

SIDEREAL TIMES

*The Official Publication of the
Amateur Astronomers Association of Princeton*

Director

Ludy D'Angelo

Treasurer

Michael Mitrano

Program Chairman

John Church

Assistant Director

Jeff Bernardis

Secretary

Larry Kane

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Bryan Hubbard, Ira Polans, & Michael Wright

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From the Director

This month we hope to have our regular meeting at Peyton Hall. I was just informed by email that there is a possibility that the hall may be needed for midterm exams. Although we have never had this problem before, we will keep everyone informed if there is a change in meeting place. If everything works out, our meeting will be on March 8th at 8 PM at Peyton Hall.

This last month seemed to be very busy for me. One thing I did do was to give a star party at my church as a fundraiser. So I set up my binoculars, my small Meade ETX-90, and my Celestron 9.25 SCT. I used the binoculars for general viewing. The small scope set to the Moon (it was $\frac{1}{2}$ full). The large scope was set to Jupiter in the early evening, then to the Orion Nebula, the Double Cluster, and a few double stars and other objects. It was a very clear night, cold, and everyone enjoyed the views I was able to provide. And it amazes me that everyone experiencing viewing the night sky was so blown away by it. I had young children to older adults, about 25 in all. The big reaction was the view of the Moon, as the viewers came to understand the surface in great detail, the more excited they got. Especially the children, the cries of joy, I can only hope that they will continue to look up and have an interest in one of the most basic natural sciences there is: Astronomy.

At our last meeting, we determined that the club picnic would be June 4th. So mark your calendars, we will send information about where as we approach the date. We open the observatory to the public again starting in April.

I will be sending out some emails inviting other members to be part of the process of nominating chair. The nominations committee is responsible for finding nominees for Director, Assistant Director, Program Chair, Secretary, and Treasurer. Nominations can be made by anyone; you can also nominate yourself for one of the positions. If you are interested in helping your club's management and growth, please be generous with your interest and time. Drop me an email if you have questions.

See you all on March 8th!

Ludovico D'Angelo, Director

Sidereal Times Now Available as a Blog!

Sidereal Times is available as an online blog at <http://princetonastronomy.wordpress.com>. Articles will be posted to the blog monthly at the same time *Sidereal Times* is mailed to members.

Members are encouraged to subscribe to the online version via the RSS feed by clicking on the red icon on the upper right side of the home page under the words "Subscribe". All articles will be automatically sent to the RSS feed reader of your choice when they are posted. For additional information on RSS feed readers, see [RSS Explained](#)

The online version allows members to comment on the articles. To maintain cordial and family-friendly discourse, members are asked to abide by the comment rules posted on the site. Violators will be banned from the blog.

We hope members enjoy this alternative way to get club news and meeting announcements.

The deadline for the April issue is:

Friday, April 1, 2010

Send your submissions to:

editors@princetonastronomy.org

Membership Meeting Minutes February 8, 2011

The meeting was called to order by Director Ludy D'Angelo.

Secretary's Report: There was no Secretary's report

Treasurer's Report: The Treasurer was not in attendance but the Treasurer's report appears in another section of *Sidereal Times*.

Web site: The Director will contact webmaster John Miller and David Zoller about updating the AAAP website.

Program Chair Report: John Church provided the line-up of speakers for the remainder of the 2011 season. John announced that he will not be running for Program Chair next season and he called for members to step up and volunteer for the position.

Outreach Report: David Letcher reported on the Lawrenceville Elementary School. The next event will be at the Hopewell Elementary School Science night on March 25. He will send out an email and ask for volunteers. Member Bill Murray announced that the original date for the State Museum's Super Science Saturday has been changed from April 16 to May 7. It was announced that an elementary school in Summit wants to hold a star party on March 24. Larry Kane announced that a local paper in Bucks County, PA had a descriptive article on the AAAP.

Other Outreach: Ludy was contacted by the Grounds for Sculpture. They want to do a large community event in November and invited the AAAP.

Picnic: Ludy announced that we will have one this Spring or early Summer. He asked for some dates. Member Dee Bosch volunteered to help coordinate it. A consensus date of June 4 was agreed to, by those in attendance.

Observatory Report: John Giles reported that he got our refractor mount back from Losmandy. It required a new hand controller that cost \$20. He is waiting for some decent weather to put the mount together and test it. Gene Ramsey said that the Park personnel are not plowing the snow. He and Jeff Bernardis are still investigating the upgrading of the alarm system. The goal is to keep the cost under \$300. Rex Parker said that a former member, Bob Wolf, will donate a G11 GOTO model Losmandy mount that we may be able to use with the refractor. Ludy raised the issue of adding a third telescope at the observatory. We might set up a dome next to the observatory. John Church reported on the physics of measuring whether a mount will work with our refractor, and how efficiently it will do it. He needs more information about the G11. It was agreed that we should accept the gift and that we will use it. We could add a permanent pad outside the observatory.

Sidereal Times: The next deadline for articles is February 23. Editor Ira Polans announced that co-editor Bryan Hubbard can no longer serve.

Larry Kane, Secretary

Community Outreach

I have received two requests for our association to participate in two events in March. One is for us to bring our telescopes and do a viewing of the skies as part of Hopewell Elementary School's Science Night on Friday evening, March 25. Their program, which is an indoor event, starts at 5:30 pm and finishes at 8:30 pm. However, it has been our experience that as parents and children leave to go home at 8:30, they often come to our telescopes for a view of the sky. So, let me know if you would like to help out. I'll be sending out an announcement to our membership with additional details plus the location's address.

Our second request comes from Victor Davis who is leading a Star Party in Summit, NJ on Thursday, March 24th, about 6:30 p.m. to 8:30 p.m. no matter what the weather is. Victor would like to recruit

a few AAAP members, with or without scopes to come and share their knowledge and enthusiasm. Victor has participated in a program called Project Astro Nova, in which he visited Brayton Elementary School (89 Tulip Street, Summit, NJ) a half-dozen or so times during the school year to teach topics in astronomy. Victor teaches 4 fourth-grade classes totaling about 80 children. The Star Party will have indoor activities led by the school's teachers which will include building a comet out of dry ice, constructing an alien out of cardboard, making scale-model planets out of Play-Doh, and other astronomy-related activities. Outside, Victor and whatever volunteers he can scare up will conduct a constellation tour, an exercise in learning to use star maps, and observing with telescopes and binoculars. Victor admits that Summit, NJ is a bit far afield from Princeton—it's not far from Newark—but I hope a few adventurous souls will make the trek to my neck of the woods.

Please let me, Dave Letcher, Outreach Coordinator, know if you are willing and able to participate in one or both of these events.
home phone

Dave Letcher, Outreach Coordinator

Interested in keyholder training?

or

Treasurer's Report

Membership has now risen to 70 members. Routine expenses for the year have been in line with expectation and no major unexpected expenses have been incurred. For these reasons, our surplus for the fiscal year to date is about \$2,000. On a cumulative basis, it is about \$20,500.

Michael Mitrano, Treasurer

From the Program Chair



On March 8th we will be having Tim Brandt, a third-year graduate student in Princeton's Department of Astrophysics, speaking on Type Ia supernovae and the search for their progenitors. Type Ia supernovae are believed to be the thermonuclear explosions of carbon-oxygen white dwarfs. They are also "standardizable candles"—objects whose luminosity can be calculated from detailed light curve observations. This has made them useful distance indicators out to redshifts of ~ 1 , and led

to the discovery of the accelerating universe. However, we still do not know how the white dwarf is destabilized. The two leading hypotheses are that it accretes mass from a companion main sequence

or giant star, increasing the central temperature and pressure, or that it merges with another white dwarf.

Tim will also discuss his more recent work as part of the Strategic exploration of Exoplanets and Disks with Subaru (SEEDS) collaboration using the 8.2-meter Subaru telescope on Mauna Kea in Hawaii. He is currently trying to characterize the instrument and understand the data, with the ultimate goal of doing statistical analyses on the entire data set. He will provide an overview of the telescope and instrument, and of the challenges in the search for companions of nearby stars.

Tim was born in rural Ohio and grew up outside of Boston. His undergraduate work was at Yale, where he majored in math and physics. He did undergraduate research with Meg Urry and collaborators on blazars and active galactic nuclei. After graduating, he spent two years teaching high school physics at the American School of Kuwait. At Princeton, he has worked on Type Ia supernova hosts and progenitors, simulations of core-collapse supernovae, scattering by diffuse interstellar dust, and most recently, direct-imaging exoplanets survey. He is also very interested in teaching and is volunteering in a program to teach algebra at local prisons.

There will be a "Meet the Speaker" dinner at 6:00 pm before the meeting. Please email by noon on Tuesday, March 8th for a reservation. I will respond with the dinner location, which has yet to be determined; it will be at either the Sports Bar (old Sotto) or the Triumph Brewing Company, close to one another on Nassau Street in Princeton. To insure a place or places at the table, it will be very important to make all reservations by noon on the 8th.

On April 12th we will have Michael Molnar speaking on "The Star of Bethlehem," a topic he has extensively researched. Michael will be signing copies of his book on this subject during the intermission. We will be hearing Ken Kremer's talk (postponed from January due to the meeting cancellation) on the future of NASA on May 10th. To round out our current session, on June 14th we will be treated to another presentation by Bill Murray in the New Jersey State Museum Planetarium in Trenton.

On a personal note, it has been my distinct pleasure to serve as your Program Chair for the 2010-11 season. It is now time for me to move on to new subjects and to give other members the chance to serve on the Board of Directors and set ongoing goals for the AAAP. For whoever is selected to be the next Program Chair, I have several possible speakers to suggest for the next session. I wish my successor, who will be elected at the May meeting, all the best as he or she discovers the rewards and pleasures of serving in this highly fulfilling position.

John Church, Program Chair

Deep-Sky Planner

If you've been thinking about ways to improve your observing skills and get more out of the precious hours you spend under the stars, here's something you might want to try. A few astronomy computer programs have appeared over the years which fit the niche of **observation session planners**. These programs generally combine databases of deep sky objects and stars along with a search engine and spreadsheet/report generator function, user-selectable search filters, and a star chart/planetarium program. However, while the concept is

a good one, I have found that the star charting aspects of some of these programs leave much to be desired (e.g., **DeepSky**, an otherwise interesting and useful program which I have used for years).

Many of us are using Software Bisque's excellent **The Sky6** at the AAAP Observatory and/or at home. The Sky6 is a high-powered, very well-designed planetarium and charting program, especially for deep-sky objects that are hard to find visually. I recently reviewed the currently available observation planning programs and was pleasantly surprised to learn of **Deep-Sky Planner 5** (by Knightware), which runs on all Windows systems, Vista upwards, including Windows 7 64-bit. More importantly, it has been developed to interface seamlessly with the Sky 6 and several other popular planetarium/charting software programs out there. You can set and modify all of the relevant search filters quickly (magnitude, RA/declin, size, object type, etc). When the database search is conducted and an NGC object of interest is selected, for example, the program automatically flips to **Sky 6** with the appropriate NGC object now centered in a field of view which the user specifies. This is a really neat trick and greatly improves the usefulness of the planner software approach. **Deep-Sky Planner 5** is available as a free trial (with reduced database) and as downloadable full program for \$65 (CD disk version slightly more), in my opinion a good deal for what it can do for observation sessions. It can also do ASCOM-based telescope control and has other interesting features which I haven't yet had a chance to try out.

Rex Parker

P.S. I am not in any way affiliated with Knightware, but I can recognize a good program when I see one!

Miss Mitchell's Telescope



Credit: Michael Wright

On a recent trip to National Museum of American History in Washington, DC, I was pleasantly surprised to find the interesting telescope pictured above as the landmark object for museum's science and technology wing. The description merely stated that the telescope was used by Maria Mitchell, America's first female professional astronomer, at Vassar College. The wood and brass refractor aroused my curiosity so I decided to find out why it has such prominent position in the museum.

The Vassar Telescope was donated to the Smithsonian in 1963 by Vassar College, the prestigious NY women's college. The instrument was previously installed in the "old" observatory, which was the first building completed on campus. (They had their priorities

straight back then!) The historic observatory is now named after its first director, Maria Mitchell.

When Matthew Vassar recruited Maria Mitchell to teach astronomy at Vassar, she already had a reputation as a skilled astronomer. Born on Nantucket in 1818 and raised in the Quaker tradition, she learned astronomical calculations from her father. At age 12, she helped her father observe a solar eclipse and calculate the position of their home. By age 14, sailors trusted her with celestial navigation calculations for their whaling voyages. In 1847 at the age of 29, she gained international fame for discovering Comet Mitchell 1847VI ([C/1847 T1](#)). For this discovery made with a telescope from the roof of the Pacific National Bank in Nantucket, she received a gold medal from the new King of Denmark, Frederick VII. Prior to Maria's discovery, Caroline Herschel was the only woman to have discovered a comet.

"We especially need imagination in science. It is not all mathematics, nor all logic, but it is somewhat beauty and poetry."

—Maria Mitchell

Maria became the first woman member of the American Academy of Arts and Sciences in 1848 and the American Association for the Advancement of Science in 1850. For a short period, she calculated tables of Venus' position at the U.S. Nautical Almanac Office. Despite resistance from Vassar College board members who objected to a female instructor, Maria was the first person appointed to the faculty of Vassar College in 1865, where she taught until shortly before her death in 1888. In addition to her scientific achievements, she was an advocate for women's rights and founded the American Association for the Advancement of Women in 1873. She encouraged her female charges by saying *"When [women] come to truth through their investigations... the truth which they get will be theirs, and their minds will work on and on unfettered."*



Maria Mitchell (seated) and Mary Whitney, her assistant and successor, with the Vassar Telescope. Credit: public domain image

The association with this remarkable astronomer and activist partly explains the telescope's historical significance. Next month I'll tell more about the scope and its maker, Henry Fitz.

Michael Wright

Space Shuttle Discovery Blasts off On Final Flight

In a truly dramatic finale to her very last launch, Space Shuttle Discovery blasted off to space at 4:53 p.m., Thursday, Feb. 24, with just two seconds to spare after an unexpected last minute computer glitch with Air Force tracking computers threatened to delay the liftoff yet again despite otherwise perfect launch conditions.

Air Force officials suddenly reported a "NO GO" for launch just 20 minutes before the planned liftoff at 4:50 PM. Critical range safety computers that track the shuttle after launch and ensure the safety of the public abruptly malfunctioned, forcing the Air Force to scramble for a quick solution to fix the mysterious problems.

Meanwhile NASA's Shuttle Launch Director Mike Leinbach ordered the insertion of an unplanned hold at T minus 5 minutes into the countdown to try and buy some time.

With the clock ticking down relentlessly to the very end of the narrow 10 minute launch window and no word of a rapid resolution from the Air Force, it seemed as though everyone's hopes would be dashed and the launch would again be scrubbed. The shuttle cannot launch without a fully functional range safety tracking system and approval from the Air Force.

All systems on board Discovery, the payloads and the weather had at last coalesced perfectly to support a blast off following numerous technical delays over the past three and one half months.

Large crowds of excited spectators had gathered along the beaches, parks and roadways of Florida's Space Coast in expectation of a fabulous viewing experience for this historic final launch of Discovery. The Kennedy Space Center (KSC) alone was packed with more than 40,000 onlookers from all across the globe. The crowds have been increasing in size as the remaining shuttle launches dwindle to a few.

It was a nail biter to the last second as the Air Force worked on the computer issues in the few minutes remaining and no information was forthcoming.

Finally, the Shuttle integration manager Mike Moses received a verbal OK from Air Force officials that the computer problems were fixed and NASA could resume the countdown just seconds before the launch window would have expired.

In all the history of the Space Shuttle program, this type of problem with the Air Force range safety system had never occurred so close to the final moments of a shuttle launch.

"Well, it was kind of an exciting last few minutes of this countdown," Leinbach told reporters at the post launch news briefing.

"Several of us have been around for many, many countdowns and this was one for the record books. ... This was Discovery's last (launch), a great way to go out. She gave us a little bit of a fit today, but it's a great way to get [Shuttle Commander] Steve Lindsey and his crew on orbit."

"I'm very, very proud of my launch team and all the rest of the people who worked so hard on Discovery."

After the months long wait, Discovery's final liftoff was absolutely spectacular. The solid rocket boosters and shuttle main engines ig-

nited and thrust Discovery on a thunderous ascent off the launch pad into a gorgeous clear blue sky.

The near deafening sounds were even louder than usual. The blazing orange flames from the rocket engines were astonishingly bright like a giant blow torch burning right through the heavens.

The all veteran astronaut crew of five men and one woman aboard Discovery achieved orbit after the eight and one half minute climb to space on the orbiters 39th mission. Also aboard was the R2 Robonaut which is the first humanoid robot in space. R2 will become an official member of the crew.

The primary goal of the STS-133 mission is to deliver the "Leonardo" Permanent Multipurpose Module to the ISS. Leonardo will be attached to the ISS as a new and permanent habitable module that will provide extra storage and living space for the six person ISS crew.

Discovery is set to dock at the ISS at 2:16 p.m. on Saturday, Feb. 26. The mission's two spacewalks will focus on outfitting the station and storing spare components outside the complex. The 11 day flight is due to conclude with a landing back at KSC on Monday, March 7.



The six person crew of Space Shuttle Discovery in their orange launch and entry flight suits wave to spectators before heading to the launch pad in the Astrovan. From left are Mission Specialists Nicole Stott, Michael Barratt, Alvin Drew and Steve Bowen; Pilot Eric Boe; and Commander Steve Lindsey. Discovery will deliver the Permanent Multipurpose Module, packed with supplies and critical spare parts, as well as Robonaut 2 to the ISS. Credit: Ken Kremer



The twin brother of the R2 Robonaut awaits launch of Space Shuttle Discovery on the STS-133 mission, its 39th and final flight to space. Credit: Ken Kremer



Launch of Space Shuttle Discovery on Feb. 24 at 4:53 p.m. from launch pad 39 A at the Kennedy Space Center. Credit: Ken Kremer



Discovery streaks skyward on Feb. 24 on 39th and final flight to space. Credit: Ken Kremer

Ken Kremer

Astronomy Outreach

My AAAP talk on the Space Shuttle and the Future of NASA has been rescheduled to May 2011.

Rittenhouse Astronomical Society (RAS) at the Franklin Institute: Philadelphia, PA, Apr 13, Wed, 7 PM. "Opportunity Mars Rover Update", "NASA Flybys of Comets Hartley 2 & Temple 1" Website: <http://www.rittenhouseastronomicalsociety.org>

Amateur Astronomers Association of Princeton: Princeton, NJ, May 10 8 PM "Whats Beyond for NASA: Shuttle, Station, Orion, SpaceX & Robots". Website: <http://www.princetonastronomy.org/>

International Astronomy Day at the Franklin Institute: Philadelphia, PA, May 7, Sat, "The Search for Life on Mars"

Please contact me for more info or science outreach presentations:
Email: ken@kenkremer.com website: www.kenkremer.com

Ken Kremer

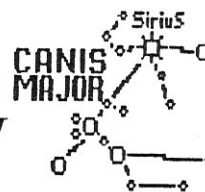
20 Years Ago In Sidereal Times...



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SIDEREAL TIMES

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Treasurer:
Ron Mittelstaedt
Secretary:
Richard Sivel
Program Director:
Victor Belanger

MARCH 1991

PERFECTION IS PAINFUL, BILL

"DAMN!"

"Well, it must be going to Hell in a handbasket", I thought when I heard that. So I zipped up my Antarctic-style parka, stubbed out my Camel, reached up and snapped off the light, and cautiously opened the warm-room door.

"A problem, Bill?", I asked.

"YOU'RE DAMN RIGHT!", I heard. "Ah---John---can you give me a---little help? The tube is starting to bash me in the head!"

I came out and saw that Bill had begun to crouch and had begun to lower his head while he was peering into the guiding eyepiece of the 12.5".

"What do you need me to do?", I asked.

"Stand over there," he said, gesturing with his gloved hand and pointing to a spot on the Observatory floor. "And pull me back a little---just a little."

I looked at the Observatory radio-clock. "You only started your exposure 20 minutes ago. I didn't imagine the tube would turn that much in only 20 minutes," I said.

"NEITHER DID I," I heard him growl.

And so I stood where I was directed, and slowly began to wiggle the observing chair back. "THAT'S ENOUGH," I heard. "FINE."

"O.K. then. Let me know if you need my help again," I said. "Oh, by the way---how long do you think you're going to go?"

"I'm thinking of something like---an hour and a half," Bill replied. And I thought I heard the beginning of the sound of desperation creeping into his tone of voice.

And so I went back into the warm-room, closed the door, snapped on the light, lit up another Camel, unzipped my parka, and opened the book I'd been reading. "AHA!", I thought. "So THAT'S A LORENZ CONTRACTION! Don MONTICELLO, EAT YOUR

FROM THE TREASURER

The Treasury balance stands at \$1,062.62. The change-over of the Observatory door locks and the making of new keys cost \$92.45. No new bills foreseen in the future, until the digital setting circles are installed in the Observatory.

-Ron Mittelstaedt

First of all I would like to ask for some help on March 8th, when I will be bringing the Ewing School District's 4th grade Gifted and Talented students to the Observatory for their annual visit. They will again come with their own lecturer to tell them about the night sky. Last year, after the lecture, some of our members learned how to locate the North Star. (!?) After the lecture they would like to observe some sky objects. I figure there will be about 40 students and parents. If anyone could help by bringing out their 'scope and manning it during their visit would be most appreciated.

On the weekend of February 23, I will attend Amateur Astronomers Inc.'s Astronomy Sunday held in Mountainside, N.J., with workshops for the kids and lectures for the adults, it sounds like it'll be a worthwhile venture for the kids.

-Ron Mittelstaedt

ASTROPHOTOGRAPHY FOR BEGINNERS ON A BUDGET

Reading all the astrophotography articles by Bill Murray and John Simpson sounded really good; and I have tried their techniques with mounting my camera on top of the 12.5" and was able to clock drive my camera for some long-exposure photos. My biggest problem is leaving the shutter open too long, and getting sky glow into my prints. And with such long exposure times, boredom soon settles in and the fun out. [Ask Bill Murray about that...Ed.] Still, even that simple form of astrophotography is out of reach for many members, because of not being able to use the Observatory or not owning a clock drive.

I have had fairly good success in taking photos with just a tripod, a 35mm SLR camera, and a shutter cable-release. I use Kodacolor 400 film, which is a good print film for this type of photography; but slide film always turns out better, and is least likely to be chewed up by commercial film developers. The developers in Princeton are experienced in astro-

HEART OUT!", I chortled to myself, as I imagined myself finally being able to discuss the intricacies of theoretical physics with Don Monticello.

But my enthusiasm waned significantly---ominously---as I continued reading, as I began to encounter page-after-page of mathematical equations. "Uh-oh," I thought. But---I forged on.

But after I'd progressed in the book several pages, I heard it again: "DAMN! Oh---John---". And so for the second time that night, I zipped up my parka, turned off the light, and went out, ready to render what aid was needed.

"Same thing again, eh Bill?" I asked.

"YOU'RE DAMN RIGHT! Listen: this time, while I continue to guide, I'll stand up on the lower board, and you take the phone book off the seat. O.K.?"

And---as before---I followed Bill's instructions, and then went back to my reading. And---which did not surprise me---my assistance was needed twice more that night. But finally (after I'd realized that my imaginary discussions on theoretical physics with Don Monticello would in all probability be more of an embarrassment to me than a "break-through" in theoretical physics), I heard another sound from the Observatory: "DONE!" But this sound was different, for Bill's tone of voice had a note of joy---make that relief---in it.

And so---as I'd already done my own piggybacking session and it was evident that Bill was not about to do another astrophotograph (the temperature was hovering around 10 degrees Fahrenheit)---we closed the Observatory and trudged back toward Bill's car.

"I'll process your Technical Pan and let you know how it turned out," I said. I looked back at the Observatory, and said, "You know Bill, I'm willing to bet that the shot you did of M51 will be terrific." I waxed romantic. "And you know," I said with affection, "I still love that 12.5." Bill stopped in his tracks and turned towards me. "You do? Fine. I HATE IT."

Technical Pan 2415

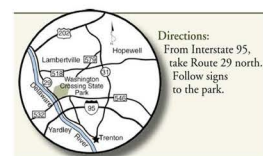
M51

80 Minutes/f6.0



Amateur Astronomers Association of Princeton - Simpson Observatory

AAAP



Directions:
From Interstate 95,
take Route 29 north.
Follow signs
to the park.

The Observatory is open to the public every clear Friday 8 to 11 PM from April to October.

Enter the park via the Philips Farm Day Use Area on Route 579, not the main park entrance. Drive past the soccer fields on the right to the soccer parking lot and look for a dirt road on left. Drive down the dirt road. Turn right on to the blacktop road and follow it to the observatory, which is on the right after the first bend.

Parking is permitted along one side of the paved road in front of the observatory. Keep vehicle wheels off the grass.

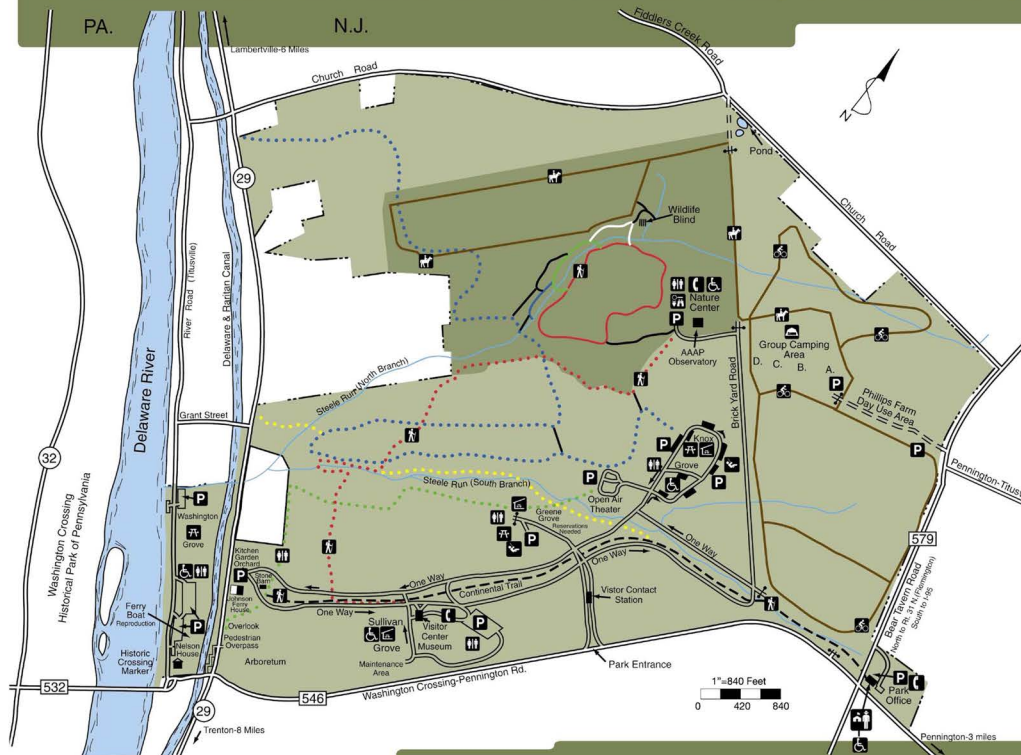
Members and guests must be accompanied by a Keyholder except on public nights.

Observatory phone: 609-737-2575

Park police: 609-737-0623

GPS:
Lat: 40° 18' 51" or 40.314°
Long: -74° 51' 42" or -74.862°

www.princetonastronomy.org



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March 2011

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