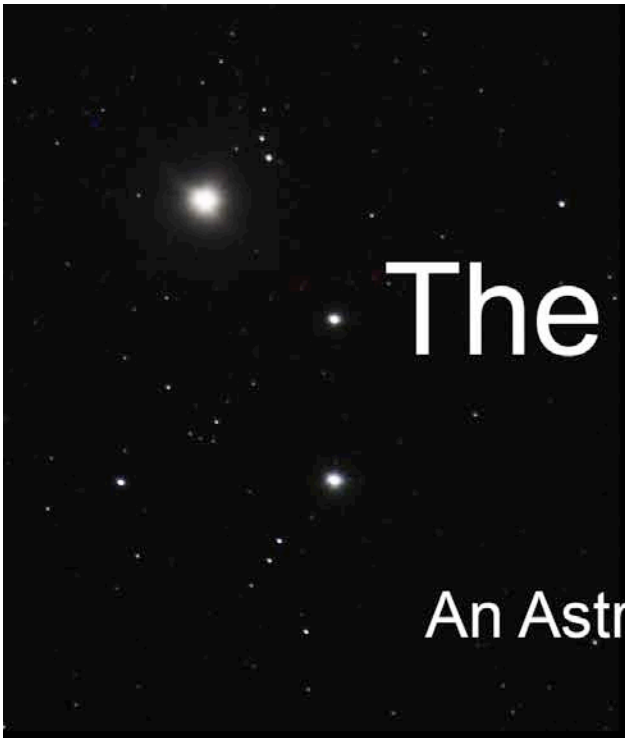
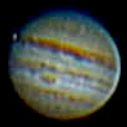




The Planets

An Astrophoto Album

by

David B.Viscio

First Edition
November 2014

The Planets 1

This album is a compilation of images of planets, dwarf planets and asteroids acquired using digital cameras. The images were taken over a 10-year span from April 26, 2002 to July 06, 2012.

A variety of cameras and optical systems were used to acquire these images. Specific details of the equipment and techniques are found within each section of the album.

This album contains images for:

Conjunctions and Appulses
Asteroids
Jupiter
Mars
Pluto
Saturn
Venus

Conjunction and Appulse

A *conjunction* occurs when two astronomical objects have either the same right ascension or the same ecliptical longitude when observed from the Earth. In the case of two objects that always appear close to the ecliptic - such as two planets, or the Moon and a planet, or the Sun and a planet - this implies an apparent close approach between the objects as seen on the sky.

Appulse refers to the closest approach of one celestial object to another as seen from Earth. Usually it refers to the close approach of two planets together in the sky or of the Moon to a star or planet as seen by an observer located on Earth.

Therefore, conjunctions and appulses involve two Solar System bodies or one Solar System body and one more distant object such as a star. In general, the precise time of an appulse will be different from that of a conjunction. It is possible in some particular cases for an appulse to occur but no conjunction.

When the celestial bodies come so close together that one actually passes over the other, the event is known as an occultation.

Both conjunctions and appulses are apparent phenomena caused by perspective only - there is no close physical approach in space between the two objects involved.

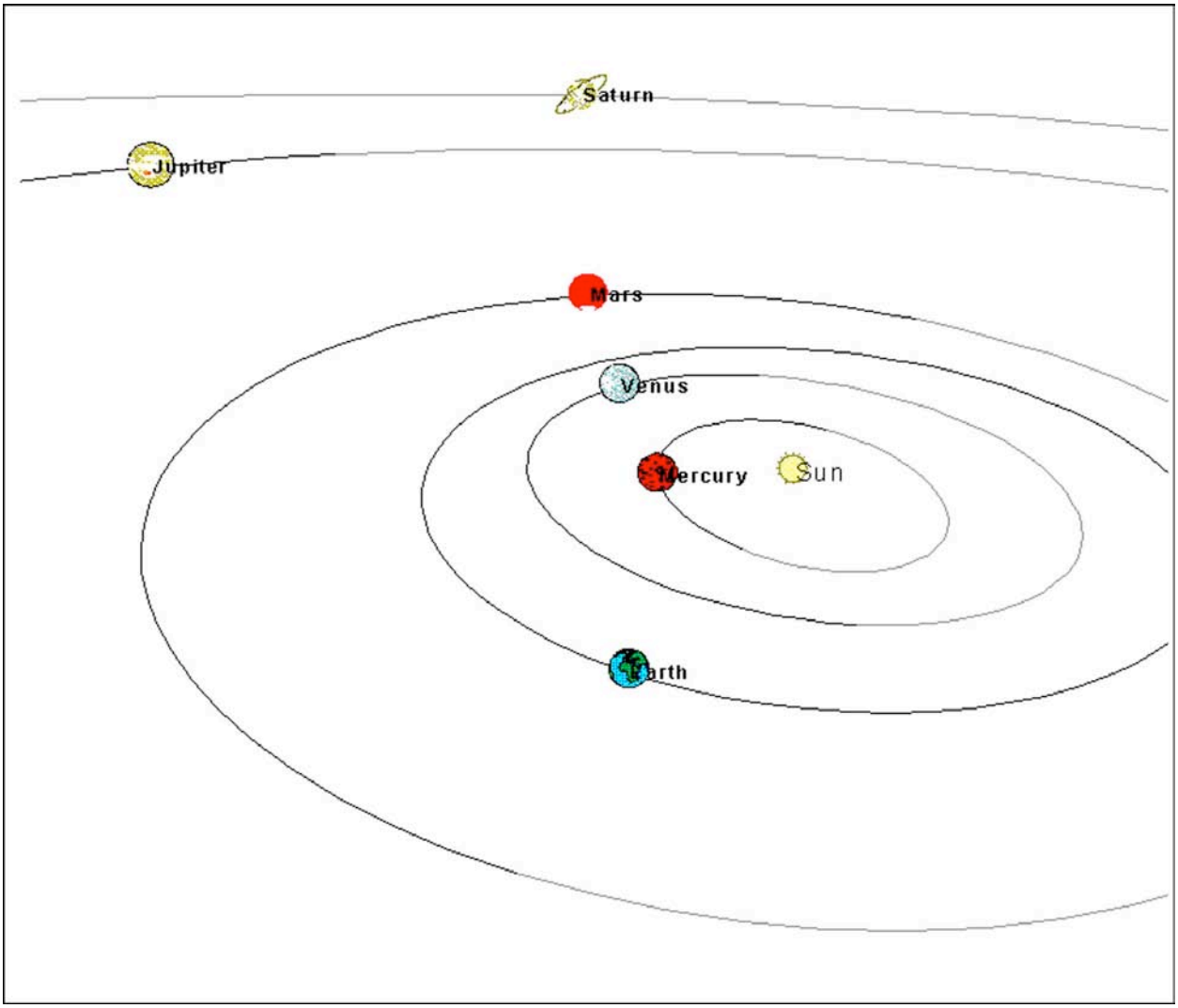
Conjunctions and appulses between two bright objects close to the ecliptic, such as two bright planets and/or the Moon, can be easily seen with the naked eye and can attract some public interest.

Conjunctions and appulses of 2 planets or a planet and the Moon are quite common and occur on a regular basis. These events become less frequent as the number of objects in the event increases.

This album shows images of several events that occurred from 2002 through 2005.

Planet Alignment - April/May 2002

In late April and early May of 2002 a rare alignment of all the naked-eye planets occurred such that all 5 planets were visible at the same time just after sunset. On May 21, 2002 a waxing crescent Moon joined the alignment, producing a pairing with Venus. Similar alignments will occur again at sunset September 2040 and sunrise July 2060.

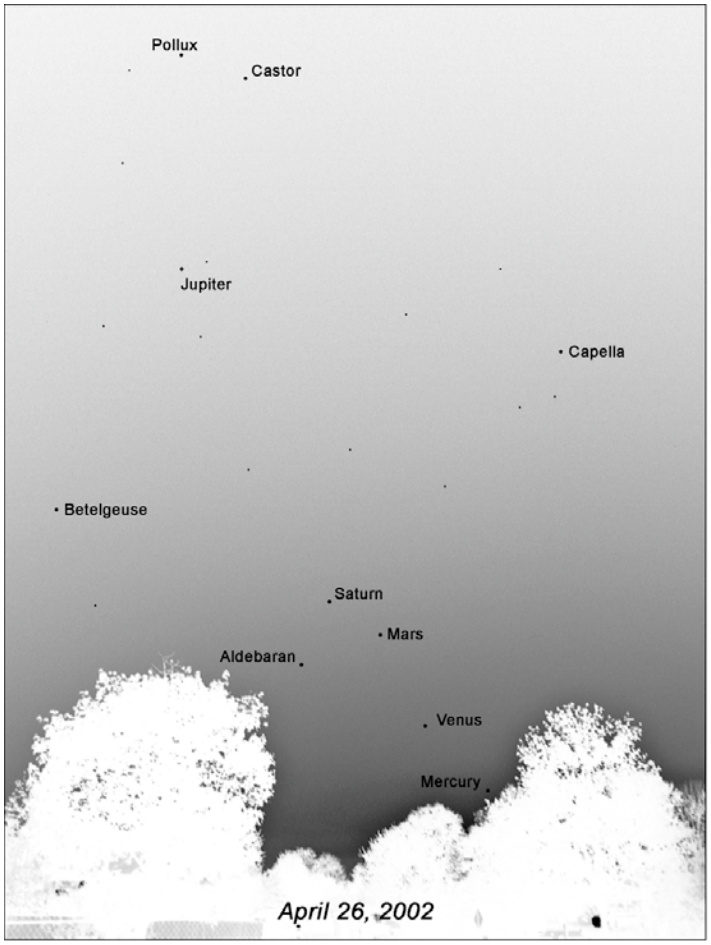


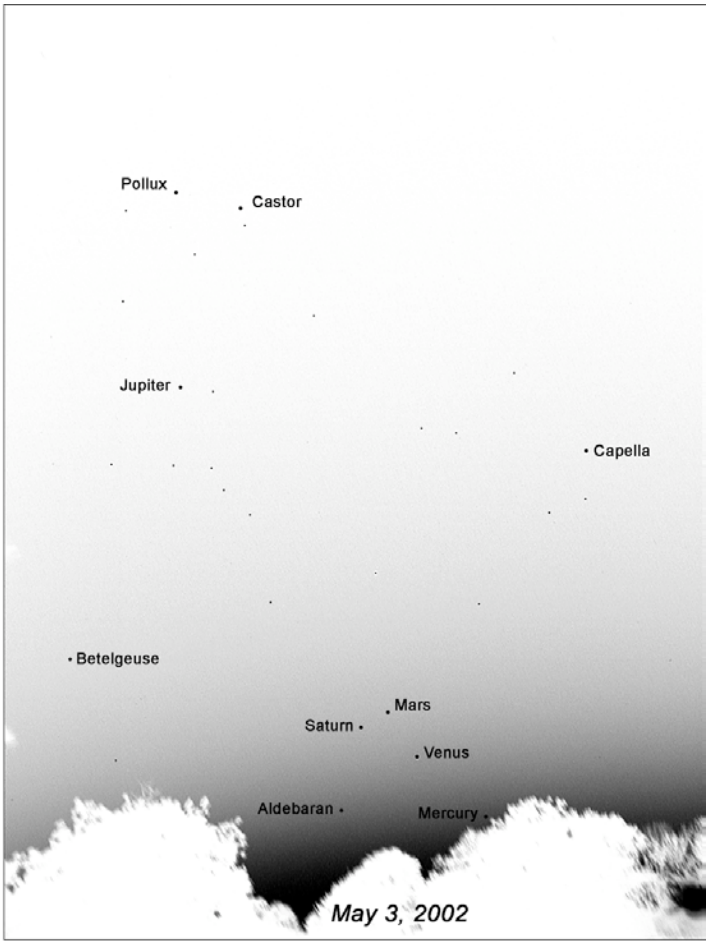
The event was photographed with a Nikon Coolpix 990 digital camera equipped with a Nikon WC-63 wide-angle converter lens. The camera was mounted on a stationary tripod. The exposure times were the camera's maximum of 8 seconds.

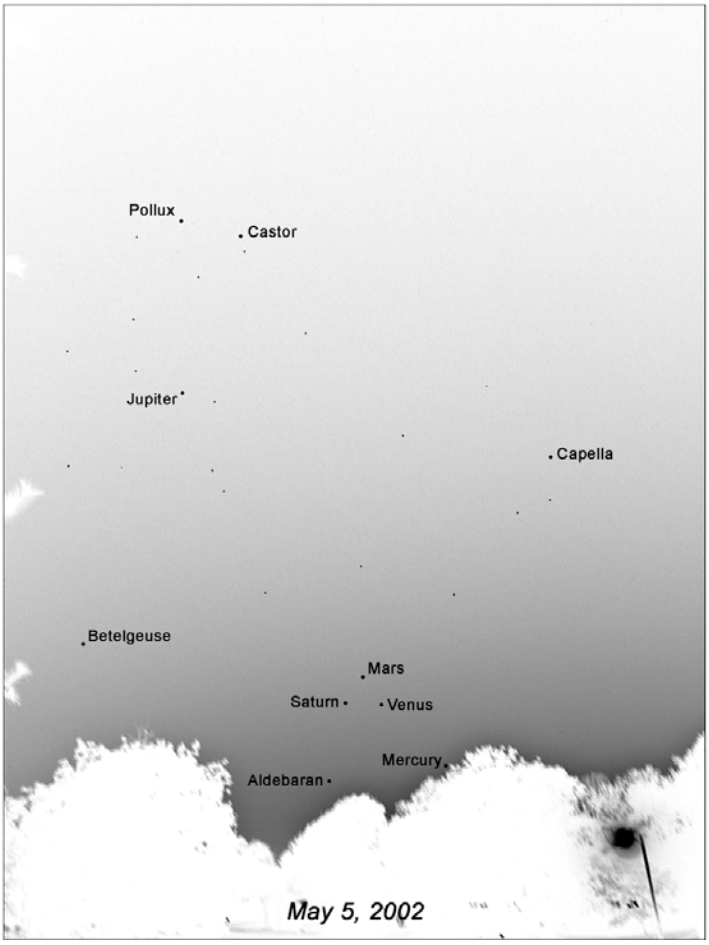

April 26, 2002


May 3, 2002


May 5, 2002


Pollux
Castor
Jupiter
Capella
Betelgeuse
Saturn
Mars
Aldebaran
Venus
Mercury
April 26, 2002


Pollux
Castor
Jupiter
Capella
Betelgeuse
Mars
Saturn
Venus
Aldebaran
Mercury
May 3, 2002


Pollux
Castor
Jupiter
Capella
Betelgeuse
Mars
Saturn
Venus
Mercury
Aldebaran
May 5, 2002


May 21, 2004
8:50 PM EDT

Additional Events

November 9 and 10, 2004

Morning event with waxing crescent Moon, Jupiter and Venus

Nikon Coolpix 990 digital camera
Image 1: ISO 100, 19.1mm focal length, f/3.6, shutter speed: unk.
Image 2: ISO 100, 17.5mm focal length, f/3.4, shutter speed: unk.

June 25, 2005

Evening event with Mercury, Saturn and Venus

Canon 20D DSLR with EF 24-105mm f/4L IS zoom lens
ISO 800, 105mm focal length, f/4.5, 1/25 sec.

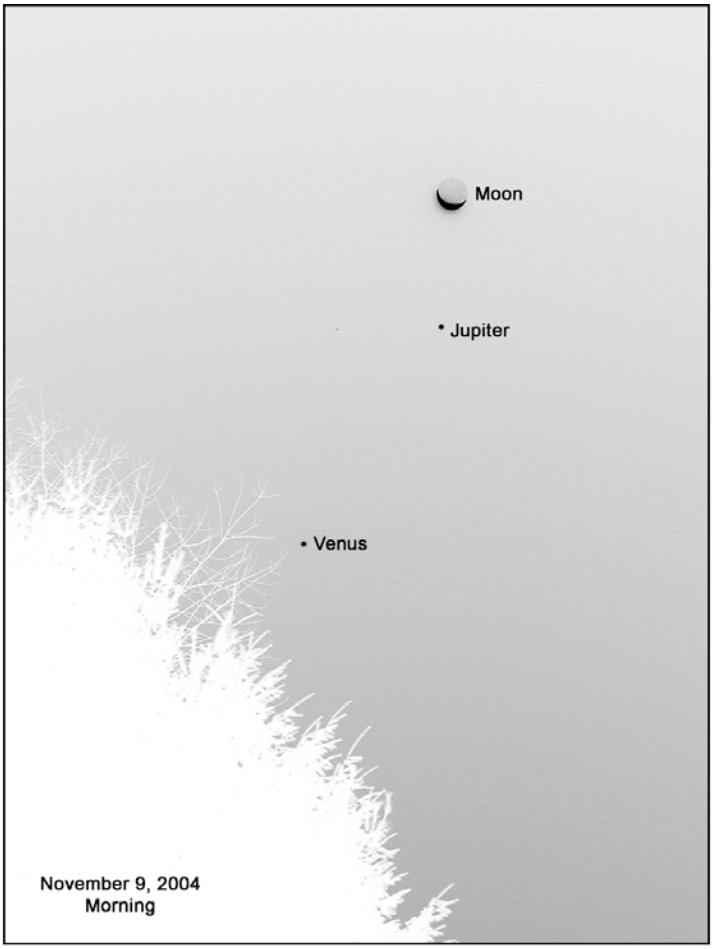
September 6 and 7, 2005

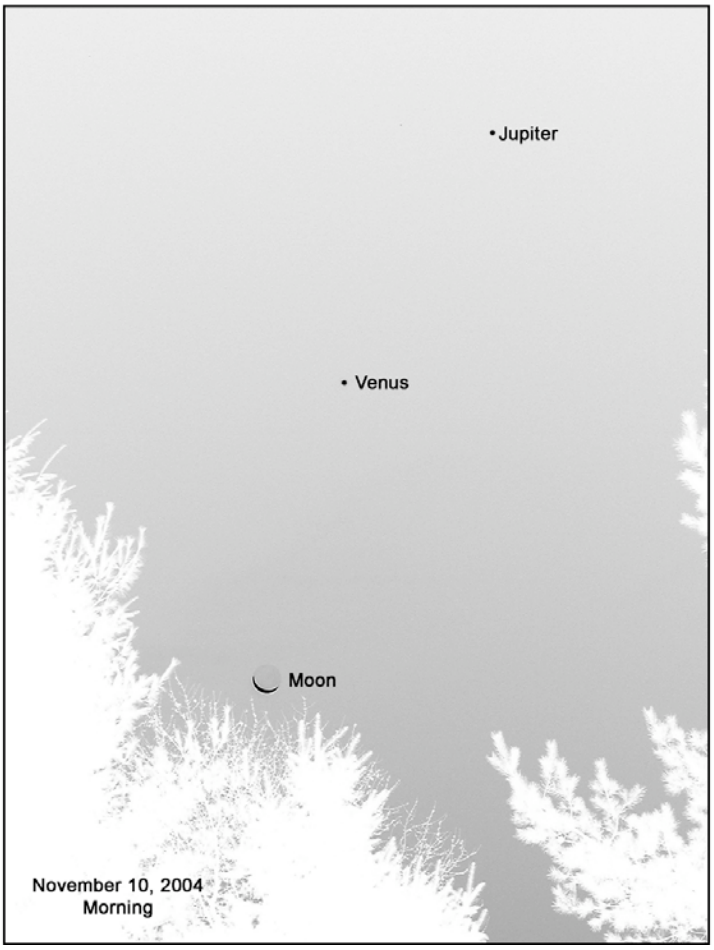
Evening event with waning crescent Moon, Jupiter and Venus

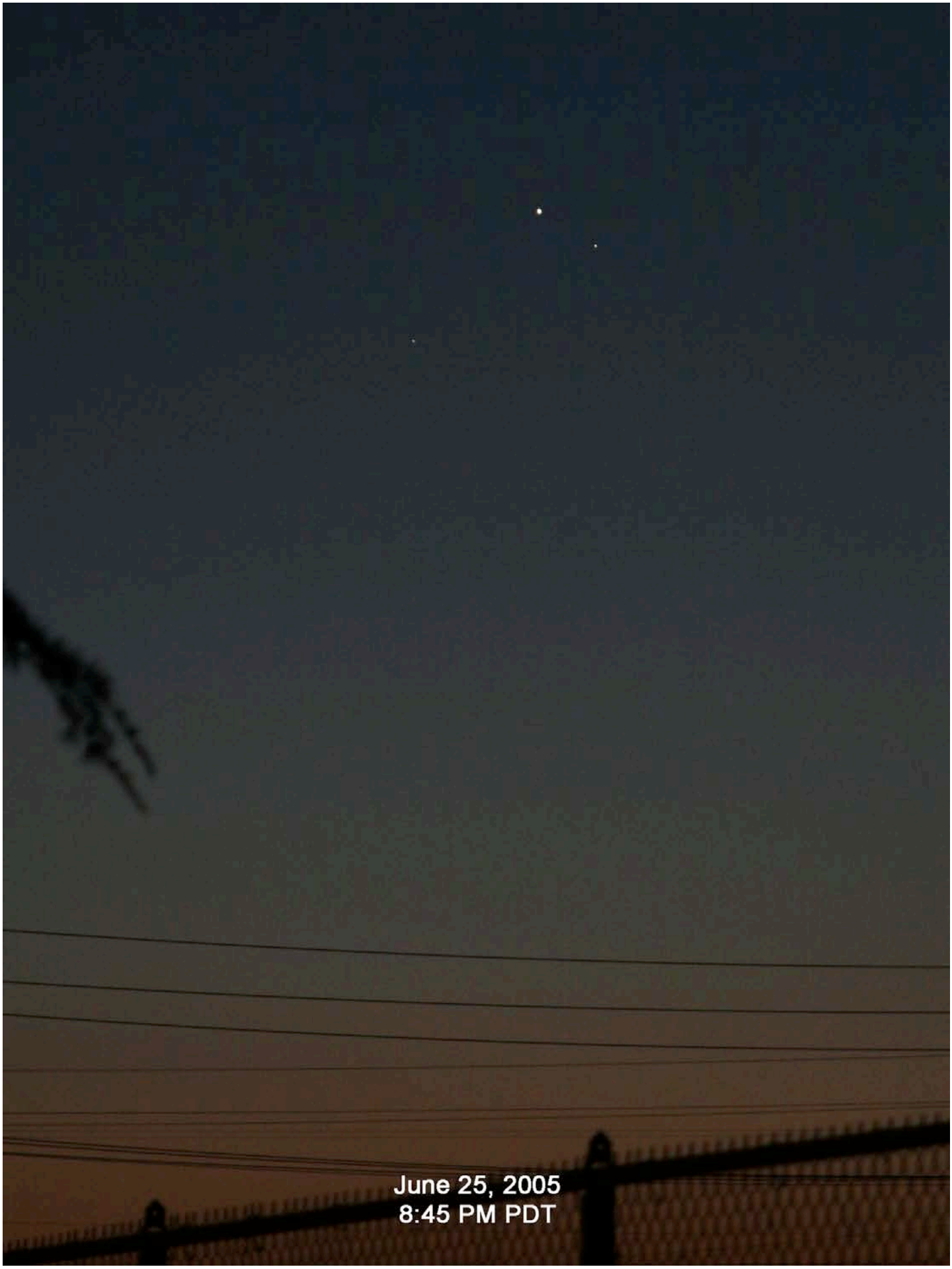
Canon 20D DSLR with EF 24-105mm f/4L IS zoom lens
ISO 400, 105mm focal length, f/5.0, 1/30 sec.
ISO 400, 68.0mm focal length, f/5.0, 1/30 sec.

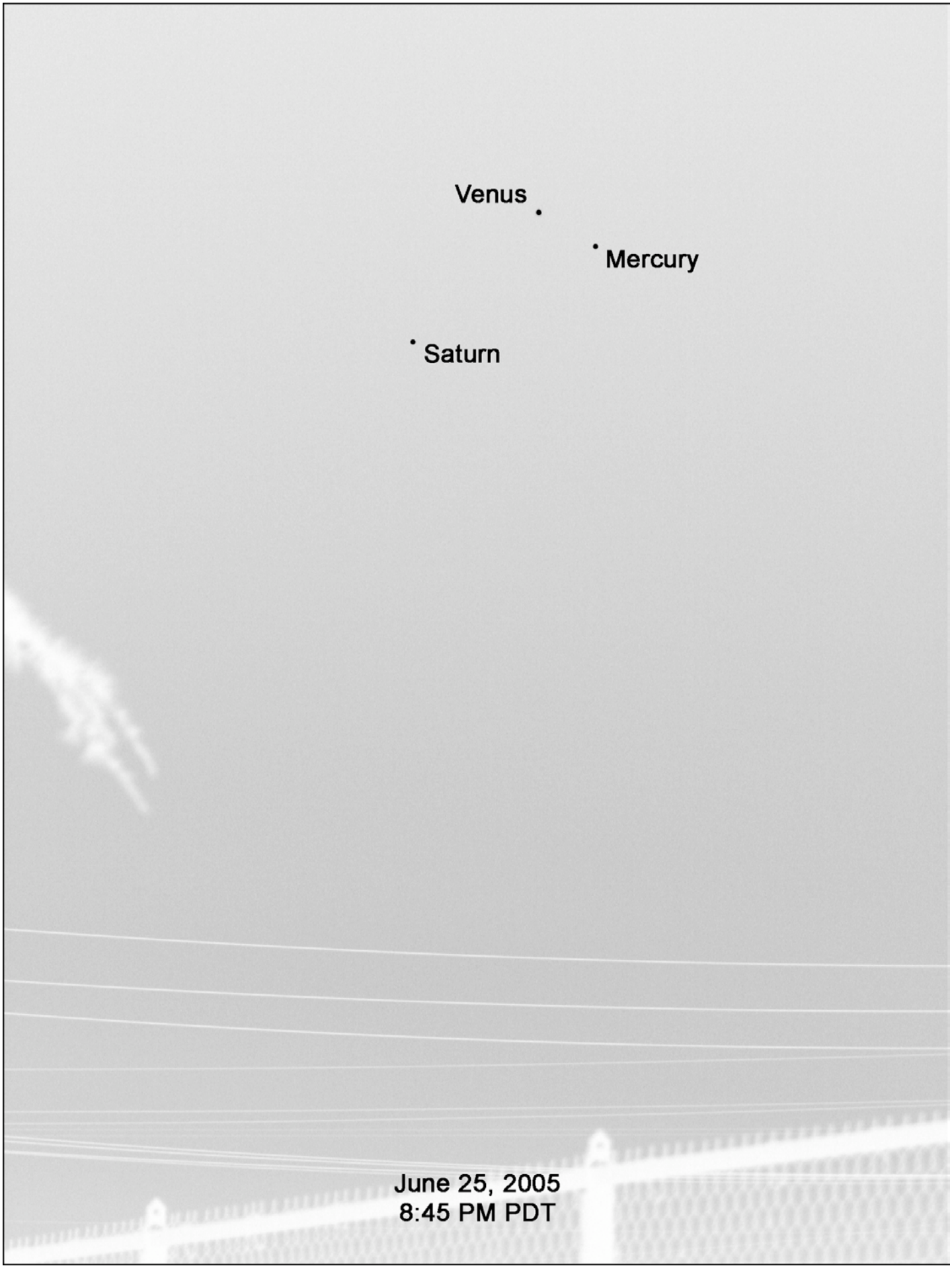

November 9, 2004
Morning


November 10, 2004
Morning


Moon
Jupiter
Venus
November 9, 2004
Morning


Jupiter
Venus
Moon
November 10, 2004
Morning

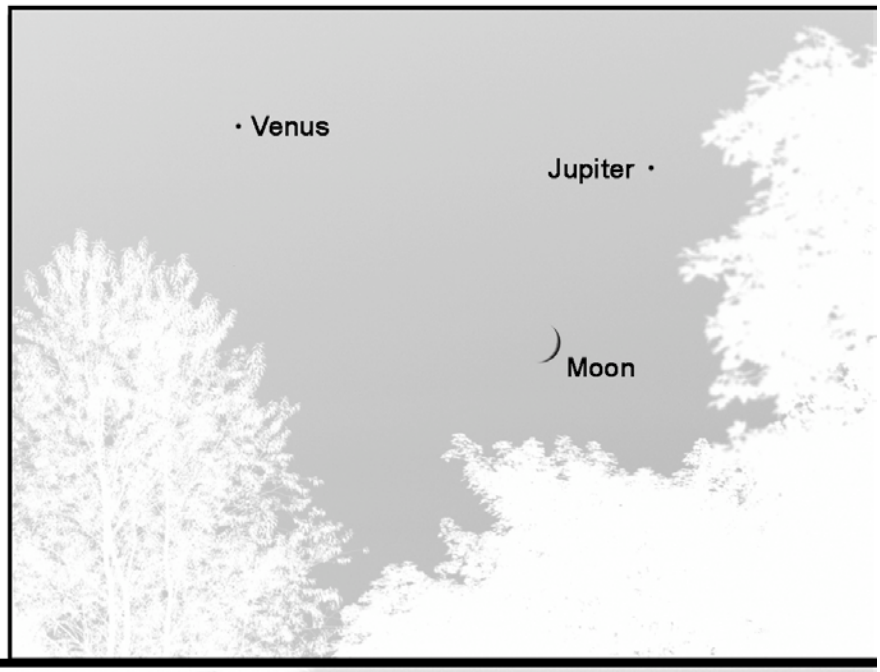

June 25, 2005
8:45 PM PDT


Venus
Mercury
Saturn
June 25, 2005
8:45 PM PDT

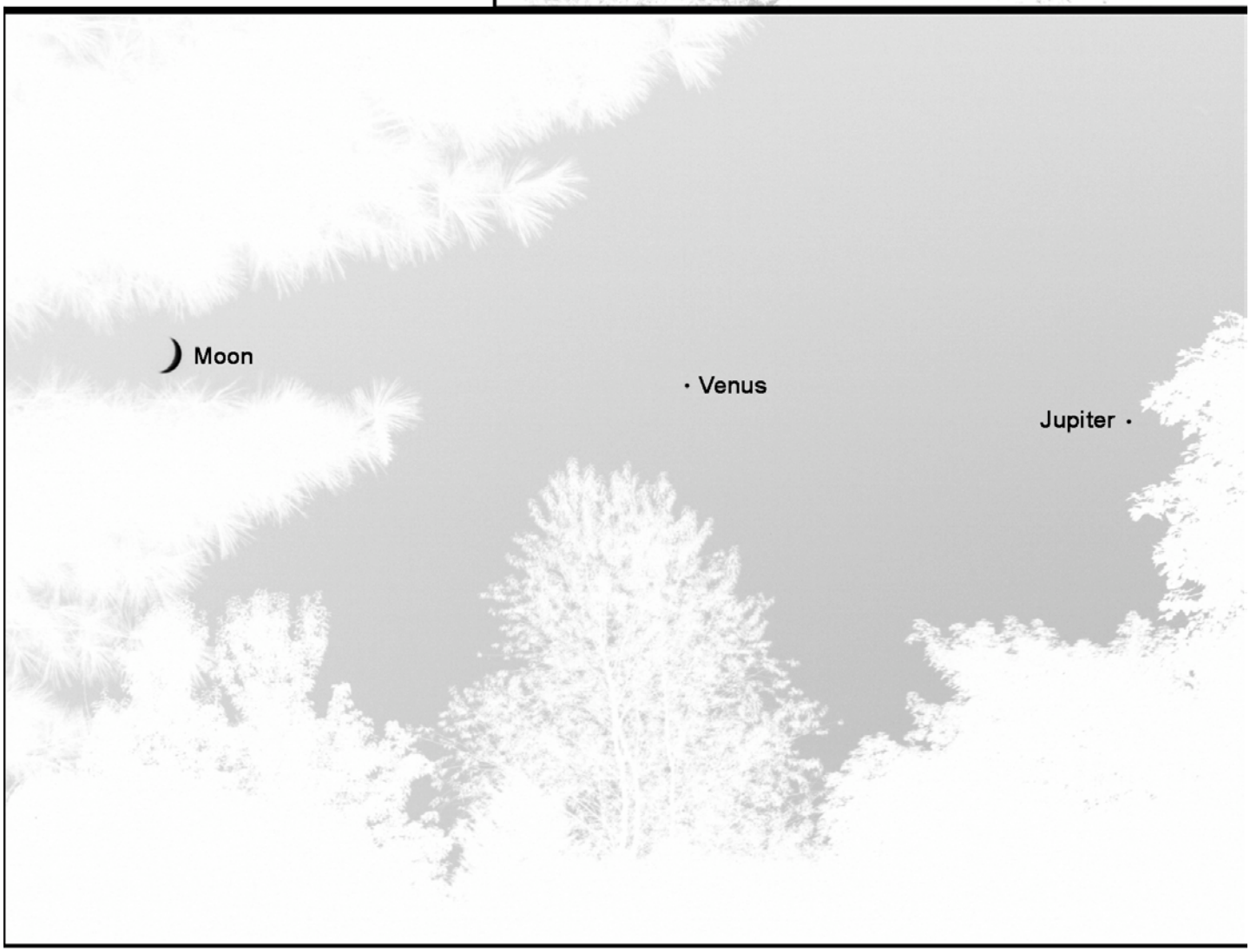
September 6, 2005
8:45 PM EDT

September 7, 2005
8:45 PM EDT

September 6, 2005
8:45 PM EDT



September 7, 2005
8:45 PM EDT



Asteroids

Asteroids are minor planets, especially those of the inner Solar System. This term has historically been applied to any astronomical object orbiting the Sun that did not show the disk of a planet and was not observed to have the characteristics of an active comet. But as minor planets in the outer Solar System were discovered, their volatile-based surfaces were found to resemble comets more closely and so are often distinguished from traditional asteroids. Thus the term asteroid has come to refer to the small bodies of the inner Solar System out to the orbit of Jupiter. They are grouped with the outer bodies - centaurs, Neptune trojans, and trans-Neptunian objects - as minor planets, which is the term preferred in astronomical circles.

There are millions of asteroids, the majority orbiting in the asteroid belt between the orbits of Mars and Jupiter, or are co-orbital with Jupiter (the Jupiter Trojans). However, other orbital families exist with significant populations, including the near-Earth asteroids. Individual asteroids are classified by their characteristic spectra, with the majority falling into three main groups: C-type, S-type, and M-type. These were named after and are generally identified with carbon-rich, stony, and metallic compositions, respectively.

For the amateur astronomer who observes or photographs asteroids, the number of objects is daunting. However, the number can be significantly reduced by selecting magnitude limits. There are approximately 200 asteroids of magnitude 13.5 or brighter. Stephen Edberg and David Levy have created a 'life-list' of 149 asteroids of magnitude 13 and brighter in their book "Observing Comets, Asteroids, Meteors, and the Zodiacal Light".

Visually and photographically, asteroids look like stars with one noticeable different - with time they can be seen to move relative to the background stars. The only difference among these objects is their magnitudes, otherwise they all look the same.

From my point of view "if you've seen or photographed one asteroid, you've seen or photographed all of them". So I photographed two asteroids as representative examples of this object class - 1 Ceres and 4 Vesta.

Equipment

Canon EOS 20D DSLR
Canon EF 100-400mm f/4.5-5.6L IS zoom lens set at 400mm f/5.6
Vixen GPDX German equatorial mount

Focusing

Focusing was done manually while observing a star through a Canon Angle Finder C at 2.5x magnification. The quality of focus was checked by examining a test image on the camera's LCD screen. Unfortunately image focus varied significantly, resulting in refocusing two or even three times.

Image Acquisition

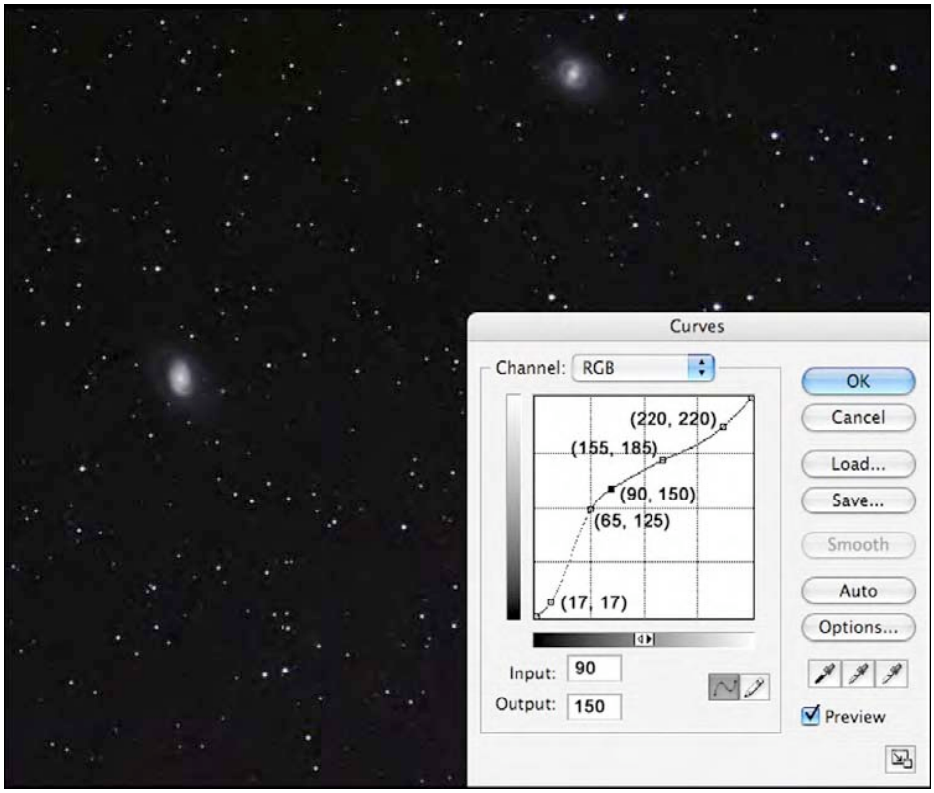
For each asteroid a set of images was acquired at one-hour intervals for three hours, resulting in four image sets for each asteroid. For 1 Ceres, an image set contained 10 light-frames and 5 dark-frames. For 4 Vesta, an image set contained 16 light-frames and 5 dark-frames. Exposure duration of each frame was 1 minute at ISO 1600 with a 10-second delay between exposures and a 5-second delay from sequence initiation and the first exposure. No bias or flat frames were used. Images were saved as highest quality JPEG files on the camera's Compact Flash card. Image acquisition was controlled with a Canon Timer Remote Controller TC-80N3.

Basic Image Processing

AIP4Win version 2.0 was used to calibrate and stack the frames from each image set. The final raw stacked image file was saved as a 8-bit TIFF file.

Image enhancement and optimization was performed with Adobe Photoshop CS2. While examining the upper right corner of the image, Levels was used to adjust the RGB black point such that R=G=B at a value of 10-15.

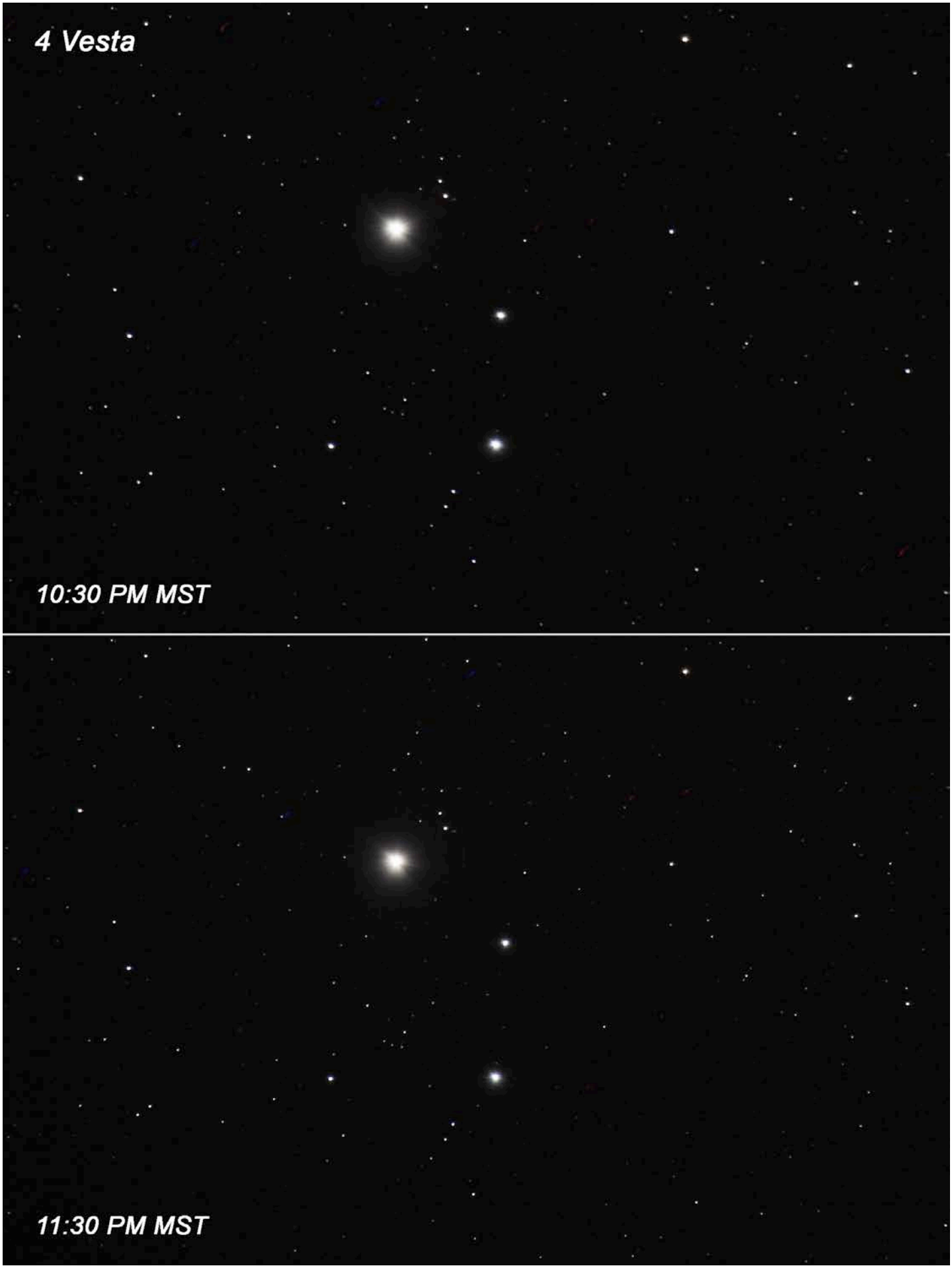
Using Curves, the low intensity objects were enhanced while not 'blowing out' bright objects or causing the black background to lighten significantly by setting Curves set points approximately as shown in the figure below.



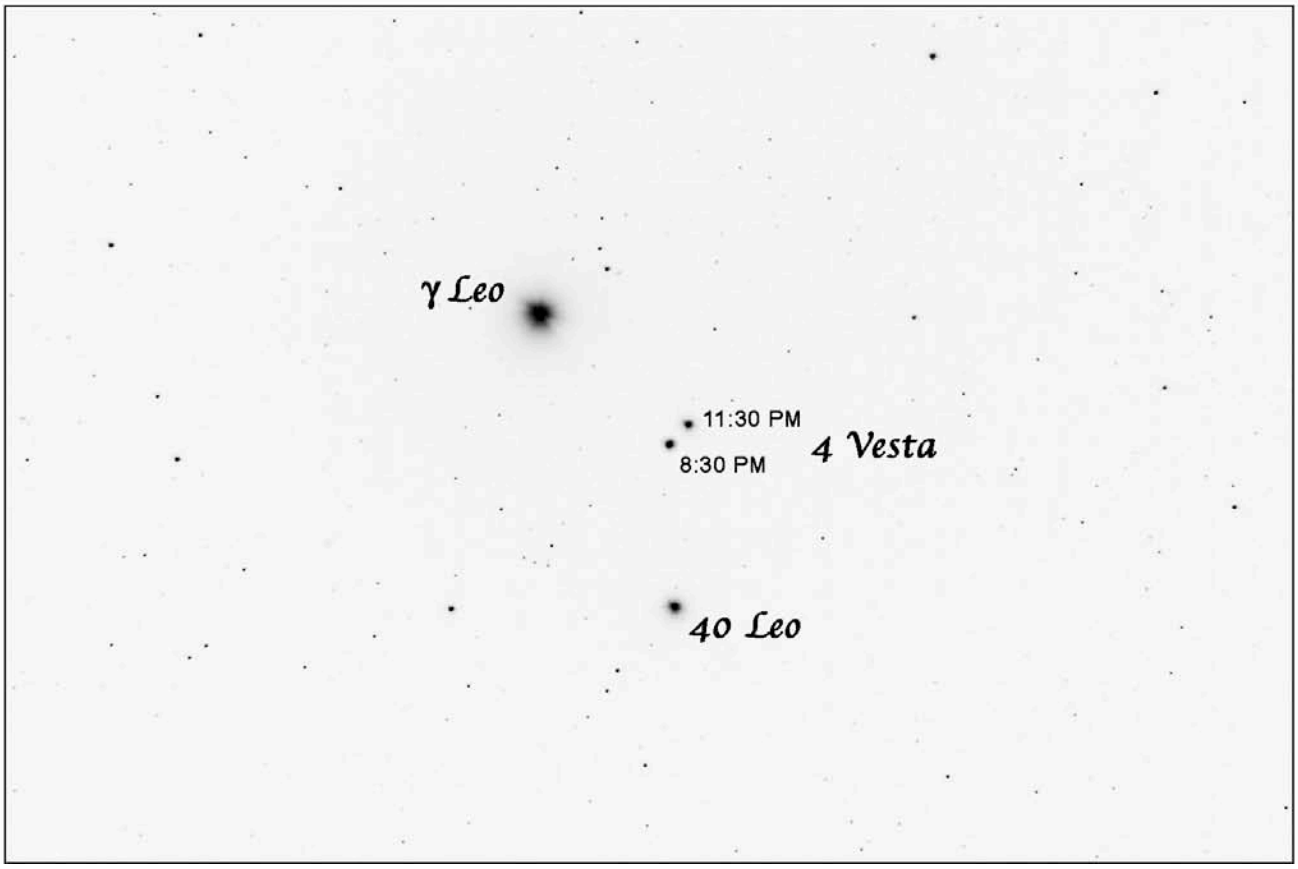
Any resulting vignetting in background sky intensity was 'neutralized' using techniques similar to those described in "*Fixing Vignetting in Astrophotos*", Sean Walker, Sky & Telescope, September 2001 and the book *Photoshop Astronomy* by R. Scott Ireland. Finally a modest Unsharp Mask (amount: 100%, radius: 1.0 pixel, threshold: 3 levels) was applied.

1 Ceres was photographed on July 4, 2010.
4 Vesta was photographed on February 16, 2010.


4 Vesta
8:30 PM MST
9:30 PM MST


4 Vesta
10:30 PM MST
11:30 PM MST

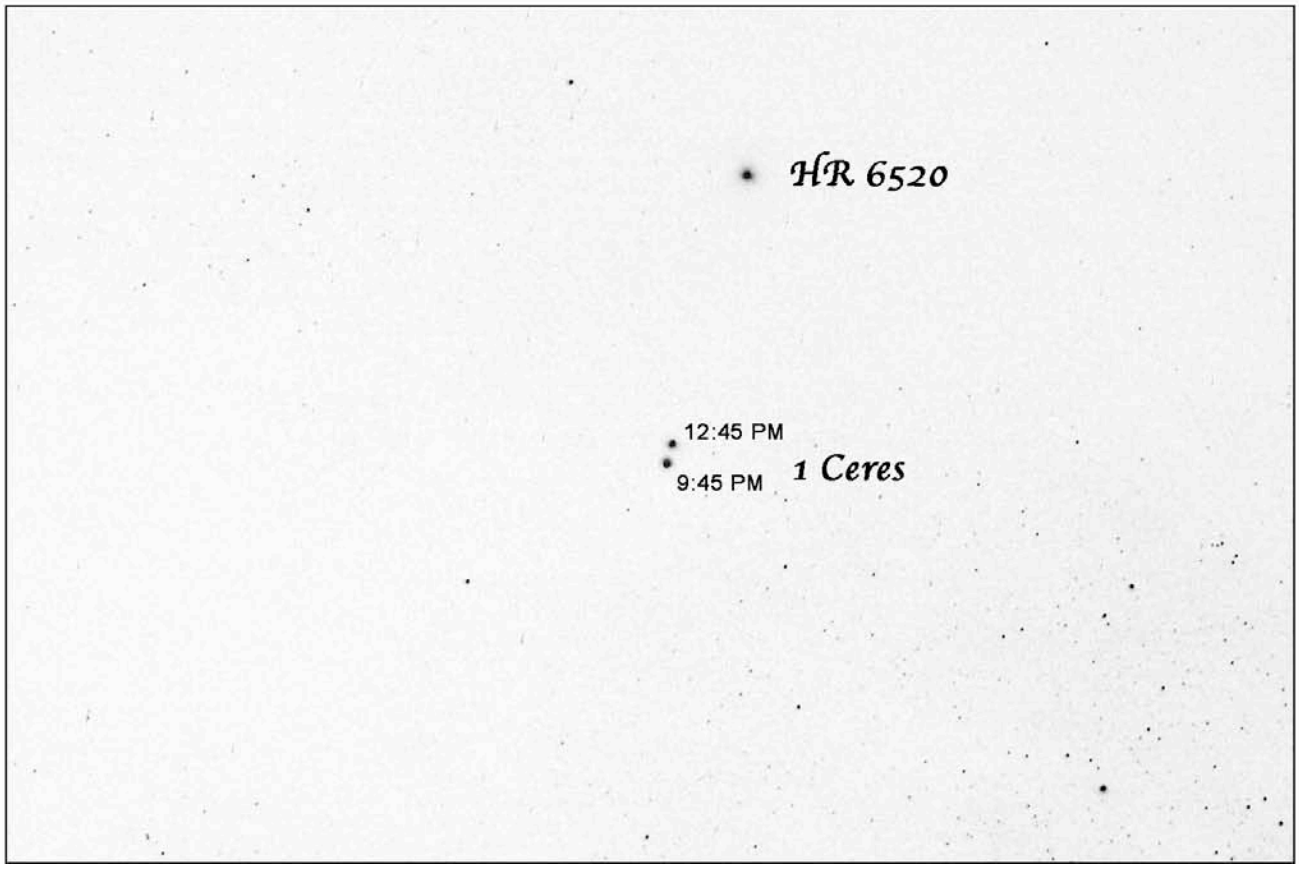
Composite image showing 4 Vesta's movement over 3 hours




1 Ceres
9:45 PM MST
10:45 PM MST


1 Ceres
11:45 PM MST
12:45 AM MST

Composite image showing 1 Ceres movement over 3 hours



Jupiter

Images 1 - 3

Celestron C5+ coupled to Coolpix 990 digital camera with ScopeTronix 14mm wide-angle eyepiece

Sets of 8 images were acquired using exposures varying from 1/30 second to 2 seconds, stacked manually in Adobe Photoshop CS2 and optimized in RegiStax 4 using wavelet processing. Image 3 is a composite of short and long exposures to show both the planet and the moons.

Images 4 - 23

Stellarvue SV115 triplet apochromatic refractor (800mm f/7) with Philips ToUCam PCVC 740K

A variety of power amplifiers (ScopeTronix 1.6x amplifier, TeleVue 1.8x and 2.5x barlows and Celestron Ultima 2x Barlow) were used to increase the image size. Unfortunately there is no record listing which amplifier was used for each image.

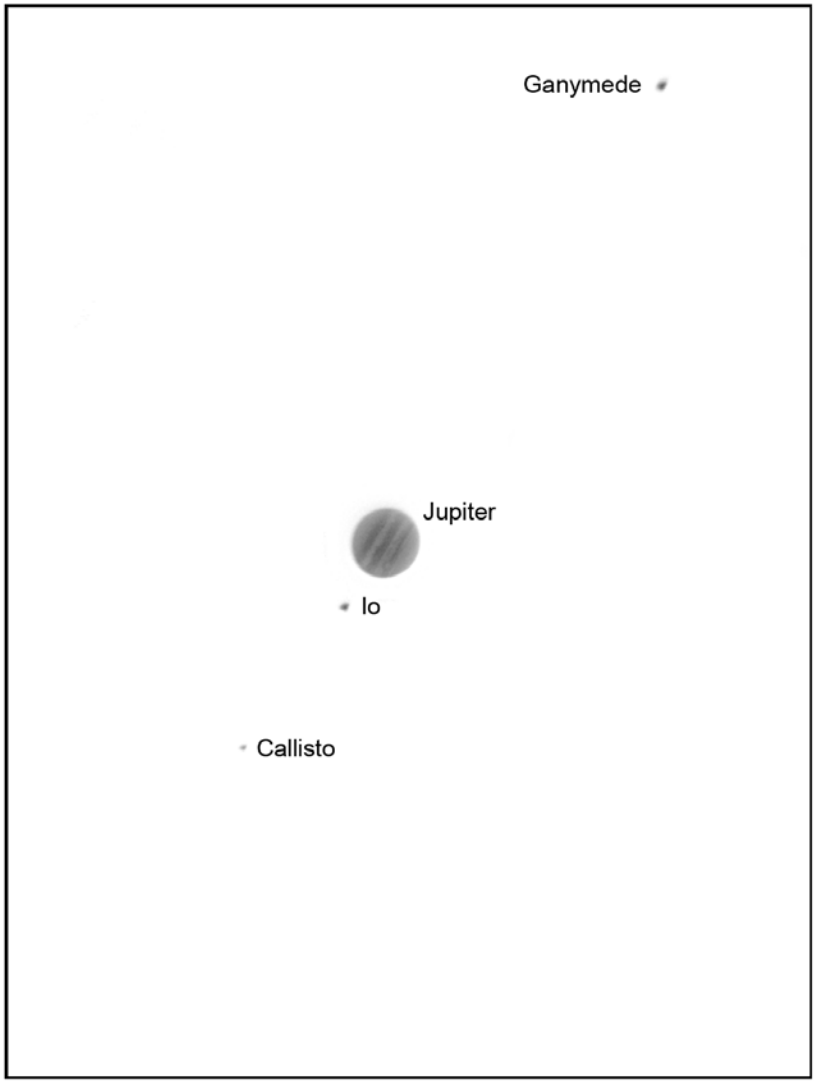
AVI format videos from the Philips ToUCam were captured at 5 frames per second using QCFocus camera control software. The videos were routinely 300 seconds (5 minutes) in duration, yielding videos with 1500 image frames.

The AVI videos were loaded into Registax 4. The best 300 frames were optimized and stacked. The resulting raw image was saved in 16-bit color TIFF format. This raw image was enhanced/optimized using wavelet processing to yield a final image which I deemed pleasing. The final images were saved in 16-bit color TIFF format.

April 16, 2004

April 30, 2004

April 30, 2004



April 30, 2004


July 14, 2006 9:55 PM EDT


July 14, 2006 10:00 PM EDT


July 14, 2006 10:05 PM EDT

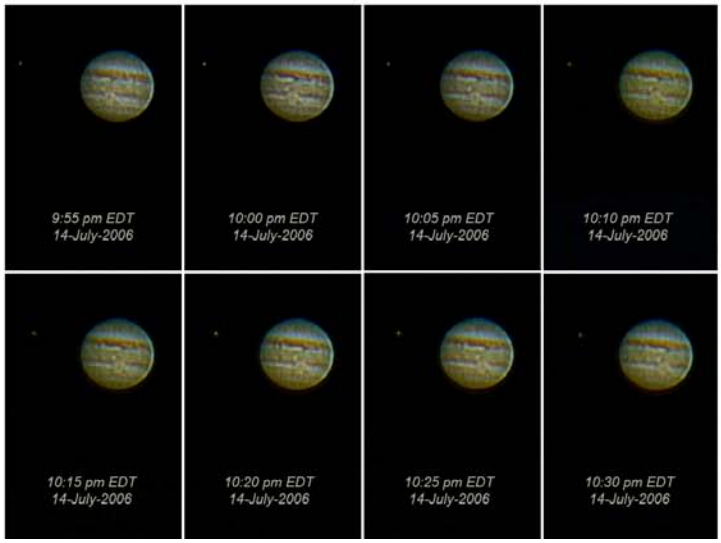

July 14, 2006 10:10 PM EDT


July 14, 2006 10:15 PM EDT

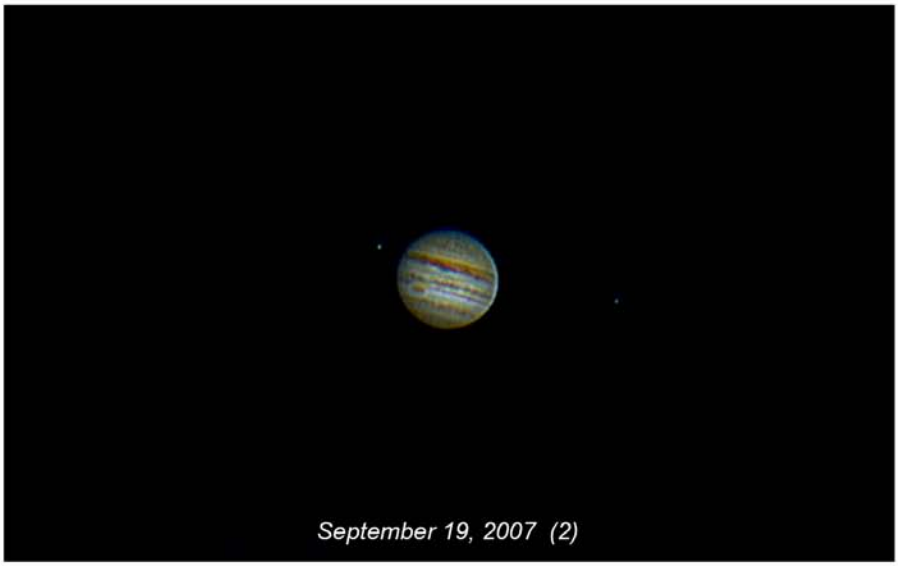

July 14, 2006 10:20 PM EDT


July 14, 2006 10:25 PM EDT


July 14, 2006 10:30 PM EDT

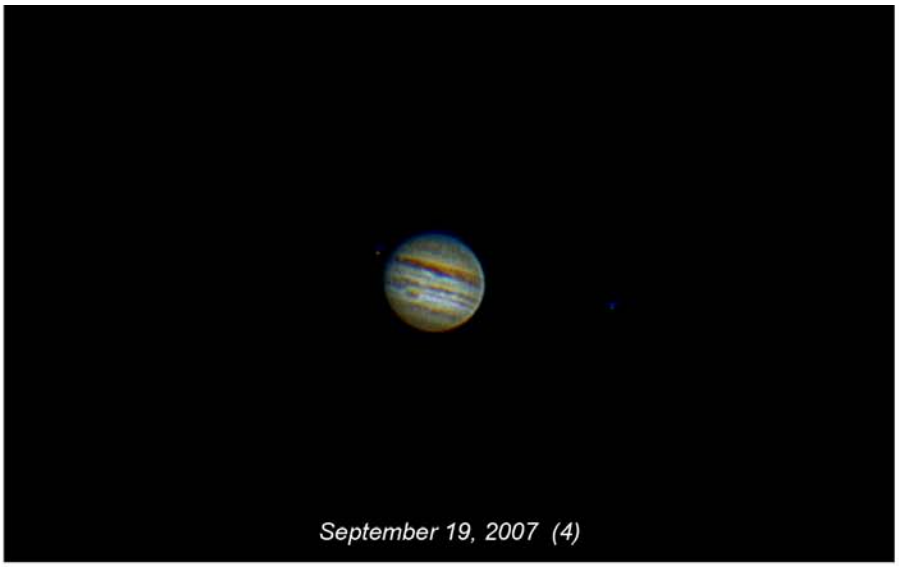

9:55 pm EDT
14-July-2006
10:00 pm EDT
14-July-2006
10:05 pm EDT
14-July-2006
10:10 pm EDT
14-July-2006
10:15 pm EDT
14-July-2006
10:20 pm EDT
14-July-2006
10:25 pm EDT
14-July-2006
10:30 pm EDT
14-July-2006

September 19, 2007 (1)



September 19, 2007 (2)

September 19, 2007 (3)



September 19, 2007 (4)

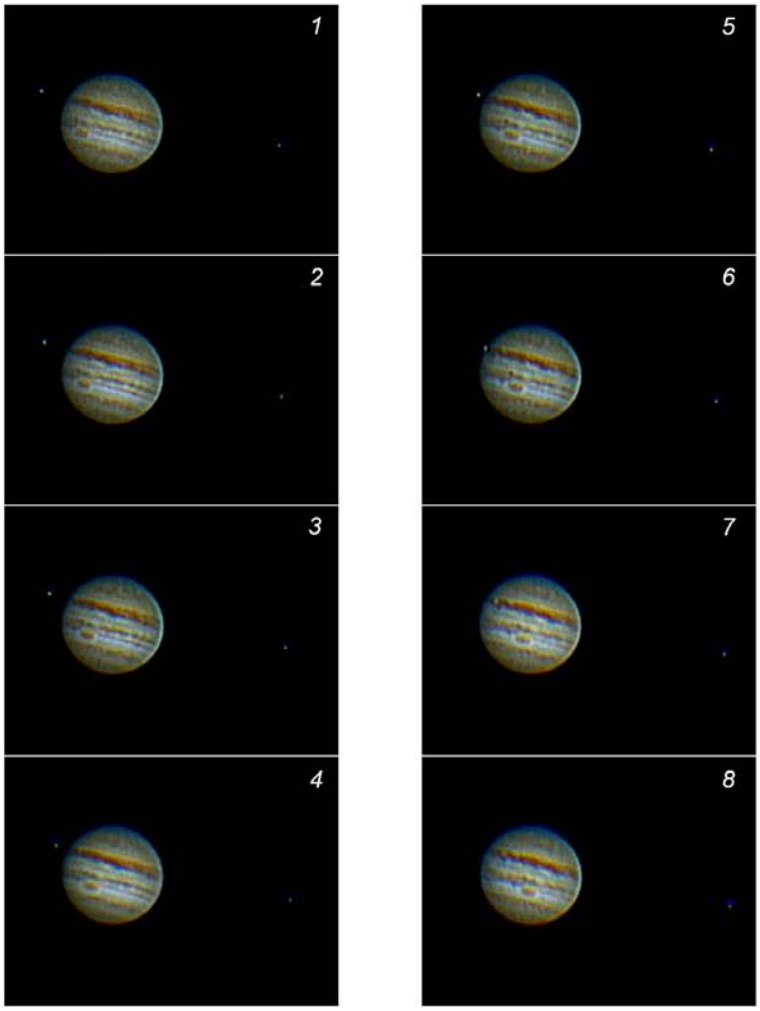
September 19, 2007 (5)

September 19, 2007 (6)

September 19, 2007 (7)

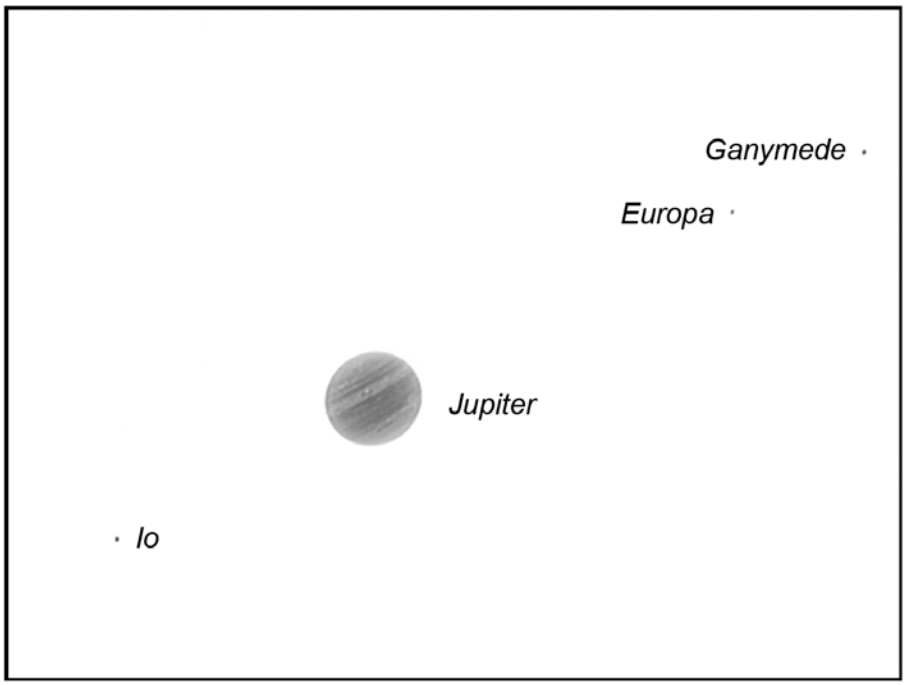
September 19, 2007 (8)

September 19, 2007



September 18, 2010

September 18, 2010



Mars

On February 13, 2010 I photographed Mars using a webcam method.

Equipment

Stellarvue SV115 triplet apochromatic refractor (800mm, f/7)
Vixen GPDX German equatorial mount with SkySensor 2000
Philips ToUCam (PCVC 740K)
640x480 pixel CCD, 5.6μ pixels, 8-bit color
Sirius NIR filter
Celestron Ultima 2x barlow

Computer and Software

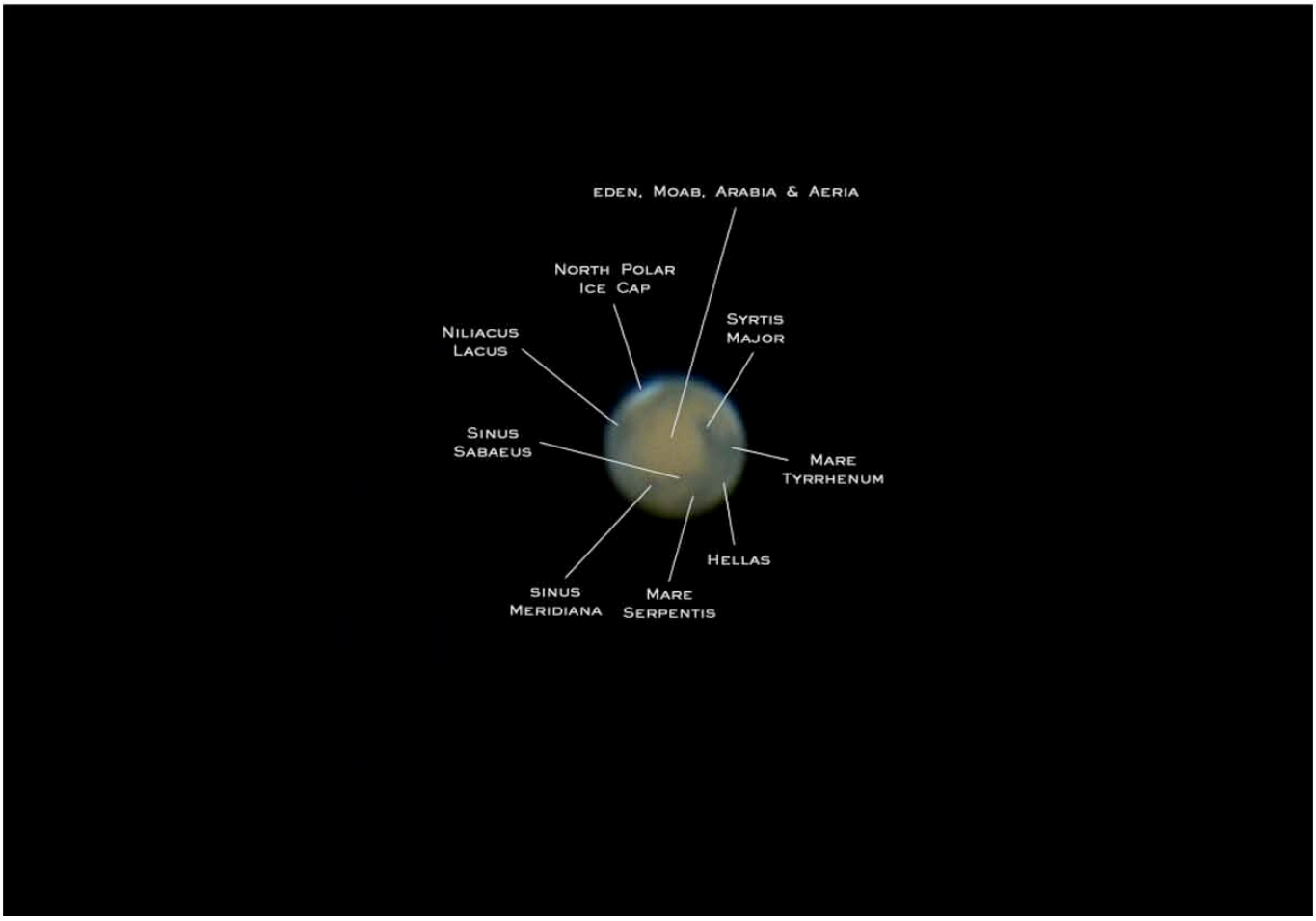
Dell Inspiron 8600 laptop computer with Windows XP
QCFocus for webcam control and video capture
Registax version 4 for video processing

Basic Procedure

AVI format videos from the ToUCam were captured using QCFocus at 5 frames per second. The videos were routinely 300 seconds (5 minutes) in duration, yielding videos with 1500 image frames.

The AVI videos were loaded into Registax. The best 300 frames were optimized and stacked. The resulting raw image was saved in 16-bit color TIFF format. This raw image was enhanced/optimized using wavelet processing to yield a final image which I deemed pleasing. The final image was saved in 16-bit color TIFF format.

Three videos were acquired at prime focus (Images 1 and 2).
Six videos were acquired using the Celestron Ultima 2x barlow to increase image size (Images 3-6).


EDEN, MOAB, ARABIA & AERIA
NORTH POLAR ICE CAP
SYRTIS MAJOR
NILIACUS LACUS
SINUS SABAEUS
MARE TYRRHENUM
HELLAS
SINUS MERIDIANA
MARE SERPENTIS

Pluto

On the evenings of September 5 and 9, 2010, I unexpectedly photographed the dwarf planet Pluto while photographing the Milky Way star cloud M24.

Equipment

Canon EOS 20Da DSLR
Takahashi Sky 90 with 0.8x focal reducer/field flattener (405mm, f/4.5)
Vixen GPDX German equatorial mount with SkySensor 2000

Focusing

Focusing was performed manually while observing a star through a Canon Angle Finder C at 2.5x magnification. The quality of focus was checked by examining a test image on the camera's LCD screen. Unfortunately image focus could vary significantly, resulting in refocusing a second or even third time before acquiring images.

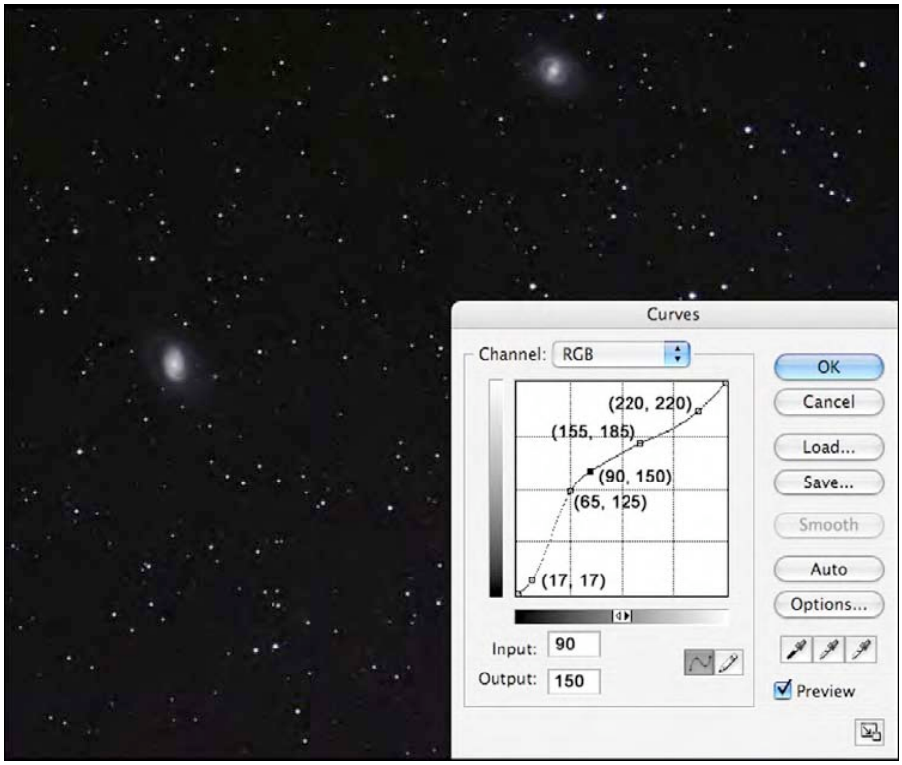
Image Acquisition

The basic image acquisition scheme was to obtain 5 dark-frames, then 30 light-frames and finally 5 more dark-frames, yielding an image set of 10 dark-frames and 30 light-frames for calibrating and stacking. Exposure duration of each frame was 1 minute at ISO 1600 with a 10-second delay between exposures and a 5-second delay from sequence initiation and the first exposure. No bias or flat frames were used. Images were saved as highest quality JPEG files on the camera's Compact Flash card. Image acquisition was controlled with a Canon Timer Remote Controller TC-80N3.

Basic Image Processing

DeepSkyStacker 3.3.2 was used to calibrate and stack the frames from each image set. The final raw stacked image file was saved as a 32-bit TIFF file.

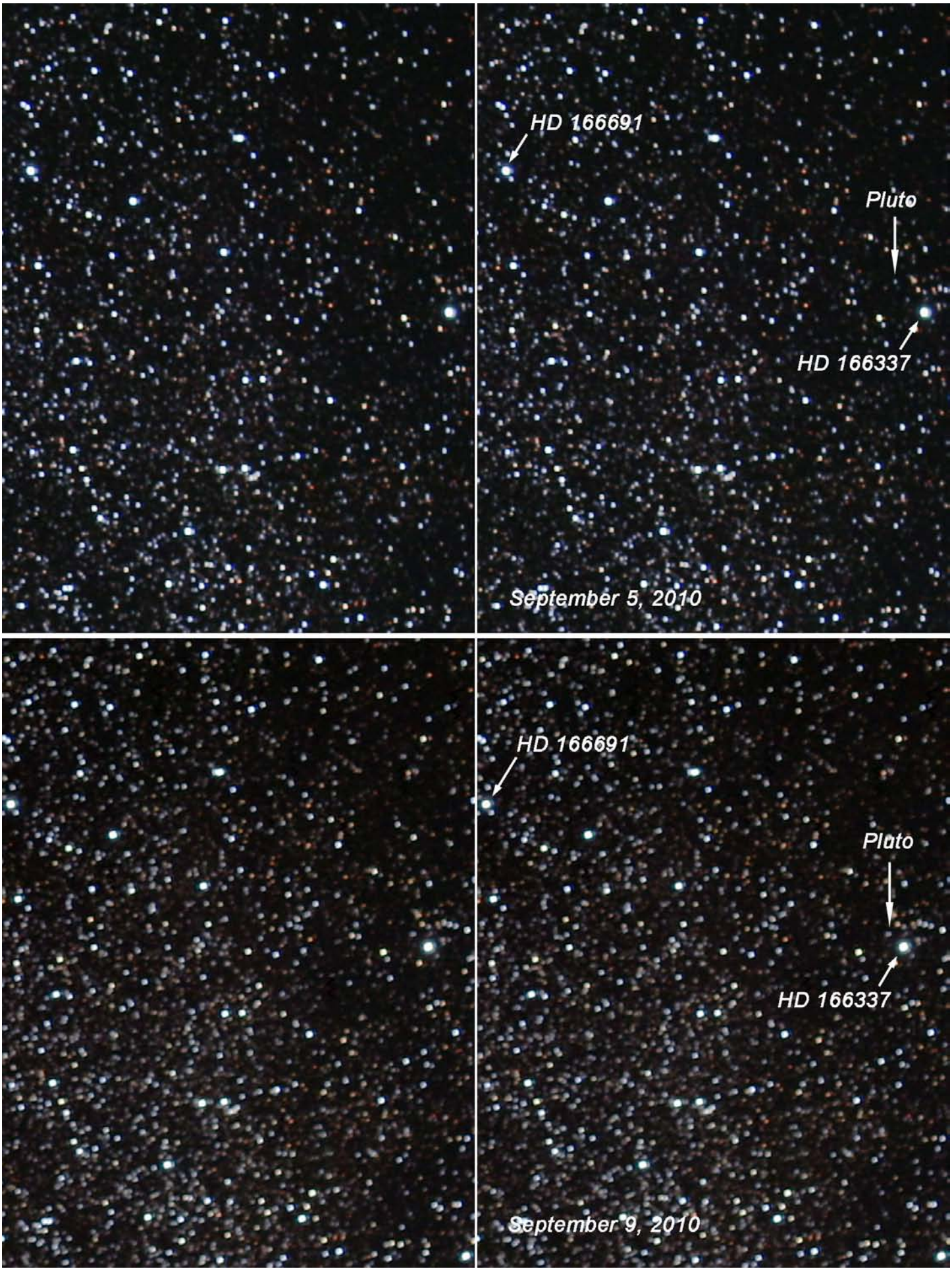
Image enhancement and optimization was performed with Adobe Photoshop CS2. First the image file Mode was changed to 16-bit. While examining the upper right corner of the image, Levels was used to adjust the RGB black point such that R=G=B at a value of 10-15.



Using Curves, low intensity objects was enhanced while not 'blowing out' bright objects or causing the black background to lighten significantly by setting Curves set points approximately as shown in the figure above.

Any resulting vignetting in background sky intensity was 'neutralized' using techniques similar to those described in "*Fixing Vignetting in Astrophotos*", Sean Walker, Sky & Telescope, September 2001 and the book *Photoshop Astronomy* by R. Scott Ireland.

Finally a modest Unsharp Mask (amount: 100%, radius: 1.0 pixel, threshold: 3 levels) was applied.


HD 166691
Pluto
HD 166337
September 5, 2010
HD 166691
Pluto
HD 166337
September 9, 2010

Saturn

Image 1

Celestron C5+ coupled to Coolpix 990 digital camera with ScopeTronix 14mm wide-angle eyepiece and Celestron Ultima 2x barlow

A set of 8 images was acquired using a ¼ second exposure, stacked manually in Adobe Photoshop CS2 and optimized in RegiStax 4 using wavelet processing.

Images 2 - 4 and 7 - 13

Stellarvue SV115 triplet apochromatic refractor (800mm f/7) with Philips ToUCam PCVC 740K

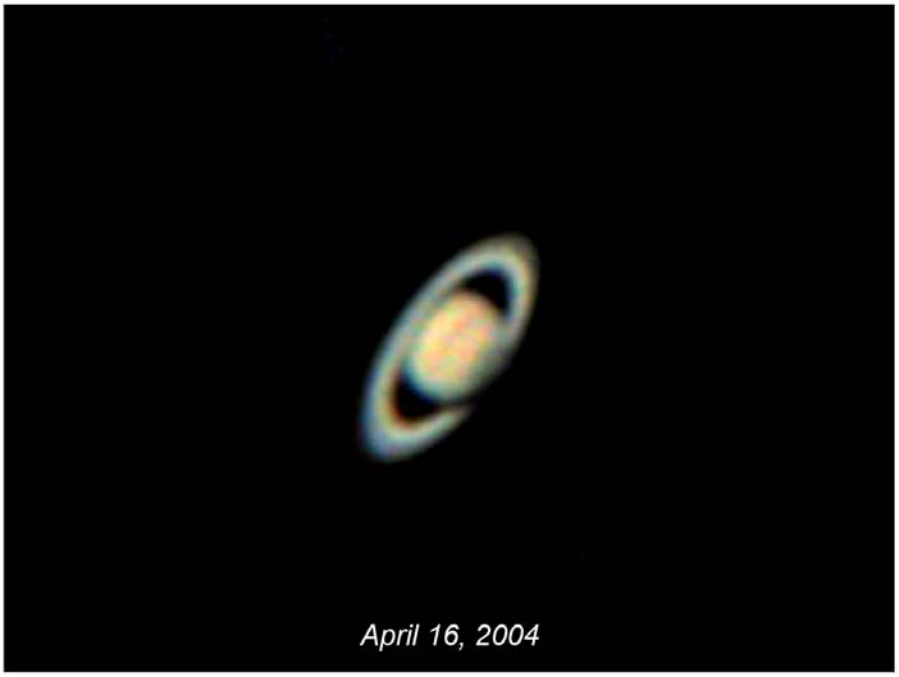
Images 5 - 6 (May 30, 2007)

Meade 152ED doublet apochromatic refractor (1370mm f/9) with Philips ToUCam PCVC 740K

For images 2-13, a variety of power amplifiers (ScopeTronix 1.6x amplifier, TeleVue 1.8x and 2.5x barlows and Celestron Ultima 2x Barlow) were used to increase the image size. Unfortunately there is no record listing which amplifier was used for each image.

AVI format videos from the Philips ToUCam were captured at 5 frames per second using QCFocus camera control software. The videos were routinely 300 seconds (5 minutes) in duration, yielding videos with 1500 image frames.

The AVI videos were loaded into Registax 4. The best 300 frames were optimized and stacked. The resulting raw image was saved in 16-bit color TIFF format. This raw image was enhanced/optimized using wavelet processing to yield a final image which I deemed pleasing. The final images were saved in 16-bit color TIFF format.



April 16, 2004

April 10, 2006


April 21, 2007


May 29, 2007

May 30, 2007

May 30, 2007

April 17, 2008


June 6, 2010

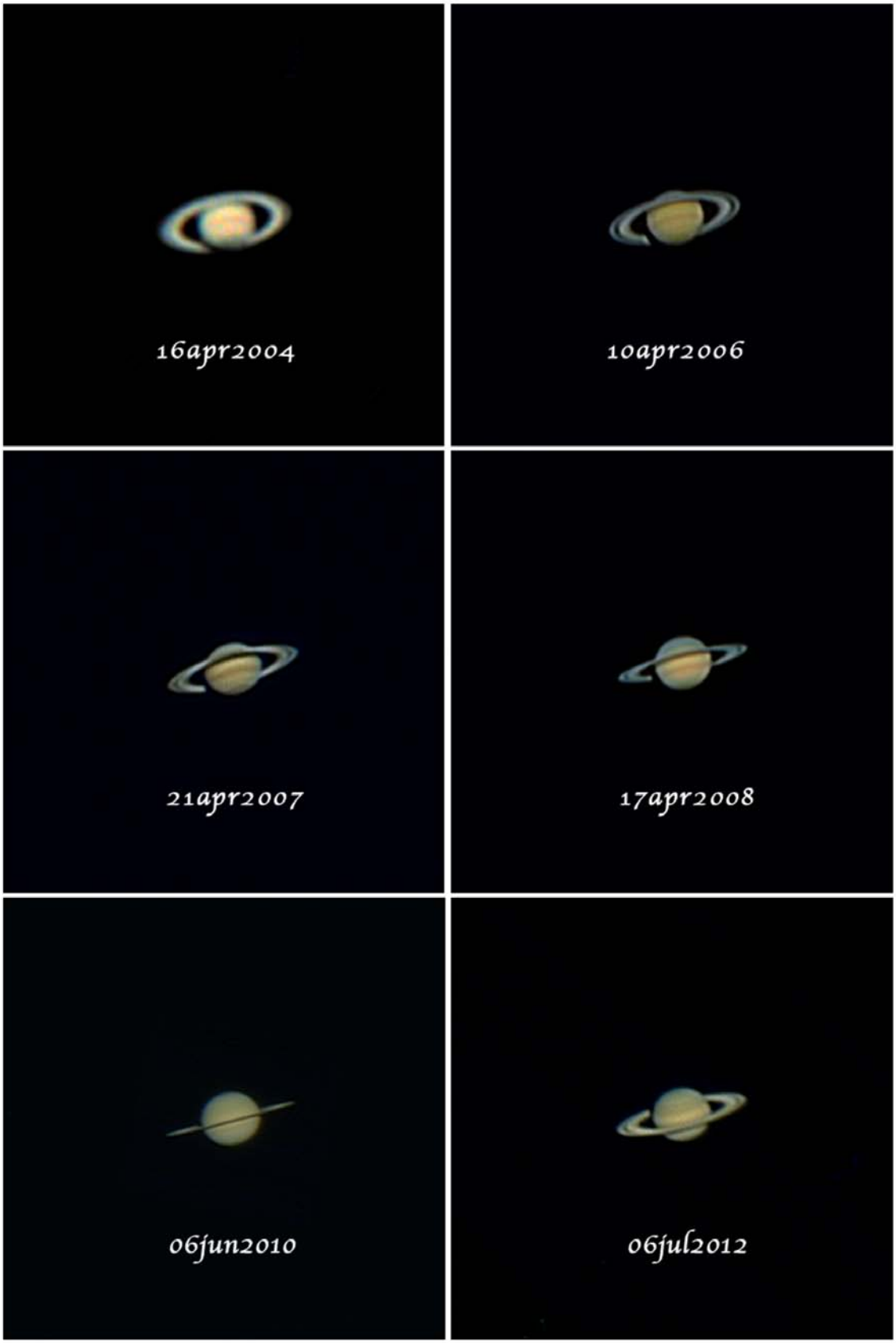

June 6, 2010


June 6, 2010


July 6, 2012


July 6, 2012


July 6, 2012


16apr2004
10apr2006
21apr2007
17apr2008
06jun2010
06jul2012

Venus

Images 1 - 3

Celestron C5+ coupled to Coolpix 990 digital camera with ScopeTronix 14mm wide-angle eyepiece

A set of 8 images was acquired using a 1/250-second exposure, stacked manually in Adobe Photoshop CS2 and optimized in RegiStax 4 using wavelet processing.

Images 4 - 7

Stellarvue SV115 triplet apochromatic refractor (800mm f/7) with Philips ToUCam PCVC 740K

For images 2-7, a variety of power amplifiers (ScopeTronix 1.6x amplifier, TeleVue 1.8x and 2.5x barlows and Celestron Ultima 2x Barlow) were used to increase the image size. Unfortunately there is no record listing which amplifier was used for each image.

AVI format videos from the Philips ToUCam were captured at 5 frames per second using QCFocus camera control software. The videos were routinely 300 seconds (5 minutes) in duration, yielding videos with 1500 image frames.

The AVI videos were loaded into Registax 4. The best 300 frames were optimized and stacked. The resulting raw image was saved in 16-bit color TIFF format. This raw image was enhanced/optimized using wavelet processing to yield a final image which I deemed pleasing. The final images were saved in 16-bit color TIFF format.

April 16, 2004

April 30, 2004

May 22, 2004

April 21, 2007

May 29, 2007

June 23, 2007

September 18, 2010

David B. Viscio

November 30, 2014