The High Desert Observer

The Bulletin of the Astonomical Society of Las Cruces

January, 2007

Presidents Message

I would like to thank the outgoing officers for the great job they did managing the Society last year. We successfully executed many events, and showed many people the beauty of the heavens. I would also like to thank our new officers for volunteering to run for office. It is because of such volunteerism that the Society is doing so well.

Janet and Bert Stevens

The ASLC has changed greatly since I joined nine years ago. The Society was primarily older members, and when a grey-haired guy like me is the youngest person in the room, things are not going well. After a few years, I suggested that we should have a booth at the Renaissance Faire, but was told that it was impossible. Do not get me wrong, these were great guys, but the Society was not growing.

Fast forward to 2006. The Society has a presence in the area unprecedented until recently. We had booths at Ren Faire, Wirefly X-Prize, and Science Day at the Mall. More importantly, we provided telescopes and knowledgeable telescope operators to many school events. This is where we ignite the interest of our future (possible far future) members in astronomy.

Our meetings now have many presentations about observing programs our members are actually doing. Astro-imaging is big part of our Society's observing, and the images that are being produced are amazing. In addition, we have variable star observers, occultation observers, minor planet observers (astrometric and photometric), and satellite observers. We have software authors and column authors, astronomy teachers and telescope builders. This is a truly diverse and very active Society. This year will be at least as active as last. We already have our first school star parties, and we have the brightest comet in the last thirty years. We get to view part of two lunar eclipses, and will have a Mars opposition at the end of the year. Hopefully, we will be at the same events as last year, but that depends on you. Yes, you, and you and you, too.

We have a small and very dedicated group that is providing most of the support for all our events. We need new members to step up and volunteer to help at some of these events. You do not have to do all of them, just one or two to make things easier on the other members. It is really fun to have a kid look through your telescope and hear the "Wow!" when they see Saturn for the first time. If you have never done it, you should give it a try.

Many of our events are discussed on our Yahoo! Group, ASLCNM. If you have e-mail (or web access), you can sign up for the group and get messages about what observations are occurring, what star parties are being planned, and other interesting tidbits. If you need help signing up, let me know. I look forward to seeing you at our meetings, and in between hearing from you in the ASLCNM group! Your president, Bert Stevens

Next Meeting

The next meeting will be held on January 26 (fourth Friday of the month), 2007 at the usual place and time (DABCC, room 77, 7:30pm). The "Astro-Tidbits" (contact: Nils Allen) pre-meeting will not meet this month so that those interested in the new "Imagers Group" (Contact: Rich Richins) can attend that pre-meeting at 7pm. Anyone is welcome to attend these special interest groups.

Other events planed for January include:

Dark Sky Observing at the Upham dark sky site, Saturday, January 20, dusk

ASLC MoonGaze, International Delights Cafe, Saturday, January 27, dusk

Please see the ASLC website for further information (http://www.aslc-nm.org)

This Month's Observer

Asteroid 4 Vesta as a Meteorite Source

Fred Pilcher

Although Vesta was the fourth asteroid to be discovered, it is the brightest and only asteroid to be easily visible to the unaided eye. It reaches magnitude 5.4 at a perihelion opposition, a full magnitude brighter than any other asteroid. Vesta's discovery is also the first of any asteroid to be premeditated, the result of a deliberate search for an asteroid.

As I described in a previous HDO, Ceres was the first asteroid to be discovered January 1, 1801. It was seen again December 31, 1801, as it approached its next opposition, and in the following months widely observed. H. W. Olbers, of Olbers' paradox fame, was one of these observers. Because he became acquainted with stars through which Ceres was moving, he detected on March 28, 1802, another moving object in the same region of the sky, which subsequently became known as Asteroid 2 Pallas.

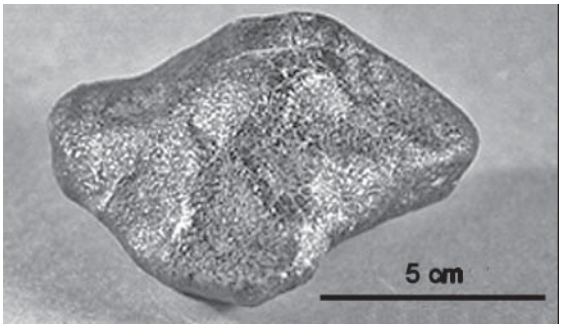
Olbers noted that the orbits of Ceres and Pallas almost intersected. This was also at the time when Chladni had established by exhaustive eyewitness testimony that stones really do fall from the sky, and that their composition and crystal structure were different from any terrestrial rocks. Olbers hypothesized that Ceres, Pallas, and the meteorites were fragments from a shattered planet and that more should exist. The best place to search for them would be near the two points on opposite sides of the sky, in Virgo and Cetus, respectively, where their orbits nearly intersected. Searches at these points were rewarded on September 1, 1804, when K. Harding in Lilienthal discovered 3 Juno, and on March 29, 1807, when Olbers himself discovered 4 Vesta. These were the first premeditated discoveries of asteroids, and allowed the shattered planet hypothesis to gain widespread acceptance. This belief persists among many laymen to the present time even though it has been replaced by recent findings.

Olbers' original concept was that all the pieces of a shattered planet should pass through the point in the sky where the shattering occurred. Even by the year 1811 Karl F. Gauss, in computing the gravitational effects caused by the gravity of Jupiter in the orbits of the first four asteroids, recognized that their orbits would shift to different orientations and very soon not pass even close to the point where the disruption occurred. In the past 50 years it has been established that planetary perturbations alone cannot account for the wide

Continued on page 3

Vesta, continued from page 2

variety of asteroid orbits. The study of asteroid spectra, to be elaborated below, shows variations strongly correlated with increasing distance from the Sun, and related to variations of temperature at which the bodies condensed. The asteroids are the original planetesimals which never collected into a single planet, a case of incomplete planetary formation. It is conclusively established that collisions among asteroids do occur, and that the meteorites are fragments from collisions between bodies which originally condensed in the size of typical asteroids. Olbers' original concept of a single shattered planet, partly correct, has been modified to specify many shattered asteroids. A major goal of meteorite research is to relate specific meteorite classes to specific parent bodies still existing in the asteroid belt. This task has proved exceedingly difficult and is still incompletely solved. The greatest success to date in these studies has linked the basaltic achondrite meteorites (eucrites, diogenites, and howardites) to asteroid 4 Vesta.



Meteorite, possibly a fragment of asteroid 4 Vesta, photograph by Russel Kempton, April 19, 1995, NASA

The spectra of solid bodies shining by reflected sunlight are not nearly as diagnostic as stellar spectra. In stars, atoms in the outer atmosphere absorb very narrow wavelength bands different for every atom. Reflectance spectra show very broad bands indicative only in a crude way of the mineralogy of the reflecting surface. Asteroid spectroscopy began in earnest about 1970 and showed that the asteroids, somewhat analogous to stars, do fall into color classes. Vesta was one of the early targets and found to have a spectrum unique among the larger asteroids with deep absorption bands near 0.95 micrometers and 2 micrometers, respectively, due to pyroxene. T. B. McCord and colleagues in 1970 found that the reflectance spectrum of Vesta matched almost perfectly that of the basaltic achondrite meteorites, somewhat intermediate between the eucrite and diogenite meteorites. It remained to prove that Vesta was the source of these meteorites.

Daniel Kirkwood in 1867 noted an absence of asteroids with periods of about 1/3 that of Jupiter near 2.52 AU. Technically called the 3:1 Jupiter resonance, this is one of the most prominent of the Kirkwood gaps, also found at 1/4 and 1/2 and to a lesser extent at other simple fractions of Jupiter's period. Kirkwood attributed this to perturbations by Jupiter always in the same direction because hypothetical asteroids with orbits in the gap would always encounter Jupiter in the same place in their orbits. More recent dynamical studies have elucidated a remarkable mechanism for their removal, to be explained later.

In the early 1990's R. P. Binzel and S. Xu performed detailed narrow band spectrophotometry on Vesta and a number of small asteroids with orbits between Vesta's and the 3:1 resonance. Some of these were objects with orbits very similar to Vesta's, collectively called the Vesta family. Binzel and Xu found, as they expected, that members of the Vesta family had Vesta-type spectra. In addition they found other Vesta-type spectra in asteroids all the way out to the 3:1 resonance. Three Earth-crossing asteroids were also found to have Vesta-like spectra. This suggested strongly that fragments from a collision on Vesta had been displaced much farther than expected out to the 3:1 resonance and subsequently deflected into Earth crossing orbits.

In 1994 and again in 1996 the Hubble Space telescope obtained a series of images in multiple wavelengths of Vesta throughout its 5.342 hour rotation period. They determined a nearly spheroidal shape, equatorial dimensions 580 x 564 kilometers (360 x 350 miles), and polar diameter 460 kilometers (285 miles). The reason Vesta is so bright is because it has an albedo about 0.35, much higher than for most asteroids. An enormous crater near the south pole, with diameter about 450 km, depth 12 km, central peak height 8 km, was found along with two smaller craters near the equator with diameters 150 km and 160 km, respectively. The volume excavated by the impact producing the large south polar crater is much greater than the combined

Continued on page 8

As Far as Eye Can See

Joseph Mancilla

M47 from http://www.noao.edu/ image_gallery, NOAO/AURA/NSF

This month we will explore the constellations Monoceros, Puppis, and Gemini. Monoceros is a dim constellation that is difficult to trace due to its medium faint stars. Using patient persistence, trace the constellation and locate Beta Monoceros. This is a beautiful triple star with components of magnitude 4.7, 5.2 and 5.2 separated by 7.3 and 2.8 arcseconds. At low power it appears as a double star. Using high power above 120x will reveal the three stars well. Part of the beauty of this group is the almost equal brightness of the three stars. In the constellation Puppis are the two star clusters M47 and M46. M47 is brighter and sparser and about one degree west of the finer and fainter M46. Be careful of your directions and don't go north of M47 because in the immediate vicinity is another faint star cluster (NGC 2423). You may mistake this for M46. I once made this mistake. M46 is a rich but fainter cluster than M47. Look closely and you will see a planetary nebula among the stars (NGC 2438). This planetary nebula is really not within the star cluster. It is just in the same line of sight. NGC 2438 is twice as far away than M46. Moving to the feet of Gemini is the large beautiful open cluster M35. Use low power. M35 is 30 arcminutes in diameter and is about 2,800 light years distant. There is a beautiful bright orange star on the northern side of the cluster. At the western outskirts of the cluster you can see NGC 2158. This faint cluster is composed of stars 16th magnitude and fainter and lies about 16,000 light years away. Almost 6 times farther than M35. The last object on our tour is NGC 2392, the Eskimo nebula in Gemini. Located near Delta Geminorium, this planetary nebula is next to a 9th magnitude star and the two resemble a wide double star. One of the stars looks fuzzier than the other. That's the nebula. At low power between 50x to 80x, this planetary will "blink." Stare straight at it and you see the 9th magnitude central star. Look away and the glow of the nebula appears. Happy hunting!

Martian Devils

Dr. Tony Phillips

Admit it. Whenever you see a new picture of Mars beamed back by Spirit or Opportunity, you scan the rocks to check for things peeking out of the shadows. A pair of quivering green antennas, perhaps, or a little furry creature crouched on five legs…? Looking for Martians is such a guilty pleasure.

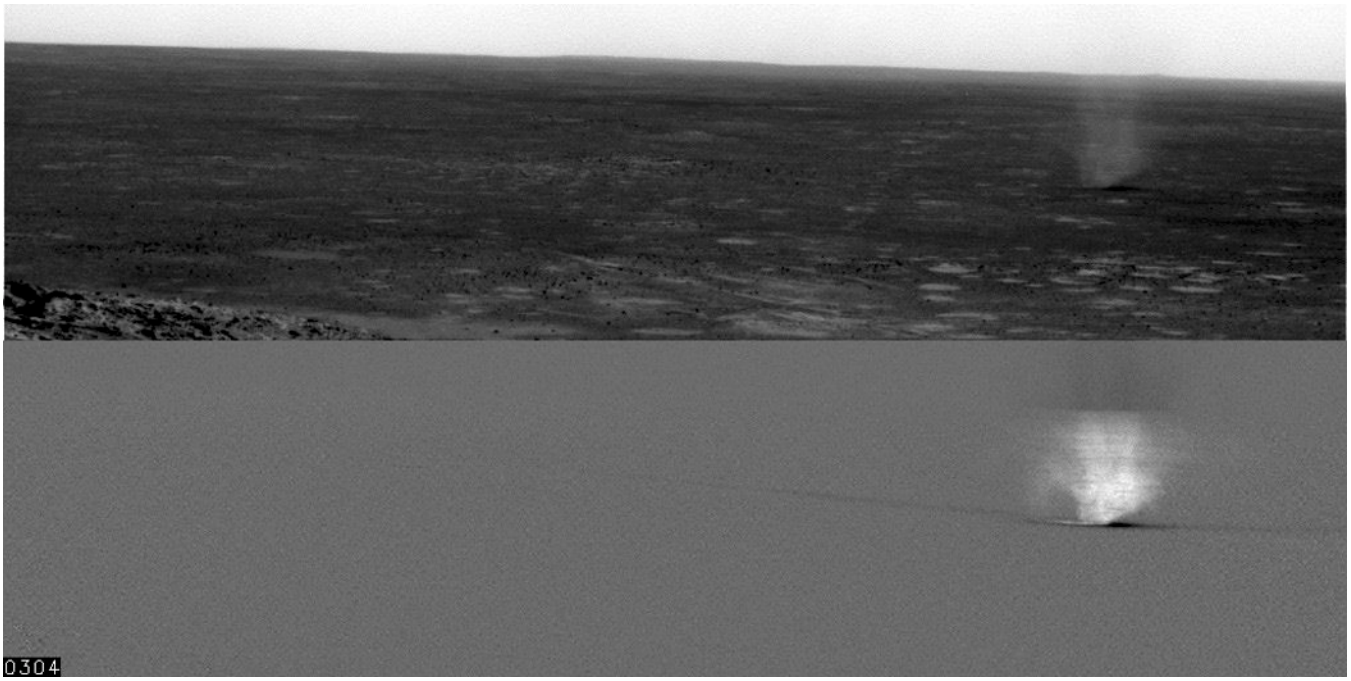
Well, you can imagine the thrill in 2004 when scientists were checking some of those pictures and they *did* see something leap out. It skittered across the rocky floor of Gusev Crater and quickly disappeared. But it wasn't a Martian; Spirit had photographed a dust devil!

Dust devils are tornadoes of dust. On a planet like Mars which is literally covered with dust, and where it never rains, dust devils are an important form of weather. Some Martian dust devils grow almost as tall as Mt. Everest, and researchers suspect they're crackling with static electricity—a form of "Martian lightning."

NASA is keen to learn more. How strong are the winds? Do dust devils carry a charge? When does "devil season" begin—and end? Astronauts are going to want to know the answers before they set foot on the red planet.

Continued on page 5

Martian Devils, continued from page 4



The top half of this image is part of a series of images of a passing dust devil on Mars caught by Spirit. In the bottom half, the image has been filtered to remove everything that did not change from one image to the other. Notice the faint track left by the dust devil. Credit NASA/JPL/Mark T. Lemmon, Univ. of Arizona Lunar and Planetary Laboratory.

The problem is, these dusty twisters can be devilishly difficult to catch. Most images of Martian dust devils have been taken by accident, while the rovers were looking for other things. This catch-as-catch-can approach limits what researchers can learn.

No more! The two rovers have just gotten a boost of artificial intelligence to help them recognize and photograph dust devils. It comes in the form of new software, uploaded in July and activated in September 2006.

"This software is based on techniques developed and tested as part of the NASA New Millennium Program's Space Technology 6 project. Testing was done in Earth orbit onboard the EO-1 (Earth Observing-1) satellite," says Steve Chien, supervisor of JPL's Artificial Intelligence Group. Scientists using EO-1 data were especially interested in dynamic events such as volcanoes erupting or sea ice breaking apart. So Chien and colleagues programmed the satellite to notice change. It worked beautifully: "We measured a 100-fold increase in science results for transient events."

Now that the techniques have been tested in Earth orbit, they are ready to help Spirit and Opportunity catch dust devils—or anything else that moves—on Mars.

"If we saw Martians, that would be great," laughs Chien. Even scientists have their guilty pleasures.

Find out more about the Space Technology 6 "Autonomous Sciencecraft" technology experiment at nmp.nasa.gov/st6/technology/sciencecraft_tech.html, and the use of the technology on the Mars Rovers at nmp.nasa.gov/technology/infusion.html. Kids can visit spaceplace.nasa.gov/en/kids/nmp_action.shtml and do a New Millennium Program-like test at home to see if a familiar material would work well in space.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Educationally Speaking

Nils Allen

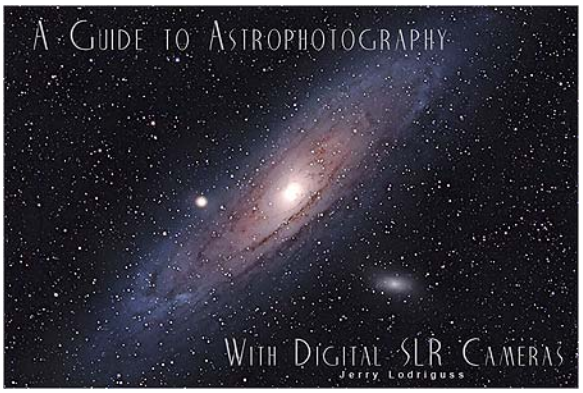
Astro-Tidbits (formerly Beginner's Corner) will not be held for the January meeting in order to encourage max participation in the brand-new "Imagers Corner" - let's help get this new group started with a bang!

The New Telescope Owner's Clinic, rev. 2.... Due to the weather and other difficulties, not much happened at the prior session held on January 6, so we're going to try it again! Hopefully we'll have some decent publicity and lotsa folks will come. Anyone with basic hardware/operation issues (especially newbies) are welcome to show up between 3:00 and 5:30pm on Saturday, January 27, at Veteran's Park off of Roadrunner. Various capable members (like Steve, Chuck, Bill, Rich, Nils...) will be there to provide whatever assistance they can. After it's dark, we can do some observing if folks so desire! So spread the word to anyone who might be interested! Contact me for additional information... nils_a@comcast.net, 522-1456.

The first school party of the season: the White Sands School Star Party is set. It will be held January 18, from 6-8pm - we always have a good time at this one. Again, contact me if you are interested. in participating.

Book Review: *A Guide to Astrophotography with Digital SLR Cameras*

George Hatfield



This is a book on CD that was recently published by Jerry Lodriguss. Many of who that are involved in imaging know of Jerry and his website, "Catching the Light" at http://www.astropix.com/. The site has a lot of his images, many of which were taken on film, and also much information on astrophotography in general. Given all the film images, it is obvious that Jerry is not a newcomer to astrophotography. He has now taken a lot of this information, plus a lot more, and published it in book form. The price is actually pretty reasonable at about $40, shipping included.

One nice thing about the CD format is that there are a lot of instructive images in the text. For some, one moves the cursor over the image to see before and after effects. I found reading the text on the computer screen rather tedious and printed most of the chapters I was interested in reading. One of the things I don't like about the CD is that it is a lot easier to open a book to review something after the initial read than starting up the computer or hunting through files to find the printed chapters.

Some of the material is very basic (e.g., cameras for astrophotography, other equipment, how digital cameras work), but the sections on taking pictures and image processing were quite good, at least for me. The discussions of ISO vs. exposure settings, filters, calibration, non-linear stretching and especially white balance were excellent as were the sections on image processing.

Video tutorials on image processing are also included on the disk. Most of the these concern using ImagesPlus and Photoshop, but several other programs such as GradientXTerminator and Noise Ninja are also

Continued on page 9

The Astronomical Society of Las Cruces (ASLC) is dedicated to expanding members and public awareness and understanding of the wonders of the universe. ASLC holds frequent observing sessions and star parties, and provides opportunities to work on club and public educational projects. Members receive *The High Desert Observer*, our monthly newsletter, membership in the Astronomical League, including AL's quarterly *A.L. Reflector*. Club dues are $35 per year. Those opting to receive the ASLC newsletter electronically, receive a $5 membership discount. Send dues, payable to A.S.L.C. with an application form or a note to: Treasurer ASLC, PO Box 921, Las Cruces, NM 88004

ASLC members are entitled to a $10 discount on subscriptions to *Sky and Telescope* magazine. S&T subscribers MUST subscribe and renew through the Society Treasurer for the special club rate. To avoid a lapse in delivery, this must be done when S&T sends their reminder, 4 months in advance.

ASLC OFFICERS, 2007
<Board@aslc-nm.org>

President: Bert Stevens
President@aslc-nm.org / 382-9131

Vice President: Bill Stein
VP@aslc-nm.org

Treasurer: Janet Stevens
jastevens@zianet.com / 382-9131

Secretary: John McCullough
Secretary@aslc-nm.org

Immediate Past President:
Vince Dovydaitus
PPresident@aslc-nm.org

Directors:
Chuck Sterling, Alfred Hughey

Education Director: Nils Allen

ASLC Newsletter Editor:
George Hatfield
gmhlcnm@msn.com

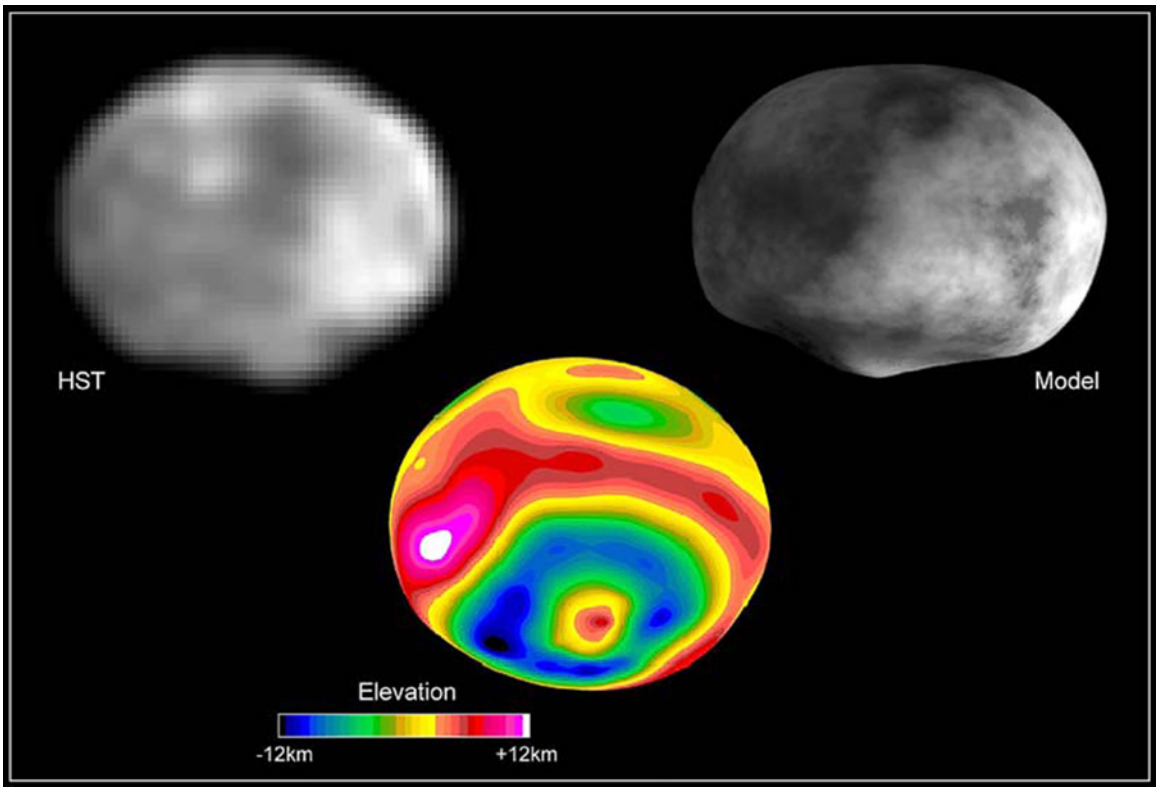
Photos from the ASLC Christmas Party

Photos by Chuck Sterling

Vesta, continued from page 3
volumes of the observed Vesta-like small asteroids.

The multiple wavelengths of the images permitted disk-resolved spectrometry. Part of the surface has the reflectance of eucrites and part the reflectance of diogenites. The eucrites have small crystals and originate as a surface lava flow. The diogenites have larger, slow-cooling crystals which originate as a subsurface emplacement, and later brought to the surface by a large impact. This is indisputable evidence that Vesta is a differentiated body. The radioactive decay ages of the basaltic achondrites show that the differentiation and cooling occurred very early in the formation of the solar system.

The mass of Vesta has been determined from perturbations on other asteroids and Mars to be about 2.7 x 10^{20} kg, with an error of perhaps 10%. From the dimensions quoted above, the mean density is in the range 3.4 to 3.8 grams/cm^3. The density of the basaltic achondrite meteorites is 3 to 3.4 grams/cm^3. This hints, but does not confirm, the existence of a dense iron core in a differentiated Vesta. Vesta is now interpreted to have a eucrite crust, a diogenite mantle partly exposed through large impacts at the surface, and likely an iron core. Klaus Keil, in 2002, termed Vesta "The Smallest Terrestrial Planet." In this Keil showed remarkable



[left] Hubble Space Telescope image of the asteroid Vesta, taken in May 1996 when the asteroid was 110 million miles from Earth. The asymmetry of the asteroid and "nub" and the south pole is suggestive that it suffered a large impact event. The image was digitally restored to yield an effective scale of six miles per pixel (picture element).

[center] A color-encoded elevation map of Vesta clearly shows the giant 285-mile diameter impact basin and "bull's-eye" central peak. The map was constructed from 78 Wide Field Planetary Camera 2 pictures. Surface topography was estimated by noting irregularities along the limb and at the terminator (day/night boundary) where shadows are enhanced by the low Sun angle.

[right] A 3-D computer model of the asteroid Vesta synthesized from Hubble topographic data. The crater's 8-mile high central peak can clearly be seen near the pole. The surface texture on the model is artificial, and is not representative of the true brightness variations on the asteroid. Elevation features have not been exaggerated.

Photo Credit: Ben Zellner (Georgia Southern University), Peter Thomas (Cornell University), NASA

Continued on page 9

Vesta, continued from page 8

foresight, as Vesta is being considered for dwarf planet status with the 2006 IAU definition of dwarf planets.

Given the dimensions, mass, and rotation period of Vesta quoted above, one can compute approximately from the combined effects of gravity and centrifugal force the gravitational acceleration as 34 cm/s^2 at the pole and 18 cm/s^2 at the equator. The equatorial escape velocity is 350 m/s. All of these figures should be accurate within 15%.

With planetary perturbations in most cases causing small changes in the semimajor axis, eccentricity, and inclination of asteroid orbits, a mechanism to divert Vesta fragments into Earth-crossing orbits must be found to complete the identification with basaltic achondrites. In the 1980's Jack Wisdom found that any asteroid in the 3:1 Jupiter resonance is subjected to large and chaotic changes in the eccentricity, which can change a near circular orbit into one with large enough eccentricity to cross the orbits of Mars and Earth. Several of these high eccentricity 3:1 Jupiter resonators are found among the Earth approaching asteroids. Close encounters with these planets produce further large and chaotic changes in the orbit which eject the object from the 3:1 resonance and render its origin completely indeterminate except for the spectrum.

A velocity change of about 600 meters/second is required to boost a fragment from Vesta's orbit at 2.36 Astronomical Units into the 3:1 resonance at 2.52 AU. For a long time this seemed difficult to achieve. Laboratory experiments and theoretical modeling suggested fragments would be ejected with considerably smaller velocities. About the year 2002 it was recognized that the emission of infrared radiation occurred preferentially on the afternoon side of the asteroid and caused the asteroid to recoil in the opposite direction. This is called the Yarkovsky effect, and recent numerical studies have showed that 10 to 20 kilometer asteroids can be subject to this much change in orbit semimajor axis in a few hundred million years. The collision which formed the Vesta spectrum small bodies need not have ejected debris at anomalously high velocities.

In June, 2007, the Dawn space probe to Vesta is scheduled for launch, with arrival about 3 years later. This should provide a detailed mapping not only of the shape of surface features, but also their mineralogy. The ages of the large craters, and hence the likely ages of Vesta family small asteroids, can be found from the density of superimposed craters. This detailed study should also determine the existence and even size of the hypothesized iron core.

It is instructive to use this as a case history in how science advances, by many lines of evidence pursued by many talented scientists, all converging toward a single result.

February Issue HDO

Articles for the February issue should be to me by Sunday, February 11. Material should be sent as email (gmhlcnm@msn.com) or as an attached Microsoft Word document. If you have any questions about submitting something to the HDO, please don't hesitate to contact me (532-5648 or via email). Thanks in advance! George Hatfield, Editor, ASLC Newsletter

Book Review, continued from page 5

demonstrated. ImagesPlus comes with video tutorials also, but Jerry's videos are more focused on SLR images and provide a good outline, from start to finish, of image processing.

In summary, I learned a lot from this book. It is well written and an easy read. The price is reasonable, but the CD format has its disadvantages, at least for me. I recommend it.

Mercury Transit Images

Jerry Gaber

These three images were taken during the November 8, 2006, transit with a DSI Pro II and an AT80 80mm 480mm FL F6 0.0002 sec exposure time. Fifteen images were stacked for a total exposure time of 0.003 sec. The image on the left was shot just as Mercury started its transit at 12:13pm local time. The center images shows Mercury continuing its transit at 1:01 PM local time. The last image was shot at 2:19pm local time . These are three of 36 images captured between 12:07 and 4:31pm when the Sun went below my roof. All have been artificially colored in Photoshop CE.

ASTRONOMICAL SOCIETY of Las Cruces
PO Box 921
Las Cruces, NM 88004

ASLC - Sharing the Universe
With Our Community
for Over 50 Years