

**MINOR PLANETS**

| | | position | | | |
|---|---|---|---|---|---|
| | | 14 February | | 15 March | |
| Planet | Magnitude | R.A. | Decl. | R.A. | Decl. |
| Ceres | 08.5 - 09.1 | 19 hr 54.8 min | -24 deg 30 min | 20 hr 40.7 min | -23 deg 07 min |
| Pallas | 09.6 - 10.0 | 18 hr 07.7 min | +06 deg 51 min | 18 hr 38.5 min | +10 deg 47 min |
| Juno | 09.5 - 09.7 | 05 hr 04.6 min | +06 deg 31 min | 05 hr 39.1 min | +11 deg 00 min |
| Vesta | 08.5 - 07.8 | 06 hr 34.2 min | +25 deg 10 min | 06 hr 39.7 min | +25 deg 47 min |

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## The Constellation Taurus

*by*

Robert C. Price

The constellation Taurus crosses the meridian just after 7:30 PM in mid-February. Taurus is a medium size constellation located just north of the constellations Eridanus and Orion. From east to west Taurus is 2 hours 35 minutes in extent, from right ascension 3 hours 20 minutes to 5 hours 55 minutes. In declination it varies from -2 degrees south declination to 31 degrees north declination. On the north it borders Auriga and Perseus, on the east Gemini and Orion, and on the west Aries and Cetus. The constellation contains a number of galactic star clusters, diffuse nebula, and two planetary nebulae. Some objects of photographic interest are listed in the table on page 61.

**Alpha Tauri**, Aldebaran, is a bright 0.86 magnitude star which visually appears to be a member of the Hyades star cluster. It is not a member because it is closer, 68 light years away, and does not share the proper motion of stars in the Hyades cluster.

**The Hyades** is a large V-shaped galactic star cluster 4.5 degrees in extent. Aldebaran is the bright star at the eastern tip of this naked-eye cluster. Estimated distance to this cluster is 130 light years.

**M1** is a bright planetary nebula and is one of the most studied planetary nebula in the sky. It is one of the few planetary nebula with fine filaments throughout the nebula. All indication is that this nebula resulted from a supernova on 4 July 1054 AD. The supernova star has collapsed to a rapidly rotating neutron star that emits x-rays and is optically variable at a rate of 30 times a second. Estimated distance to this planetary is 6300 light years, making it some 6 light years in diameter.

**M45**, the Pleiades, is a bright naked-eye galactic star cluster. It consists of 9 bright B-type giant stars and about 200 fainter stars. The most striking photographic feature is the bright blue nebulosity around the stars Maia, Taygeta, and Merope. This nebulosity is caused by the blue light from these stars reflecting off dust particles. Estimated distance to this cluster is 400 light years.

**S 147**, is large faint elliptical shaped nebula 2 by 3 degrees in extent. It is comprised of faint filaments similar to that of the veil nebula but its faint slender filaments are more circular in appearance. Because of its faintness S 147 was not discovered until 1952.



Above: M1, the Crab Nebula, photographed by John Sussenback using a 14.5 inch F/4.7 Newtonian with coma corrector and H-alpha pass filter. Exposure was 40 minutes on hypersensitized Kodak 2415 film.

## Objects for Astrophotography in Taurus

| | Mag. | Size. | R.A. | Declination | Description |
|---|---|---|---|---|---|
| IC 1435 | | 3' dia | 03 hr 43.2 min | +23 deg 42 min | Nebulosity surrounding star Merope. |
| M 45 | 6 | 100' dia | 03 hr 43.9 min | +23 deg 58 min | Galactic star cluster, the Pleiades. |
| NGC 1514 | 6 | 120" dia | 21 hr 30.9 min | -01 deg 04 min | Planetary nebula with 10th. magnitude central star. |
| I.359 | | 1' | 04 hr 17.1 min | +28 deg 06 min | Small diffuse nebula. |
| NGC 1555 | 11.9 | 30" dia | 04 hr 19.0 min | +19 deg 25 min | Hind's Variable Nebula. |
| I.2087 | | 2' dia | 04 hr 36.9 min | +25 deg 38 min | Diffuse nebula. |
| NGC 1647 | 6.5 | 40' dia | 04 hr 43.2 min | +18 deg 59 min | Galactic star cluster with 25 members. |
| NGC 1746 | | 45' dia | 05 hr 00.6 min | +23 deg 44 min | Irregular galactic star cluster. |
| NGC 1758 | 8 | 45' dia | 05 hr 00.6 min | +23 deg 44 min | Part of NGC 1746. |
| NGC 1807 | 7.5 | 10' dia | 05 hr 07.8 min | +16 deg 28 min | Galactic star cluster with 15 members. |
| NGC 1817 | 8 | 15' dia | 05 hr 09.2 min | +16 deg 38 min | Galactic star cluster with 50 members. |
| NGC 1952 | 9 | 5' x 3' | 05 hr 31.5 min | +21 deg 59 min | Planetary nebula M1, the Crab Nebula. |
| S 147 | | 120' x 180' | 05 hr 36.0 min | +28 deg 00 min | Large elliptical duffuse nebula. |



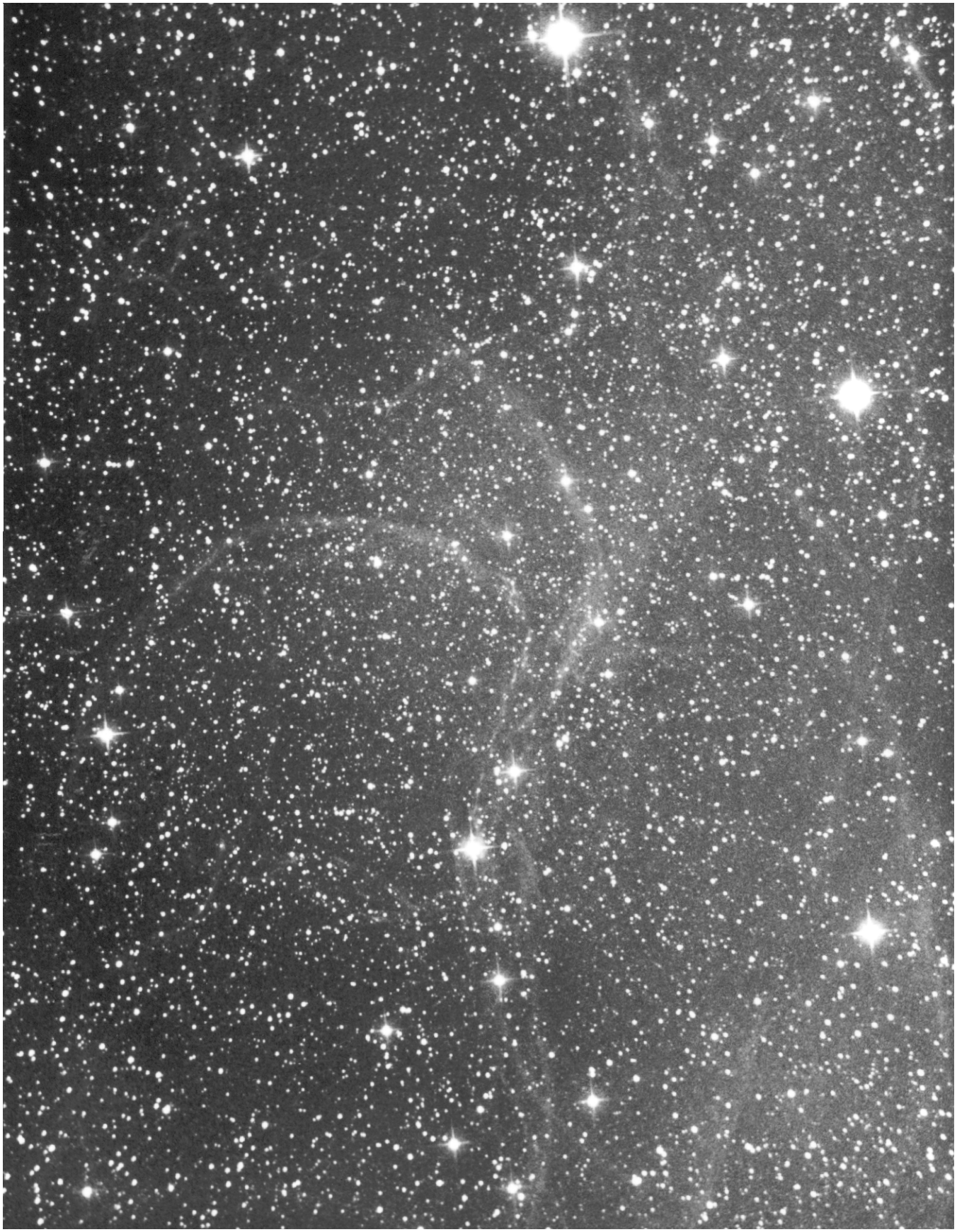
Above: NGC 1514 photographed by Lee C. Coombs on 4 December 1978 using a 10 inch F/5 Newtonian. Exposure was 15 minutes on Kodak 103a-E film developed in MWP-2 for 9 minutes at 20°C. Enlargement was 8 times.



Above: NGC 1746 photographed by Martin Germano from Mt Pinos CA on 26 October 1997 using an 8 inch F/5 Newtonian with coma corrector and St-4 autoguider. Exposure was 60 minutes on hypersensitized Kodak 2415 film developed in D-19 for 6.5 minutes at 70°F. Enlargement is 7 times.



Above: NGC 1807 photographed by Martin Germano from Mt. Pinos CA on 11 November 1990 using an 8 inch F/5 Newtonian with coma corrector. Exposure was 30 minutes on hypersensitized Kodak 2415 film developed in D-19 for 8 minutes at 68°F. Enlargement is 7 times.



Above: S 147 photographed by Martin Germano from Mt Pinos CA on 9 October 1988 using an 8 inch F/5 Newtonian. Exposure was 90 minutes on hypersensitized Kodak 2415 film developed in D-19 for 7 minutes at 68°F. Enlargement is 7 times.



Above: Duffuse nebula IC 1318 photographed by Lee C. Coombs on 2 July 2005 using a 10 inch F/5 Newtonian. Exposure was 30 minutes on Kodak Ektachrome P200 slide film.