SIDEREAL TIMES

The Official Publication of the
Amateur Astronomers Association of Princeton

Director:
Rex Parker
(609) 730-0670
drexparker@aol.com

Assistant Director:
John Miller
(609) 252-1223
jmiller@princetonastronomy.org

Treasurer:
Ron Mittlestaedt
(609) 771-6981
C8User@aol.com

Secretary:
Ludy D'Angelo
(609) 882-9336
ldangelo106@comcast.net

Program Chairman:
Ken Kremer
(609) 558-4955
ken@princetonastronomy.org

Editor:
Victor Belanger
(609) 448-8598
vic@apink.com

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From the Director

AAAP "Annual Meeting" May 9 (8:00 Peyton Hall). At the May 9 meeting we will continue our adventures through the cosmos with a very exciting, cutting edge speaker and topic. **Dr. Michael A'Hearn** from the University of Maryland will present "Deep Impact: Excavating Comet Tempel-1". Dr. A'Hearn is the PI for the Deep Impact NASA mission's and is deeply involved in the development and attainment of the scientific objectives. For more information please see Ken Kremer's article in this issue and on the AAAP website. Don't miss this rare opportunity to hear one of NASA's most dynamic scientists in this exclusive visit to the AAAP!

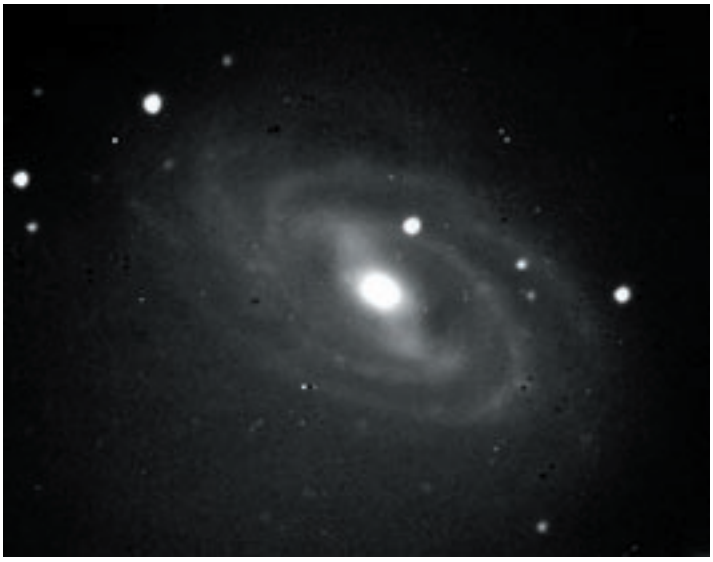
May 9 will also mark the **44th convening of the Annual Meeting of the AAAP** as set forth in our Constitution and By-Laws. During the meeting we will hold the election of the Board of Trustees. Suppressing a laugh, I noticed that the archives of club history (accessible on the AAAP website) record many instances in the minutes of "Current officers are re-elected for another term." But in this case, we have the opportunity to elect a new Treasurer (candidate **Brian Van Liew**) along with returning candidates for Program Chair (**Ken Kremer**), Assistant Director (**John Miller**), Secretary (**Ludy D'Angelo**) and Director (me).

I would like to extend a very big and heartfelt **THANK YOU to Ron Mittelstaedt**, our outgoing Treasurer. Ron has been an invaluable colleague to me and to the Board and the Club in many ways, serving ably as Treasurer ever since being first elected in 1989 (with one year hiatus in 2001). While he relinquishes that post, I'm counting on Ron to continue in the other areas in which he is a cornerstone of the AAAP, sharing his expertise as an observer and telescope engineer, and helping with his technical and personal skills at the Observatory.

New Appointments. In addition to the Board members mentioned above, I would like to announce a few additional appointments to the core Committees in the AAAP. As Brian Van Liew moves to the Treasurer slot, he will relinquish the role of **Public Outreach Coordinator**, to which I am appointing **Jeff Bernardis**. Jeff is an experienced observer and will take over this key position to integrate and enhance our outreach efforts with the public.

In addition, **Bill Nagel** is being appointed along with **Ron Mittelstaedt** and **Gene Ramsey** as **Observatory Co-Chairs**. Ron and Gene will focus on maintaining equipment and the physical plant at the Washington Crossing Observatory, while Bill will lend a hand to overseeing the Keyholders, improving the organization of training and other observatory events, and ensuring good coordination with Public Outreach.

Spring is Galaxy Season. With the warming weather comes a changing of the guard for the object types you can observe. In mid-spring, galaxies rule! Among the dozens of Messier and NGC galaxies well-positioned high in the sky now, I caught these images last week using my C-11 and SBIG ST-10XME CCD camera.



Setting focal reducers aside, I have been concentrating on prime focus F/10 imaging with the C-11, which of course makes tracking challenging. M109 (above) is a barred spiral galaxy, magnitude

(Director, continued on page 2)

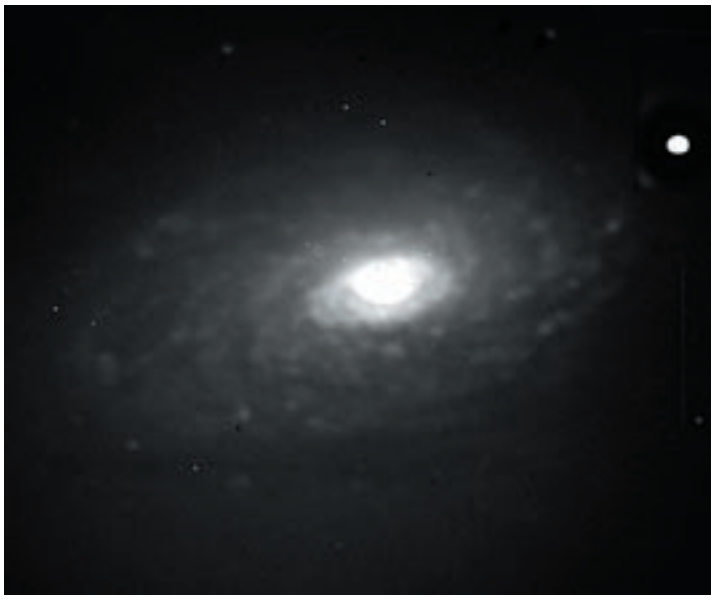
Simpson Observatory (609) 737-2575

Set Aside June 23 - 25

for Jersey StarQuest '06

(See details inside)

(Director, continued from page 1)



10.6, with angular size about 7 x 4 arc-min located about 55 million light years distant; while M63 (above) is magnitude 9.8, about 10 arc-min across, and a member of the M51 group located about 40 million light years away from us. These gems are visible through the eyepiece of the club's C-14 at the WC Observatory—let me know if you can see them next time you're there, or whether you can pick them up in your own home telescope.

Dark skies! -- Rex

Minutes of the

AAAP General Meeting

April 11, 2006

The meeting started at 8 PM. The speaker for the Evening was Robert Nemiroff, co-author of the Astronomy Picture of the Day. The meeting hall was well attended.

After the lecture break, Rex Parker started the meeting mentioning some opportunities that are coming up for observing and indicated that we had a good start on Starquest, with the registration forms ready to go. Don Monticello will do a mailing in a few weeks. The website will be updated with the new information. There will be two speakers at Starquest, one on Saturday afternoon, and the other after dinner on Saturday evening. The speakers will be Andrew Youdin and Rus Belikov. There is a need to do work on gathering raffle/door prizes. John Miller is leading this effort and has assigned Linda Papetti, Larry Kane, Jeff Bernardis, Rex Parker and himself to call last year's donators. Action to be taken over the next few weeks.

The proposed Starquest tee shirt was discussed. Member Linda Underwood volunteered and will research and price the cost of the tee shirts and quantities needed. Discussion indicated we should get at least 60, some of different sizes.

Rex brought up the subject of the black AAAP logo shirts. Barlow Bob has asked for 2 extra large and one medium AAAP logo shirt to give away at NEAF. Rex asked Brian Van Liew to order 20 of the shirts and hats for general inventory. The hope is that they will sell over time.

Bill Murray confirmed that our June 2006 meeting would be at the New Jersey Planetarium. Also, The Planetarium will bring people out to the observatory open house on April 28th.

Jeff Bernardis has agreed to take over as Public Outreach coordinator; Brian VanLiew will be taking on other responsibilities. Rex stressed the importance of getting members involved in all the committees of the club to bring new ideas.

Bill Nagel and Ron Mittlestaedt will be Observatory co-chairs. Gene Ramsey continues to be Observatory Chairman.

Larry Kane, Nominations Chair, announced that the slate of officers up for election at the May meeting will be Rex Parker (Director), John Miller (Assistant Director), Ludy D'Angelo (Secretary), Brian VanLiew (Treasurer), and Ken Kremer (Program Chair). He will accept any additional nominations for those positions for the next month.

John Church reports that he and Gene Ramsey continue to work on the logistics of some tree removal at Washington Crossing Park. Brian VanLiew reported that Ludy D'Angelo, Mike Mitriano, and John Miller installed a new carpet at the Simpson observatory.

Ludy D'Angelo (Secretary) reports that the membership stands at 110. Jong Lee was the last new member. He welcomed any new members in the audience. Linda Pappetti had set up a table of food, handouts and a donation piggy bank. Everyone gave Linda a round of applause for her efforts. $20 was collected and will go into the treasury.

Ludy read the thank you letter addressed to Gene Ramsey from the NJ Planetarium for his and the club's efforts at the reopening of the planetarium. Ludy also read a letter from Derrick Pitts of Franklin Institute calling for local astronomy clubs to represent at the National Astronomy Day activities in Philadelphia on May 6. This is the same day as NEAF. Anyone interested should contact Ludy. We also received an email from Steve Mazlin announcing an astroimaging conference to be held in Philadelphia in August. We will get the announcement out via email for those interested. More info at www.pennastroimaging.com/eccai

Ken Kremer (Program Chair) gave an update on the Honeybee trip. It should be happening between April 18th and the end of the month. He also reported on several outreach activities. One was at Stuart School the other at Plainsboro with Ken's lecture inside and telescopes outside. Ken and Linda Pappetti also took part in the Princeton University science day for middle school students. Another program is scheduled for Pennington Tollgate Elementary School on April 18TH, with scopes outside and lecture inside. He also mentioned his presentation at NJAA at the end of March.

John Miller reported that the website got in excess of 48,000 page views in the last month. There was a discussion of how our club comes up in search engines/indexes.

Ron Mittlestaedt (Treasurer) reports that there is $xxxxx in the treasury and that the picnic cost $169.

The next deadline for the Sidereal Times is April 28th. Vic Belanger is asking for anyone interested the newsletter layout to please contact him.

Meeting adjourned at 10:30 PM.

Submitted by
Ludovico D'Angelo, Secretary

Honeybee Robotics Field Trip on April 20; Martian HQ in NYC:

We were welcomed with a big friendly smile by Honeybee Chairman Stephen Gorevan for our invited tour of his aerospace company in mid-town Manhattan on a gloriously sunny day of fun and learning. Steve is a leading member of the Mars Rover science team. Honeybee is situated just 2 short blocks walk from Penn Station. The suite of offices and labs are located on the 7th floor with broad windows overlooking the mid-town area. In September 2005, Steve was the keynote speaker for the first lecture of the 2005-2006 AAAP season.

All Honeybee Field Trip Attendees (from left): Prof. Mary Lou West, Phyllis Johnson, Stuart Warmink, Dr. Mathieu Petitjean, AAAP Program Chair Dr. Ken Kremer, AAAP Treasurer Ron Mittelstaedt, Honeybee Chairman Stephen Gorevan, Bryan Hubbard and twins James and Jeziah Johnson standing in the Honeybee Workshop in front of an engineering prototype for the Sample Manipulation System planned for the 2009 Mars Science Lab Lander.

Youth is apparent with virtually everyone under 30 years of age and eagerly working on missions to explore the unknown with cutting edge technology. And that is the secret to Honeybee's success, repository of the world's most advanced drilling expertise in extreme environments.

Steve made us feel right at home with a generous heap of time, custom presentation and personal tour of his hi-tech facility. Honeybee Robotics designed and built the amazing and still functioning science drills for the Mars Explorations Rovers *"Spirit"* and *"Opportunity"*. They are nicknamed the ***RAT*** and are formally known as the Rock Abrasion Tool. These engineering marvels are located at the terminus of the deployable robotic arm and have been absolutely crucial to the mission's success in finding evidence for past alteration of Martian rocks by liquid water, a critical requirement in the search for habitable environments.

Our group of 9 gathered in Steve's conference room and he began with a detailed summary of the history, operation and science results of the Honeybee RATs. Steve mentioned that "the RAT bits were the last component of the rover to be delivered", just prior to launching from the Kennedy Space Center in Florida in the summer of 2003. This permitted further experiments to optimize the lifetime and capabilities of the grinding bits. The RATs represented a leap into the unknown as the first instruments to access the interior of rocks on another planet. And NASA gave only general science goals not specific design specs to Honeybee. Steve said that "the teeth had to be tiny for optimal cutting force and longevity. The grind heads consist of small diamonds (~ 0.1 mm) embedded throughout a phenolic resin. As grinding continues, diamonds pull out of the phenolic epoxy revealing sharp new diamonds. This finite resource in the teeth has lasted longer on Mars than expected. For some still unknown reason, the diamonds have been more resilient on Mars", perhaps related to the very dry environment. With the launch deadline near, the final epoxy used could not be fully vacuum tested to simulate cruise conditions, and thus the effects of the 7 month cruise phase were unknown.

Steve showed us a full-scale model of the RAT, roughly the size of a can of coke, which has a grinding width of 45 mm and depth of 5 mm and operates on about 11 watts of electricity. The teeth rotate at 3000 RPM while 2 brushes made of 301 Stainless Steel bristles sweep away the cuttings and fines. He said that "the brushes can be used independently of the grinding bit and were an add on" suggested by Honeybee and not part of NASA's design specs. Virtually all of the actual flight hardware for the RATs was constructed in Manhattan.

Both rover RATs continue to operate to this day. Steve said that "there have been 127 successful deployments of the RAT, 121 deployments beyond the mission success target". The flatness of the grinding was a surprise and a great technical achievement and they have completed additional tasks beyond the original goals.

The brushes have turned out to be critical to the continued use of the RAT, since *Spirit's* RAT teeth are now nearly ground away. In most cases, simply brushing away the uninteresting Martian dust is sufficient to expose the surface of the rocks and conduct chemical analysis on the composition of the rocks.

In the very near future, the brushes on the *Spirit* RAT will again expand the envelope of science and engineering. For the first time ever, Steve said that "the RAT they will be commanded to carefully brush directly into the soil and progressively displace several mm of soil at a time". The newly exposed surface will then be chemically analyzed with the spectrometers. Then the RAT will brush even deeper, exposing new layers for highly detailed science investigation to determine the mineral content and physical attributes of the soil such as texture and particle size. *Spirit* will have ample time for exploration while spending the cold Martian winter at a north facing slope nicknamed *"Low Ridge Haven"* in order to maximize the solar power output essential for her survival.

The long working life of the RATs has also been aided by the surprise finding that most of the Martian rocks are weaker

(Honeybee, continued on page 4)

(Honeybee, continued from page 3)

compared to similar Earth rocks. The team has searched in vain worldwide for rocks matching or very similar to those on Mars.

When *Opportunity* happened upon a meteorite lying on the Martian dunes near its heat shield in January 2005, Steve mentioned that special testing was done with samples obtained from the Hayden Planetarium. Honeybee engineers determined that the meteorite was too strong to grind into with the Rover's RAT since the bit was ground down about 2/3 of the way in the lab tests.

One of Honeybee's young engineers demonstrated remote rover ops from the twin computer display monitors used for Command and Control flight operations. This RAT control room sends signals to both Mars rovers, without the need to be sitting at a monitor in JPL (The Jet Propulsion Lab in Pasadena, Ca), something that Steve never imagined before or even at the start of the mission. He "spent over 5 months camped out at JPL, living on Mars time with 3 wrist watches set for Mars, LA and NY time". Steve was present in the JPL control room for the "10 nerve wracking minutes" leading up to the ultimately successful twin rover landings. Thereafter "the science team members lived on Mars time which was essential to success at the beginning of the mission. We lived in a bubble with all windows shuttered in the labs and offices at JPL as well as the buses and hotels in order to simulate local time on Mars with its 40 minute longer days". Sleep experts were brought in from NASA's Ames Research Center to help the team members cope with the altered daily time cycle and round-the-clock operations for the twin rovers separated by 12 hours.

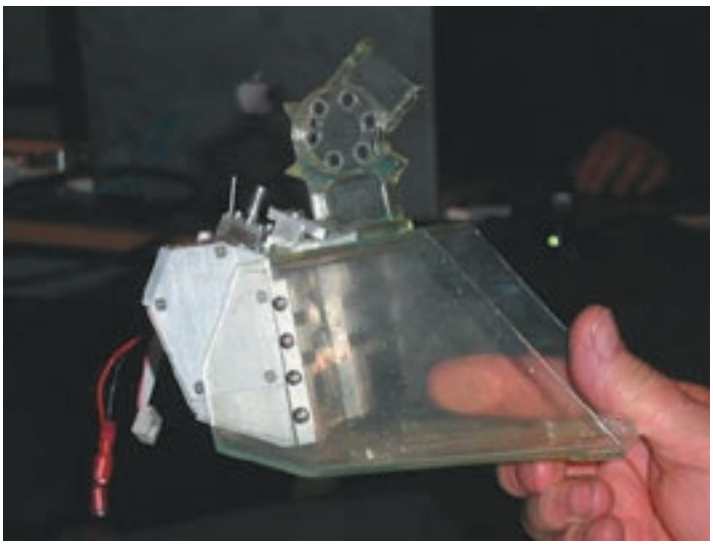
Mars Rover Command and Control Center at Honeybee Robotics; demonstrated by engineer Brandon Basso

The first rock target to be ground was by *Spirit* on a rock nicknamed *"Adirondack"*. After sending the commands from JPL, the team had to wait a full day to learn if the operation was a success. And Steve "didn't sleep at all during the night while waiting for the results. The actual outcome was better than the lab simulations and the happiest day on my life".

Steve then took us on a tour of the clean room and the labs and allowed us to view up-close and actually handle the full-scale prototypes which Honeybee is developing for the 2 upcoming Mars Missions; The 2007 Phoenix Lander and the 2009 Mars Science Lab (MSL) Lander.

Honeybee is hard at work on 3 instruments for MSL, including the Advanced RAT, the Mini-Corer and the Sample Manipulation System (SMS). About 80% of the MSL mission science objectives will be accomplished via the 78 sample cup SMS. The system will rotate and transfer the soil samples collected into the neighboring Oven and Gas Chromatograph Mass Spectrometer (GCMS) for analysis. 10 of these sample cups (ca. ½ cm^3) will be dedicated to *"wet"* chemistry in the search for signs of Martian organisms, after being carefully selected by the science teams. According to Steve, "the SMS represents a big leap in technology" and will be the most advanced sampling and analysis system ever flown on a robotic mission. The Mini-Corer will be capable of drilling 8 mm wide and 10 cm deep into the Martian soil. That depth is deemed to be sufficient to provide shielding from the continuous bombardment of deadly cosmic rays and to protect any potential Martian living organisms. Deadlines are fast approaching based on immutable launch windows. The prototype Mini-Corer we observed was being tested the day of our visit and we witnessed the results of several soil sampling experiments. In late April, the unit will be shipped to JPL and faces a crucial Preliminary Design Review (PDR). The advanced RAT is being designed to have at least 3 times the working lifetime of the MER counterparts by incorporating longer teeth and a narrower grinding width of 30 to 35 mm.

For the 2007 Phoenix lander, NASA called Honeybee on an "emergency basis" to help build the water ice sampling scoop after the original design by a different company was deemed a failure. "Within 30 days, Honeybee engineers built a new prototype. They added a rasp" to ensure penetration into the extremely hard and very cold (-80°C) icy layer that is expected to be a few cm below the Martian regolith and enable subsurface sampling for delivery of several grams of the icy mixture into the scoop and subsequent transfer to the science instrument package.



Engineering Model of Water Ice Sampling Scoop which Honeybee is fabricating for NASA's 2007 Mars Phoenix mission targeted to land in an icy region near the North Pole of Mars.

Steve also showed us the prototypes of the Champollion comet sampling drill, the Sniffer sampling drill, the subsurface telescoping deep drill system and the Mars deep drill.

Finally, we gazed upon the overwhelming "Wall of RAT Grinds". Steve invited us all to make detailed observations of the RAT

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(Honeybee, continued from page 4)

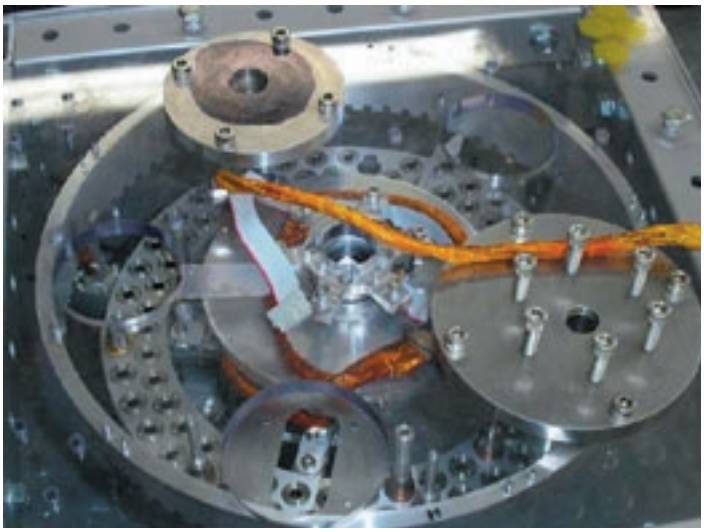
Holes using a magnifying glass, and especially to view first hand the worm like "rotini" squiggle feature created during an early RAT grind and which has not been duplicated since.

We thanked our hosts for their generosity and kindness in treating us to a first hand look at Honeybee's space exploration efforts. Everyone had a great experience. Steve will return sometime next season for a follow-up lecture to the AAAP.

Ken Kremer

AAAP Program Chairman

Honeybee Chairman Stephen Gorevan inspecting mysterious "rotini" feature created by grinding a RAT Hole on Mars in search of past water.



Sample Manipulation Sample (SMS) under construction at Honeybee for 2009 Mars Science Lab (MSL) lander is the crucial component required for delivery of soil/rock samples to on board instruments for detailed scientific analysis.

Science Outreach

Toll Gate Grammar Elementary School: Pennington, NJ, Tue, Apr 18, 8 PM: An enthusiastic crowd greeted me for a very successful family night dedicated to astronomy. The school principal invited me to present *"Twin Robots Exploring Mars and a Journey in 3-D"*. The audience had lots of great questions about the solar system and chances for life beyond Earth and I invited the crowd to our monthly lectures and visit our nearby observatory. Afterwards, the fun continued and everyone enjoyed the fabulous view of the heavens above courtesy of the AAAP telescopes from Brian van Liew, Bill Nagel and Jeff Bernardis with help from John Miller and Ludy D'Angelo. Another great combo program of presentations and observing.

Super Science Weekend: NJ State Museum: Trenton, NJ, Sat/Sun Apr 29/30: On a bright sunny weekend, many families keen on science enjoyed my displays on the solar system and 3-D explorations. Linda Papetti, Ludy D'Angelo and John Miller were on hand with a solar scope and AAAP club info booth.

Lawrence Intermediate School: Lawrenceville, NJ, Thur, May 4, 7 PM. At Family Science Night, the kids will display science fair projects and families will enjoy learning about robots and hearing my astronomy presentation on *"Twin Robots Exploring Mars and a Journey in 3-D"*.

NEAF Northeast Astronomy Forum: Suffern, NY, May 6-7. Check out the Rockland Astronomy Club (RAC) website for a prestigious group of speakers. Barlow Bob is organizing the Solar Star Party with help from Ron Mittelstaedt and Ralph Marantino. RAC has invited me back for presentations and displays including 3-D on NASA's current Solar System exploration.

http://www.rocklandastronomy.com/neaf.htm

For science outreach presentations please contact me at Email**:** ken@princetonastronomy.org

Ken Kremer

AAAP Program Chairman

From the Program Chair:

Spring 2006 AAAP Lecture season:

May 9: Distinguished Prof. Michael A'Hearn from the University of Maryland will be the keynote speaker and give a first hand account of the Deep Impact comet smashing mission. The title of Professor A'Hearn's presentation is: *"Deep Impact: Excavating Comet Tempel 1"*. As the Scientific Principal Investigator (PI) for NASA's Deep Impact Mission, Prof. A'Hearn is responsible for the mission's overall success in meeting its science objectives.

On 4 July 2005, Deep Impact delivered 19 GJoules of kinetic energy to comet 9P/Tempel 1. The ejecta were studied in virtually all wavelengths. On approach, the team learned that outbursts by comets are far more common than previously realized and that they can be associated with regions on the surface. We can confidently rule out exogenic sources for these outbursts. Although there are similarities, the geology of the surface is clearly different from that of the few other cometary nuclei visited and very puzzling. There are clearly distinct layers, which are likely not concentric shells but rather discrete blocks. Surface photometric properties are reasonably uniform except in a few small areas.

The impact itself was oblique. Most ejecta were cold, slow-moving, few-micron sized particles. After the first second, the ejecta include small crystals of ordinary ice, indicating excavation without heating and thus without chemical alteration. The ejected gases included a large amount of CO_2 and a very large amount of organics in addition to water and species yet unidentified. The

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refractory to volatile ratio in the ejecta is greater than unity but not dramatically so.

The ejecta enable us to show that the strength of the surface layers, at scales from microscopic to a few hundred meters is remarkably weak and also to show that the bulk density of the nucleus is so low that the entire nucleus must be extremely porous.

This talk will present the current state of our rapidly evolving understanding of the structure, evolution and composition of Comet Temple 1, while trying to solve the mystery of what conditions were like in the early solar system. Comets and asteroids are the scientific tools. This work was supported by NASA's Discovery Program.

Mike serves on the advisory boards of numerous scientific journals and committees and is also the PI for the Small Bodies Node of NASA's Planetary Data System. Asteroid 3192 A'Hearn is named in honor of his contributions to cometary science. He is a traditional astronomer by training and enjoys observing the stars and sailing the high seas as Captain Astronomy.

June 24 Starquest: **Dr. Ruslan Belikov** will be the evening speaker on *"Searching for Other Earth's"*. **Dr. Andrew Youdin** will be the afternoon speaker on *"Planets and Planetesimals from Protoplanetary Disks"*. Both speakers are from Princeton University.

On April 11**, Prof. Robert Nemiroff**, the Co-founder/author of the immensly popular *"Astronomy Picture of the Day"* Website, spoke to a large audience about *"Astronomy's Best Images -- As Subjectively Selected by the Editors of Astronomy Picture of the Day."* Robert cited *"Earthrise over the Moon"* as the image of the century. The remaining top NASA images were STS-1: First Shuttle Launch, Solar Eruptions with Prominences from SOHO, Apollo 17 Lunarscape: Magnificent Desolation and M16: The Eagle Nebula Pillars of Creation. The top 5 APOD images were Inside the Eagle Nebula, The Big Corona of the Sun, M31: The Andromeda Galaxy, Looking Back on an Eclipsed Earth and The Earth at Night. The audience included quite a few members from other astronomy clubs whom I have invited as part of my public outreach efforts.

2006-2007 AAAP Lecture Season

On tap so far for the new season are Princeton University Professors Christopher Chyba (Topic: Astrobiology) and Edger Choueiri (Topic: Plasma Propulsion). On Dec 12, Cornell University Professor Jim Bell will speak on Astrophotography. Several cosmology topics are planned as well as Optics, the Sun and more.

Please send me your suggestions for speakers, with contact/topic information.

Email: ken@princetonastronomy.org

Ken Kremer
AAAP Program Chairman

Deadline for the June Issue of
Sidereal Times
May 26, 2006

From the Treasurer

This will be my last Treasures Report. The Balance is $xxxx. Brian Van Liew will be assuming the Treasurers position. I have full confidence that he will prove to be the right person to take this board position.

I would like to thank all for the support I have received in the sixteen years I have been the AAAP treasurer. When I took over back in 1989 the treasury balance was around $800 with maybe 45 members. The club has grown in many ways since.

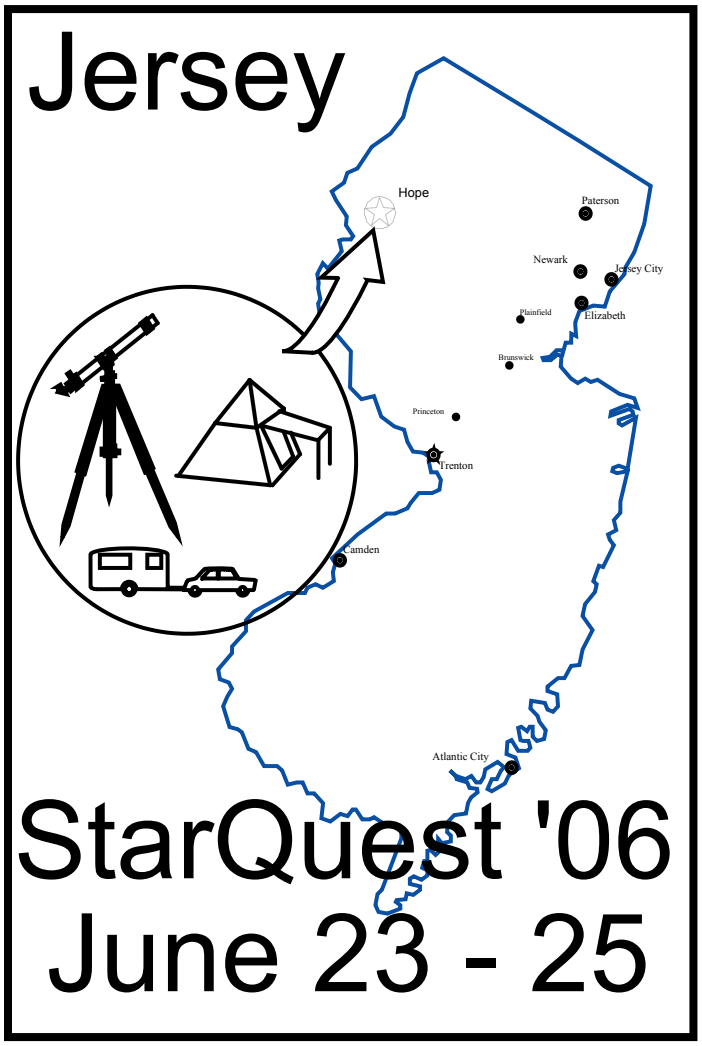
I move on to help Gene Ramsey with the everyday maintenance of the observatory, something that I wanted to do for a long time. I also look forward to assisting Bill Nagel with keyholder training and duty night assignments.

Ron Mittelstaedt

A Note of Thanks

On the facing page, you will find a letter of gratitude from the NJ State Planetarium for the efforts of our members in public outreach. Often times we may think this work goes un-noticed by those we serve but as you can see our efforts are greatly appreciated.

Editor



State of New Jersey
DEPARTMENT OF STATE
TRENTON, NJ 08625
(609) 984-1900

JON S. CORZINE
Governor

NEW JERSEY STATE MUSEUM

NINA MITCHELL WELLS, ESQ.
Secretary of State

Jon S. Corzine
Governor

Mailing Address:
New Jersey State Museum
PO Box 530
Trenton, New Jersey 08625-0530

Nina Mitchell Wells, Esq.
Secretary of State

Location:
New Jersey State Museum
205 West State Street
Trenton, New Jersey 08625-0530

Mr. Gene Ramsey
Amateur Astronomers Association of Princeton
PO Box 2017
Princeton, NJ 08543

March 30, 2006

Dear Gene,

We are still talking about the wonderful grand opening we had at the State Museum Planetarium on Saturday, March 18. Over 2,300 visitors were in attendance with many telling us how much they enjoyed themselves. I want to express my sincere thanks to you for organizing the AAAP members. It was a rare treat and truly remarkable to see the valuable telescopes and the demonstration of safe ways of solar observing. The visitors were captivated with your groups vast astronomy knowledge and your first rate equipment both inside and outside the planetarium.

I look forward to working with you and the AAAP again. Thank you again for making the grand opening a memorable one.

Sincerely,

Jay Schwartz
New Jersey State Museum Planetarium

The best way to get to the observatory is to take Interstate 95 South towards Pennsylvania. Then take Scotch road at Exit 3 and proceed north (this amounts to right). Then, at the third traffic light take a left onto the Washington Crossing-Pennington road (County Route 546). Take this road to the first traffic light and take a right onto Trenton-Harbourton road (County Route 579). Take this road to the first driveway on the left, this is the Phillips Farm/Soccer Field entrance to the park. There is a series of three gates with club combination locks. If the gates are not open, you will need the lock combination to open the gate or be accompanied by a Keyholder member.

See us on the Web: www.princetonastronomy.org

May 2006

Amateur Astronomers'
Association of Princeton
PO Box 2017
Princeton, NJ 08543