

The Sidereal Times
Amateur Astronomers Association of Princeton
Duncan Planetarium
Princeton Day School
P. O. Box 75
Princeton, New Jersey 08540



Comments:

Can you please:

send me your planetarium for the Sidereal Times?

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How much?

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John Church
11 Princeton Place
Princeton Jct., N.J.
08550

AMATEUR ASTRONOMER'S ASSOCIATION OF PRINCETON

The Sidereal Times

Director: Barry Hancock

Editor: Roxanne Tobin

Member of the Astronomical League

vol.1 no.3

April, 1972

The next meeting of the Amateur Astronomer's Association of Princeton will be held on Tuesday, April 11, 1972, at 8:00 p.m. in Room A-07 of Princeton University's Jadwin Hall (in the Physics Department). Our meeting will be devoted to the planning for observing the total solar eclipse of the sun in Canada on next July 10th, 1972. Everyone is invited to share his plans and ideas with the rest of the society. Start thinking now how you can contribute to this session with suggestions, data, maps, photographs, diagrams, etc. Barry Hancock will head the meeting.

* * * * *

The next session of the Study Group will be held on Friday, April 14, 1972, at Duncan Planetarium at Princeton Day School on the Great Road. The topic presented will be Chapter 14; "The Earth Moon System". Mr. Karl Koehler will present it. In the past Mr. Koehler has presented other chapters which members of the Study Group will agree have been excellently presented.

Everyone should make it a point to attend Study Group meetings. The objective of the Study Group is to teach the members astronomy themselves, and meetings are quite enjoyable to attend.

* * * * *

The next meeting of the Observation/Astrophotography Group is on April 21, at Karl Koehler's home in Bordentown. The Group has had very few clear observation nights since its' formation.

Mr. Koehler's address is: 13 Shady Lane. Good Luck!

* * * * *

The next public lecture in the Peyton Hall Open House series is on Thursday night, 20 April. At 7:30 PM, the two fine refractors on top of the building will be opened up for public use, including the 9" Clark. The speaker at 8 PM is Douglas Richstone, a graduate student at the university and former junior member of the National Capital Astronomers in Washington. Richstone's B.S. in Astrophysics is from the California Institute of Technology.

* * * * *

The Physics Department of Princeton University has lent Duncan Planetarium a 10" Celestron Schmidt-Cassegrain with 4" guide, for an indefinite period. The instruments are currently being cleaned, and should be in use at Star Parties at PDS and other club observing functions. The telescopes are subject to recall by the University at any time. Contact Norm Sperling for details.

* * * * *

Starting in March a door-prize is being given to some lucky amateur astronomer who attends the regular meetings. Each person will be assigned a number and will have a chance for the prize when a number is picked out of a hat. Such items as books, star charts, magazine subscriptions, and accessories will be given. In March, Mr. John Church won a 17th Century Moon Map.

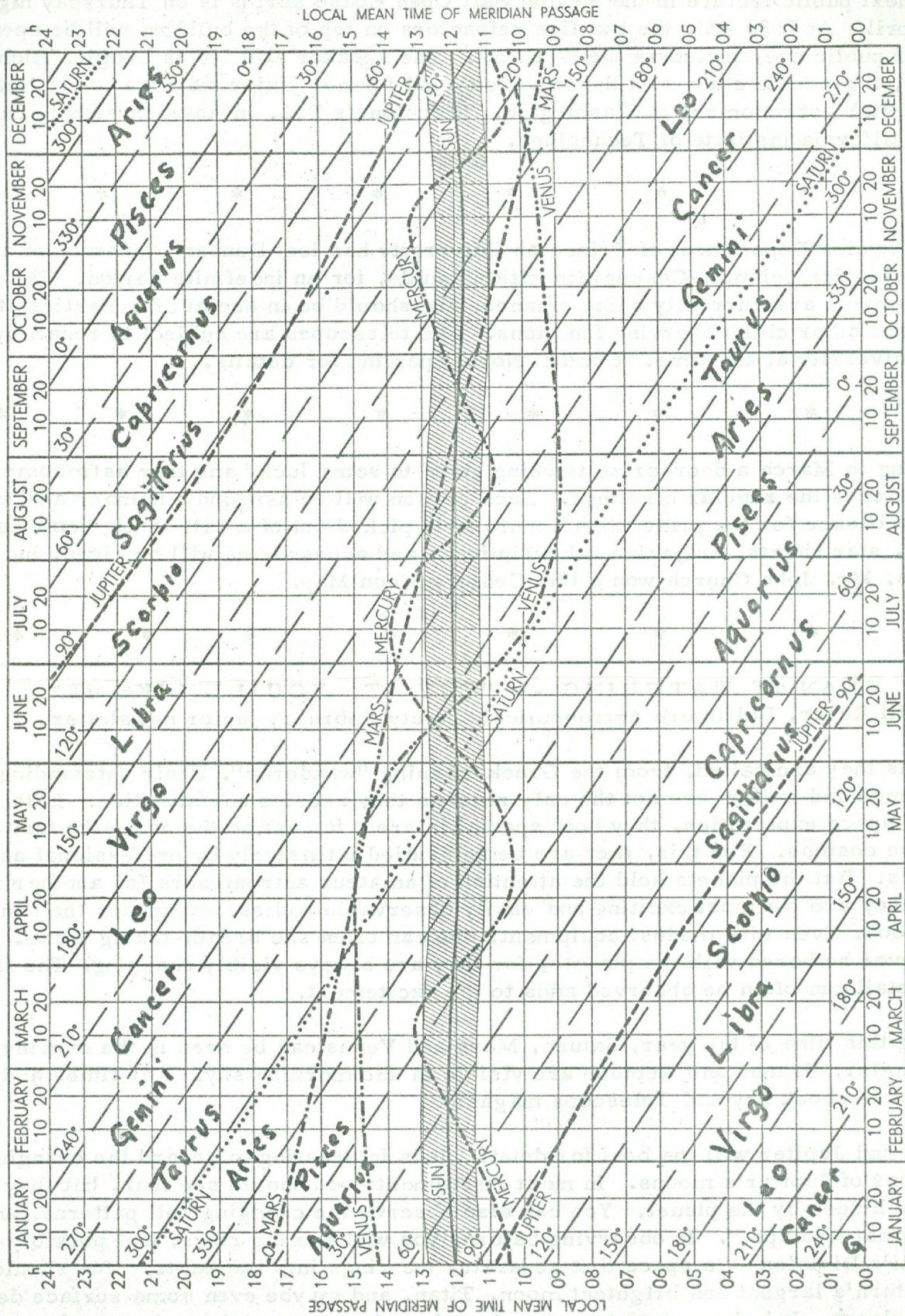
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PLANET WATCHING -- "TRY IT, YOU'LL LIKE IT"
by Bill Rever, Baltimore Astronomical Society, February junior newsletter.

Planets they are called, from the Greek meaning "wanderer". Their outstanding brilliance and motion are not the only reasons they receive our attention. In this era of space exploration, they hold special interest for us: as the next step forward into the cosmos. For this, they are being studied intensively by professional astronomers. But the planets hold the attention of amateur astronomers for another reason: they are the most exciting and easily observable bodies, except for the sun and moon. Even with modest equipment, one can often see breath-taking views. You can never be bored with the planets, for they are always visibly changing. The fact that detail can often be observed adds to the excitement.

During this time of the year, Saturn, Mars and Venus can be seen in the evening, and Jupiter, Uranus and Neptune are visible in the morning sky. For times and positions, check Sky and Telescope magazine.

Saturn and Jupiter will be best for detail. It is interesting to record the changing positions of Jupiter's moons. In most instruments you should see four, but they may be hidden by the planet. You can also observe the changing belt patterns, and the "Great Red Spot". In observing Saturn, you will see the rings, and possibly Cassini's Division -- a space that separates the rings into two parts. You should see Saturn's largest and brightest moon, Titan, and maybe even some surface detail of the planet. It is important to remember that what you see depends greatly on the quality of the telescope, and the visibility. I use a 60mm equatorial refractor and have seen all of the above-mentioned things. You may expect accordingly. If you don't do too well the first couple of tries, don't get disappointed or discouraged -- it takes time. So, happy observing!



Detection of Black Holes: When matter flows in, it excites other matter around it because when near the Schwartzschild Radius the matter is condensed and hot. This matter emits X-Rays. An X-Ray emission with no apparent source may indicate a Black Hole.

A Binary system with a black hole can happen, too. Where one star becomes a black hole and the other stays visible, the visible one would appear to us to be orbiting "nothing".

Dust attracted to the area of the hole can be detected if the hole eclipses another star as in an eclipsing binary. The hole itself would be much too small to notice.

FEBRUARY BUSINESS MEETING

Barry Hancock opened the meeting at 9:25 PM. The treasurer's report, by Art Martz, stated that we have \$236.57 in the treasury. The minutes of the previous meeting were approved as printed in the February Sidereal Times. Norm Sperling asked for a volunteer to write more member-biographies. Mike Clark announced that the eclipse tour will cost between \$600 and \$800 with Mr. Little's expedition. Barry Hancock closed the meeting at 9:40.

MARCH MINUTES

27 people attended the presentation by Robert Little of the Celestron company. Mr. Little showed a number of astrophotographic results he has had, and discussed some of the methods he used. Cdr. Joseph L. Richey was appointed to chair a committee to nominate club officers for 1972-3. Offices are: Director, Assistant Director, Secretary, Treasurer, and Program Chairman. Cdr. Richey's committee will report its nominations to the April business meeting. Nominations are also open from the floor. Election will be held at the May business meeting.

It was suggested by Norm Sperling that doorprizes be given each meeting to further dissemination of astronomical goods among the membership and encourage attendance at meetings. This proposal was passed unanimously by the Board of Directors and with one dissenting vote at the business meeting.

The meeting was adjourned at 9:25 PM.

The 1972 General Assembly of the International Union of Amateur Astronomers will be held in Malmö, Sweden, near Copenhagen, Denmark, 31 July-5 August. Included will be an excursion to Tycho Brahe's observatory-island of Ven. This will be the 400th anniversary of Tycho's Supernova in Cassiopeia. Tycho's observations from Uraniborg were incredibly accurate, enabling Kepler to calculate his three laws from them. Also to be visited is the Observatory of Lund, Sweden. In addition to the many items of association business to be conducted, extensive astronomical meetings are planned for the following sections: Aurora, terrestrial, moon, occultation, meteor, history, instrumentation, variable stars, artificial satellites, major planets, and comets. A variety of presentations on other subjects may also occur. Accommodations, meals and entertainment in the Malmö area are available through convention planners at very reasonable cost. For a tentative schedule of the meeting, contact Norm Sperling. To submit a paper (all topics welcome), a summary must be submitted to Mike Flinsch, Box 400, East Brunswick, NJ 08816, by 30 April 1972.

FEBRUARY MINUTES

45 people attended the lecture on Black Holes by Mr. Richard Gott III of the Department of Astrophysical Sciences.

With Albert Einstein's special theory of relativity, black holes are predicted theoretically. In the theory light always seems to move at the same speed because movement of the observer changes the time units and distance measurements of the observer. So if the observer speeds up the units get slower and shorter, so light appears to be at the same speed as if the observer was still. This happens close to the speed of light ($c = 3 \times 10^8 \text{ cm/sec}$). The escape velocity is expressed in the equation

$$V^2 = \frac{2GM}{R} \quad \text{where } G = 6.67 \times 10^{-8} \quad \begin{array}{l} V \text{ is velocity, } M \text{ is mass} \\ R \text{ is radius} \end{array}$$

So as the radius decreases the gravity appears to be greater or the escape velocity becomes greater.

	SUN	EARTH	WHITE DWARF	NEUTRON STAR	BLACK HOLE
M	1 $M_{\odot}$	1/300,000 $M_{\odot}$	1 $M_{\odot}$	1.5 $M_{\odot}$	2.5 $M_{\odot}$
R	600,000 km	6400 km	6400 km	18 km	
V	17 km/sec	11.7 km/sec	6000 km/sec	1.5 $\times 10^5$ km/sec	

Forming Black Holes: Since gravity accelerates everything to the center of the object's mass, pressure must be supplied to keep the mass from squeezing into nothing. The earth is held from collapsing by chemical pressure. The sun is held out by the thermal pressure -- the atoms pushing each other away. When the sun cools it becomes a white dwarf because the thermal pressure is not enough. But then it must rely on electrons resisting the pull into the atomic nuclei. When the mass of an object is over 1.5 solar masses the electron degenerate pressure does not hold them and the electrons collapse into the nucleus and become neutrons, producing a neutron star. When the mass is over 2.5 solar masses the neutron star collapses further, into a black hole.

The Schwarzschild Radius: $R_s = \frac{2GM}{c^2}$

where R_s is the radius, G the gravitational constant, M the mass and c the speed of light.

At this radius a mass that has undergone contraction beyond the neutron degenerate stage cannot escape, because at this mass the matter would have to travel at the speed of light. Once the matter is inside the radius, the physical size of the mass cannot get any larger. Since the matter cannot expand and no other pressure can keep it at a constant size, it collapses into a geometrical point.

Since the hole is a point it cannot be seen. The only detectable part is the curve it makes in space. The gravitational field stays the same outside the star's radius. But as it collapses the surface gets closer to the center so the force of gravity becomes greater as time continues. At a certain distance from the center of gravity (not within the star) the gravitational field remains the same no matter what the matter does around the center of gravity.

Tidal distortion is very strong near the hole because the distance from the hole to a near part of a body is significantly different than for a distant part of that body. Thus, the near part of the body is pulled more strongly than the distant part, and the body is stretched along a line from the hole and perpendicular to the Schwarzschild radius. Any body that comes closer than that radius cannot escape and will be squeezed onto the point, though it will not ^{make} the point any larger. It will become more massive, though.

Detection of Black Holes: When matter flows in, it excites other matter around it because when near the Schwartzschild Radius the matter is condensed and hot. This matter emits X-Rays. An X-Ray emission with no apparent source may indicate a Black Hole.

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STAR PARTY IS A SUCCESS

On Saturday, 18 March, a star party was held at Mike Clark's home in Trenton. Although skies were partially clouded we decided to try our luck. Those present were: Mike Clark, Roxanne Tobin and her father, John Church, Dave Larach, and a few others. The telescopes present were three 4" Edmund refractors and an 8" Celestron.

Our luck held and the skies cleared up very nicely. We were in time to view the occultation of a 6.7 magnitude star by the 4 day old moon. John Church gave us a countdown which was only off by 1/2 second. It was quite impressive to see, especially for those of us who had never seen an occultation before. After that, everyone hunted for Gamma Leonis, a pretty double. Castor was examined at several different powers, as well as a fruitful search for the companion of Sirius with the Celestron. Several clusters were found this night, as well as the Great M42 Nebula in Orion. Some of the other clusters viewed were M35, M37, M38, M46, and a few unidentified ones.

Towards the end of the evening the Celestron was turned to Leo to hunt for the galaxies M65 and M66. My 4" refractor failed to pick them up, but the Celestron did so with ease. They were quite impressive for 11th magnitude galaxies.

We adjourned at 10:30 PM because of clouds and enjoyed some delicious coffee and cake prepared by Ms. Clark, while Mike developed some pictures he had taken of us at the telescopes during the night. I hope more people come to these star parties because they are fun as well as beneficial to members. One more item -- members with 4" Edmund refractors can be assured that their scope is just like everybody else's 4" refractor from the same company.

---Roxanne Tobin

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RECENT JOURNAL ARTICLES REVIEWED BY JOHN CHURCH FOR SIDEREAL TIMES

"The Rotation of the Earth", Scientific American, December 1971, p 80.

The rotation of the earth is quite complicated and non-uniform, due largely to the fact that it is not a simple rigid body but contains large liquid and deformably solid masses. The non-uniformity of the rotation manifests itself by variations in the length of the day, by variations in the direction of the axis of rotation in space (precession), and variations in the orientation of the rotation axis within the earth (wobble). Recent measurements show that the wobble may derive its exciting energy from major earthquakes. It has long been known that precession arises from the torque produced by the gravitation of the moon and sun on the slight equatorial bulge of the earth.

The fact that wobble does take place is evident from photographic zenith tube (PZT) observations of stars. Both the apparent declinations and predicted transit times of stars show unmistakable variations which can only arise from small variations in the position of the earth's poles from their mean positions. The slowing of the rotation due to tidal friction is taken into account when drawing this conclusion. Over the span of a year, earth may accumulate as much as 50 milliseconds of discrepancy in rotation.

The North Pole can wander as much as 30' from its mean position. (Whether Adm. Peary actually set foot on the pole in 1909 may therefore be a matter of some conjecture; probably Matt Henson, with the sextant, said they were reasonably close and they let it go at that).

There is some evidence that a sudden shift in the position of the pole may precede a major earthquake. The coming status symbol in Hollywood may be for every star (??!!) to have his own PZT, so that he can leave just before L.A. slides into the briny deep.

"Planetary Exploration -- Space in the 70s", NASA Booklet EP-82, June 1971

This is a fine reference booklet which gives details of 4 scheduled planetary exploration missions to be conducted by unmanned spacecraft through 1975. These are the Mars Mariner orbiting Mission of 1971 (Still in progress and sending back incredible pictures every week), Mars Viking orbiter/softlander scheduled for 1975, the Jupiter Pioneer flyby spacecraft recently launched, and the Venus/Mercury Mariner flyby scheduled for 1973. Detailed sketches of apparatus are included, as well as descriptions of the scheduled experiments and the names and affiliations of the principal investigators. This excellent booklet is available for 75¢ from the Government Printing Office in Washington, DC 20402 (stock # 3300-0399).

"Tides and the Earth-Moon System", Scientific American, April 1972, p 43.

The movement of the lunar tides relative to the ocean bottom, as the earth rotates underneath the moon, is accompanied by friction and therefore gradual dissipation of the rotational kinetic energy of the earth (the ocean is slightly warmed as a result). The rotation of the earth is slowed in the process, and the length of the day increases about 2 milliseconds per century. Another result of the interaction is that the mean distance of the moon from the earth increases about 3 cm/year, which is causing a gradual increase in the length of the month. The rate of tidal energy dissipation is about 2.6×10^{12} watts, which is approximately equal to the world's total power consumption.

It is possible to extrapolate the data backwards and thereby predict the state of the earth-moon system at times in the remote past. It is not possible at present, however, to come to a conclusion concerning the origin of the moon which will overcome all objections. One theory presently in favor is that the moon formed by gradual accretion of material in earth orbit. Return of lunar material by Apollo 16 from the lunar highlands (the most heavily bombarded area and the oldest) is expected to shed more light on this question.

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Dr. Sally Heap of the Goddard Space Flight Center's Laboratory for Optical Astronomy discussed research on the central stars of planetary nebulae at the 5 Feb 72 meeting of the National Capital Astronomers in Washington, DC.

The basic questions the astrophysicist asks about a planetary nebula concern its size, composition, history, and the past history of its central star. The fundamental observational information about the central star is based on its position, luminosity, spectrum and polarization. We can conclude that a nebula is the sloughed-off shell of a given star because the radial component of the nebula's expansion can be traced back to the central star, an expansion that lasts about 50,000 years before nebulosity invisibility. A typical planetary nebula represents 20% of the original star mass. A typical central star has a mass similar to the sun's, but this former nova is hotter than an O star, with a spectrum that defies complete classification. They are more dense than the sun. During 1971, theoretical work strongly established the idea that virtually all stars of solar mass will eventually produce planetary nebulae in the unstable phase ending their red giant stages of evolution. The reason these "old red giants" are hotter than O stars is because we are seeing a part of the star much nearer the core.

A major difficulty in studying central stars of planetaries is that their radiation peaks at wavelengths below $900\text{\AA}$. Important spectral lines are blocked by interstellar matter even from earth satellites. In general, treatment of the nebula itself as a "photon counter" of the central star is necessary.

(---from Star Dust (NCA) March 1972, by permission).

SOLAR ECLIPSE EXPEDITION FROM DUNCAN PLANETARIUM, PRINCETON, N.J.

Date _____

Name: _____ home telephone: _____

Address: _____

% probability of your being with this expedition : _____ When can you commit _____.

Site preference (If you are unable to camp outdoors, mark Murray Harbour)

Manicouagan, Quebec _____ or Murray Harbour, Prince Edward Island _____

Do you speak French? _____ Do you need indoor accomodations? _____.

Can you offer financial assistance to someone?

Will you need financial assistance?

Please describe any telescopes or binoculars you may be able to bring:

type	make	diameter	focal length	mounting	weight	comments

Please describe any cameras you may be able to bring:

type	film size	brand	model	lenses	comments

Please describe any camping equipment (tents, sleeping bags, cooking hardware, etc.) and other similar gear you may be able to bring:

Can you be at your site the morning of Saturday 8 July 1972? Earlier? _____ later? _____

On the way up do you prefer to stay in motels _____ or campsites _____?

Can you provide transportation for other people _____ and other cargo _____?

How much?

Would you like another driver in your car?

Will you need transportation for yourself and/or your equipment?

Can you drive?

Comments:

In addition to the Peyton Hall Open House on 20 April, three other observing times are designated by the AAAP and a fourth is also open.

Two star parties will be held on the Soccer Field at Princeton Day School. These will start at 8 PM on 6 and 24 April. Club members are invited to bring their telescopes, binoculars, cameras, etc. Also participating will be members of the PDS astronomy classes. Easiest way to reach the observing site is from either Great Road or Province Line Road to Pretty Brook Road. A new gravel road leads from Pretty Brook north to the soccer field, behind the school building.

The regular meeting of the Observing and Astrophotography group will be at the home observatory of Karl Koehler, 13 Shady Lane, Bordentown 08505. This is near where U 206 and US 130 come together. Information is available from Mr. Koehler at 609-298-2672.

To the south, another star party will be held as a commercial demonstration of company telescopes at Edmund Scientific Company in Barrington. Scheduled for Saturday, 22 April (rain date 29 April) from 7:30 to 10:30 PM. Reflectors of 3", 6" and 8", and 3" and 4" refractors will be used. The session will be conducted by members of the Willingboro Astronomical Society, our neighboring club on the south and one of the most active and advanced groups of juniors anywhere. Edmund store hours are 8 AM-9 PM Saturdays, so there will be a good opportunity to browse through the many astronomical items and accessories they sell. Also featured will be the automated light show, an experience for anyone interested in light, sound, projection or music. Edmunds is most easily reached by taking the New Jersey Turnpike south to exit 4; west two blocks on Jersey 73, south on I-295 to the Berlin-Collingswood-Barrington exit, US-30. South on US-30 (White Horse Pike) a few blocks. Turn right onto Gloucester Pike, between the Pathmark and the Jack-in-the-Box. Edmunds is on the right within a block.

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Word has reached us that an amateur astronomer in Deland, Florida, has refurbished the Stetson University Observatory and its 12" reflector. He has held a number of public observing sessions. The public interest in astronomy has been so increased by his activities that the local power company has installed an on/off switch at the observatory controlling the street lights for blocks around. This eliminates a large fraction of disturbing sky light and somewhat lessens the city electric bill.

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