THE FOCAL POINT

Vol. I, No.X | *The Newsletter of the Atlanta Astronomy Club* | June 1989

TABLE OF CONTENTS

CLUB CALENDAR

Next Meeting: June 16, 8:00 p.m. at Fernbank Science Center. **Program:** We will see the planetarium show "Galaxies: Beyond the Stars", then weather permitting, observe through the 36 inch telescope. Meet at the planetarium entrance at 7:45.

Editor: .... Steve Gilbreath
Contributing Editors: .... Dr. Ralph Buice, Hal Crawford, Richard Jakiel, Mark Lancaster

The Focal Point is published monthly during the academic year by the Atlanta Astronomy Club, Inc. The AAC is a non-profit organization dedicated to the advancement of amateur astronomy. Meetings are held the third Friday of each month (except the second Friday in December) at the Bradley Observatory on the Agnes Scott campus. Dues are $25 annually for a single membership and $30 for a family membership and include a subscription to **Sky & Telescope** magazine and use of the club observatory in Villa Rica.

Submissions: Article submissions are welcome, and may be delivered to the editor for consideration. Articles on computer floppy disk are encouraged.

OFFICER'S PHONE NUMBERS

Leonard Abbey	*President*	634-1222
Bill Bagnuolo	*Program Chrm*	498-5451
Richard Jakiel	*Observing Chrm*	473-9873
Eugenia Abbey	*Recording Sec*	634-1222
Steve Gilbreath	*Corresponding Sec*	634-7466
Bud Rosser	*Treasurer*	879-0304

THE PRESIDENT'S SOAPBOX

by Leonard Abbey

Those of you who missed our annual banquet meeting will probably be surprised to receive this newsletter. Many changes are being made in our club, and our future is brighter than ever. Here's what is going on, and how you can get in on it.

First the banquet. After a hiatus of several years, we have resumed our annual banquet meeting. This meeting has always been a special one. It comes at a time when we elect officers for the next year, and is the final meeting before our summer break. We always try to have a very special speaker for this meeting. This year's speaker, John Burgess of Fernbank Science Center, filled our needs to a T! John has done many years of research into the calendars of ancient Mexico, and is onto some rather subtle relationships between the apparitions of Venus and the hitherto undecipherable time-keeping schemes of our southern neighbors' ancestors. We hope to hear more of this as his research, which is not yet complete, progresses.

Before John spoke, several important announcements were made. For the past forty-two years we have met during the school year at Bradley Observatory. We have had occasional summer meetings, usually in the form of observing parties or conventions. Beginning this summer, we will meet twelve times a year.

This year our summer meetings will be centered around Fernbank Science Center. For June, as you will read in this issue, we will have a special planetarium show prepared by David Dundee. In July we have tentatively scheduled an observing party/picnic at Villa Rica, and in August we will return to Fernbank for another custom-tailored planetarium show. In addition to these activities, we will be assisting the Fernbank astronomers at their open house during the upcoming total eclipse of the Moon in August. We are expecting many hundreds of visitors, and it will be a good opportunity to find new members, and to show off our telescopes.

Our club is the product of hard work by dedicated members. Many people labor long hours in order that we all may benefit from our association with each other. But some work harder and longer than others (fortunately!). We have long needed an appropriate manner of recognizing the extraordinary achievements and contributions of the few who have made an extra effort to further our goals.

This year we have instituted the Atlanta Astronomy Club Merit Award. The first recipient of this award, which was presented at the banquet, is Steve Gilbreath. This year's officers labored under unusual burdens which our club has never before experienced. Steve has done much of the extra work. Our strong position today is largely due to him. I do not know of anyone who deserves the appreciation and respect of our members more than Steve does.

The Merit Award will not be presented every year. It will be given for extraordinary effort and achievement to further the goals of the Atlanta Astronomy Club. The recipient will be chosen by the President, with the advice of the other officers.

At the ripe old age of forty-two it is appropriate to recall our achievements, but it is even more important to look to the future. Our most important achievement has been the establishment of the Walter F. Barber, Jr. Observatory, in Villa Rica. This wonderful facility has made it possible for many of our members to become truly "professional" amateur astronomers. But now is the time to begin to look towards the coming century. Even at the distance of Villa Rica the city's lights are beginning to encroach on our Milky Way. Where Stygian darkness once reigned supreme, one is now able to walk about without the crutch of a flashlight.

We must begin to think about what we will do when Villa Rica is no longer dark enough for true deep-sky observing. That day will come. We cannot stop it. However, we have plenty of time, and we must now begin to examine the options available to us. I have therefore appointed a Planning Committee, to be headed by Don Hall, which will seek to define our needs, identify possible solutions, and provide us with the information we will need in order to make an informed decision about our future. This is not a six-month or one-year committee. It is a five-year committee. Hasty decisions are usually poor ones.

Other committees will soon be appointed to examine our programs, structure, and goals so that we will be able to measure how effectively the needs of our members are being met. In the coming year we will also to institute an active publicity and recruitment program and begin a general refurbishment of our Villa Rica observatory. We also plan to continue our joint public star parties with Stone Mountain Park and Fernbank. If you are interested in working on any of these projects, please contact me.

All in all an exciting year of astronomy in the Atlanta area is shaping up. You will not want to miss a single minute of it.

How To Support A Telescope Mirror

by Steve Dodson

Imagine an empty telescope tube and a fine straight line passing directly down it's center (the tube axis). For simplicity let's assume that the optical axis of the telescope will lie along the tube axis. Now imagine a parabolic curve cutting across the tube axis near its lower end, its own axis exactly aligned with the tube axis. In your mind rotate the parabolic curve about the tube axis and you will have a perfectly aligned "ideal" paraboloidal surface.

For excellent telescope performance we want the reflecting surface of our mirror to lie precisely along this imaginary "ideal" paraboloidal surface. Any deformation of the mirror's surface away from the ideal paraboloid should be a very small fraction of a wavelength (1/8 or less) since reflection makes each error count twice. Here we are talking about precision levels amounting to a couple of millionths of an inch or so. Any tilt of the mirror's axis away from the optical axis of the telescope should be less than a tenth of a degree for long-focus mirrors and even smaller for faster systems.

Obviously mirror positioning and supporting system for a high performance reflecting telescope has to hold the mirror precisely in position without forcing it in any way that would distort its shape.

The magnitude of the problem can be visualized by seeing the mirror disc as mechanically resembling a disc cut out of a foam mattress! When bends and bumps on the order of small fractions of a wavelength of light are important glass behaves exactly like that. If you can design a support system that doesn't allow a floppy mattress disc to flop visibly out of shape you probably have a good mirror support system.

In the past a common approach has been to make the mirror so thick that it had enough rigidity to cover-up the sins of the support system. Mirrors up to 12.5 inches in diameter with thicknesses equal to at least 1/6th of the diameter can safely be mounted in a simple manner. But lighter mirrors have been increasingly in favor. Consider the example of the 5 meter mirror of the Hale Telescope at Mount Palomar, and the sophisticated support system that was employed to allow the glass to be lightened. If the mirror disc were solid glass 5/6 of a meter thick it would have weighed well over 30 tons, and even a simply support system would have contributed significantly to a snowballing escalation of the overall weight of the telescope and mounting.

Continuing the analysis started above, a mirror support system must perform the following functions:

A) It must keep the center of the mirror from moving off the optical axis of the telescope. RADIAL OR EDGE SUPPORT takes care of this.

B) It must keep the reflecting surface from moving up or down the tube axis. BACK SUPPORT (Also called SUSPENSION) takes care of this.

C) It must keep the reflecting surface squared-on to the optical axis. BACK SUPPORT takes care of this too.

D) It must do all the above WITHOUT creating enough unequal pressure on the mirror to distort it! (Remember the foam disc!)

When the telescope is aimed low in the sky most of the weight of the mirror will be taken up by the edge support system. If it consists of small pads or pressure points around the edge of the mirror they can distort the mirror. Star images seen at high power may have "spikes" in the corresponding directions. As the tube rotates on an equatorial mounting we want the edge supports to push upwards on the mirror balancing its weight without squeezing it sideways, which would also create distortions. This is why in equatorial telescopes many schemes have been adopted for edge support, such as air-bags, mercury-filled rubber tubes, and networks of weighted levers.

For telescopes with thin mirrors and altazimuth mountings the beautifully simple solution to the edge support problem is John Dobson's sling. A seat-belt or other strong strap hanging from two blocks at horizontally opposed positions on the mirror cell's back plate circles the lower half of the mirror and supports it exactly as required. If the strap contacts only the REAR two-thirds of the mirror's edge virtually no distortion will be produced in the thinnest glass!

When the telescope is pointed high in the sky most of the weight of the mirror will be on the back supports. To understand the BACK SUPPORT problem let's think again of the disc of mattress foam. If you set this "floppy disc" down on a heavy rigid plate, then any unevenness in either the back of the foam disc (the mirror) or the heavy plate will be transmitted to the front (reflecting) surface. If we try supporting our floppy "mirror" on a lighter yielding back plate it may distort as much as your back does when you lie in a hammock!

So just laying a mirror down on any kind of a backing plate (using a simple flat-backed cell) is not a great idea, at least for a mirror that is getting on the large or the thin side.

Now suppose the foam disc is again lying in a horizontal position (like the mirror of a telescope pointing towards the zenith). Suppose you and a friend place your finger-tips under the outer portion of the back of the disc and gently lift up. Of course the foam will sag towards the middle. SO WOULD A MIRROR SUPPORTED LIKE THIS. Now imagine placing a hand under the center of the disc and lifting it. The outer edge of the disc will sag.

Where would you place your hands to get the least sagging? The answer is you would need THREE hands evenly spaced under the 70% zone, that is 70% of the way from the center to the edge. This works because each hand will now be supporting two equal portions of foam (or mirror) by weight -- one towards the center and towards the edge. There is a state of balance here.

This sort of dividing the mirror up into balancing portions or domains has to be carried further and further as larger or thinner mirrors are used. The three hands at 70% constitute the familiar three-point suspension. If more points are used, each centered in smaller pairs of balancing "domains", there will be less pressure at each point and less sagging between points.

Place a TRIANGLE of the correct dimensions between each of the three points above and the mirror's back and we get a NINE POINT suspension. These triangles have contact points at their vertices and MUST rock freely on the original three points. If so the nine points will conform perfectly to the back of the mirror with perfectly even pressure, even if the back of the mirror is not flat.

Place short straight bars with support points between the mirror back and each of the nine points on the triangles and voila, the 18 point suspension! John Dobson has found this to be good enough for his 24-inch mirror, which is only one inch thick.

Of course we can get an even smoother distribution of the mirror's weight if we put tiny triangles on top of the bars... (54 point suspension???)... but you get the idea by now!

It is of utmost importance to get all the support point positions and lever lengths (rods and triangles) just right, or else some points will bear harder on the mirror than others. The dimensions for 9 and 18 point suspensions are given in AMATEUR TELESCOPE MAKING BOOK ONE, available from Scientific American, pages 229 to 234. See also TELESCOPE MAKING MAGAZINE #26. To modify or extend these designs use the principle of equal portions of the mirror's weight. This principle means that if your mirror is proportionately a lot thinner in the middle than at the edge the support points will be spread out further from the center of the disc. Maybe someone can write a program to calculate the support points for any number of points (3, 9, 18, 36, 54, 108...) and any center-to-edge thickness ratio. HINT...HINT...

THE MAUNDER MINIMUM; SOME QUESTIONS, SOME ANSWERS

by Peter O. Taylor

"For the space of three years now (the sun) has remained without spots, which at other times, were so frequently to be seen". So wrote the famous Dutch astronomer, Huygens, to his contemporary Hevelius, on 16 September 1658 (Shove, 1983). Strangely, it would be late in the nineteenth century before two well-known solar astronomers, Gustav Spoerer and E.W. Maunder, would describe fully the lull in solar activity that lasted for almost seventy-years, spanning the entire reign of Louis XIV and encompassing the times of Milton and Newton.

During what we now consider to be normal circumstances, the number of sunspots regularly rises and falls in accordance with an average cycle length of approximately eleven years. During cycle "minimum" the numbers often fall to zero, while at "maximum" daily counts have soared to over three-hundred.

Although Spoerer's work (Spoerer, 1887) preceded Maunder's, it is the latter who is generally credited with the most complete description of the strange behavior of the sun in the 17th century. In his second paper on the subject, Maunder (Maunder, 1922) reported the following findings: During the period from 1645 to 1715, only a few spots were seen. For nearly half of this time, 1672 to 1704, no spots were observed on the sun's Northern Hemisphere; and for sixty years, until 1705, there was never more than one group visible at any one time. Thus it appears that the total number of spots for the entire period would have been less than we have come to expect in any one active year since that time.

Did this prolonged lull actually occur, or was it a lack of sophisticated equipment, or skilled observers, that only made it seem so? Is there other evidence, from associated, or seemingly unrelated studies, that could confirm its existence? Was anyone even looking? These are some of the fundamental questions that have been asked during the many years that have elapsed since Maunder's time.

Well-known solar physicist, John Eddy, in his analysis of the Maunder Minimum (Eddy, 1976), answered many of these questions. Eddy concluded that the modest equipment that is required for serious sunspot observation was readily available in the 17th century. In fact, drawings of the sun from that era show almost all of the detail that modern drawings show. And of course, the 17th century supported many accomplishments in other areas of astronomy, many by active solar investigators. For example, the first known division in Saturn's ring-system was discovered in 1675, along with five of its moons (1655 to 1684), implying a telescopic resolution of nearly one arc-second. Other examples include Romer's discovery in 1675 of the velocity of light from observations of the orbits of Jupiter's satellites; and transits of Venus and Mercury were recorded, demonstrating a certain familiarity with sunspots and their motions.

Eddy mentions many of the noted astronomers of the day. To name but a few: Flamsteed, Hooke, Halley, Huygens, Hevelius, Romer, Cassini, Grimaldi, and so on; many of whom regularly observed the sun and recorded their observations. Some supporting evidence for the minimum can be deduced from observations of "naked-eye" sunspot sightings. Reports of sunspots seen without visual aid can be traced back to 28 B.C., and before. These sightings were made when the sun was obscured by heavy haze or smoke, or was low in the sky during early evening or morning hours. (*Note* we now realize that this practice can be highly dangerous, and *must* be avoided.) As naked-eye sightings are relatively rare, the likelihood of their discovery is statistically greatest during times of high sunspot activity. Although a number were observed prior to, and later than the Maunder Minimum, apparently none were recorded during the period from 1639 to 1720 (Kanda, 1933). However, at least two other similar "gaps" do exist in Kanda's compilations.

Additional evidence comes from a generally unrelated field. It concerns the abundance of carbon 14 in tree rings. For technical reasons, we would expect to find a relative abundance of the element when solar activity has been at low levels. During the period of Maunder's minimum this is exactly the case. Increasing amounts do occur that peak in the year 1690 (DeVries, 1958).

Further, both the naked-eye-sunspot and carbon 14 indices correlate extremely well with each other and with long-term auroral activity, a phenomenon closely associated with periods of high sunspot number, and historically viewed with wonder. Aurorae were very rare during the period; far less common than in seventy-year periods previous to, and following the Minimum (Clerke, 1894).

In fact, in his extensive analysis, Eddy found virtually no evidence to dispute the minimum. Thus it appears that the sun did undergo major changes, with possible terrestrial effects, during the 17th century. We are not certain what mechanism could cause such an event to occur. Many explanations have been suggested, ranging from the interaction of secondary and tertiary (or even additional) sunspot cycles, to complex explanations of the physics of the solar dynamo itself.

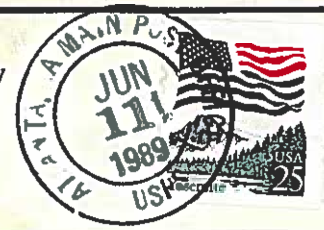
Perhaps Eddy best summarizes the scenario when he concludes, "the reality of the Maunder Minimum and its implications of basic solar change may be but one more defeat in our long and losing battle to keep the sun perfect, or, if not perfect, constant, and if inconstant, regular".

References

Clerke, A.M. 1894, "Knowledge", 17, 206.
DeVries, H. 1958, "Proc. K. Ned. Akad. Wet. B", 61, No. 2, 94.
Eddy, J.A. 1976, "Science", 192, 1189.
Kanda, S. 1933, "Proc. Imp. Acad. (Tokyo)", 9, 293.
Maunder, E.J. 1922, "Jour. Br. Astron. Assoc.", 32, 140.
Schove, D.J. 1983, "Sunspot Cycles", Hutchinson Ross Pub. Co., p145.
Spoerer, F.W.G. 1887, "Astronom. Gesell. Vierteljahrsschrift", 22, 323.

THE FOCAL POINT

First Class Delivery



Article submissions and address corrections to:
Steve Gilbreath, Editor
1410-C Druid Valley Dr.
Atlanta, Ga. 30329

AAC membership renewals to:
Bud Rosser, Treasurer
5198 Avanti Court
Stone Mountain, Ga. 30088

W. Tom Buchanan
105 Carriage Station Circle
Roswell, GA. 30075