Astronomy Club of Tulsa

Observer

June 2012

Photo: The shadow of Venus transits the sun, towards sunspots, by Stan Davis. Thank you Stan for your contribution!

Inside This Edition:

A Message from the Editor:

THE PICTORIAL ON THE VENUS TRANSIT EVENT WILL BE PUBLISHED AND SENT OUT AS A SEPARATE SPECIAL EDITION.

As some of you may know, I have been working for most of this month on a special pictorial commemorating the Venus Transit event that we did with TASM on June 5. I wanted this to be something special for everyone, as this was an extraordinarily special event that will not occur again in any of our lifetimes. I have to announce that due to 1.) the size of it, which, according to my own personal IT Department (Owen), is twice the size of the entire newsletter, and 2.) the formatting got all jacked up somewhere along the way, that it will be published and sent to the membership SEPARATELY from this newsletter.

When I completed the pictorial, which not only includes my own photos, but also photos contributed by John Land, Stan Davis, Cody Lawson and Judy Moody, and converted the MS Publisher format to PDF, it looked LOVELY! The photos came out sharp and clear and were very nicely arranged.

However, when I inserted the pages of the pictorial into the test run of this newsletter and converted it from MS Publisher into PDF, it looked, to put it as politely as I can, like something I barely missed stepping in on the sidewalk during one of my lunchtime walks. The photos came out grainy, wavy, heavily pixelated, blurry-looking and the colors were dull. It was a flaming disaster, the likes of which even Nat Geo would hesitate to film an episode of "Seconds From Disaster" about. Not the sort of thing I want as a commemorative for this event. It would have been embarrassing to publish the newsletter in the condition it was in, especially after working my behind off on it for so long!

Happily though, the original is still intact and looks amazing. *Which is why I have decided to publish it separately from the newsletter, as a "Special Edition". It will be sent out as a "supplementary" of sorts, and I hope you enjoy it. Here are a few photos from it, as a "sneak preview":*


Photo: Tamara Green


Photo: Stan Davis


Photo: Cody Lawson

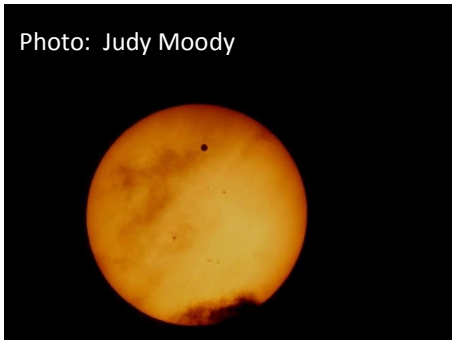


Photo: Judy Moody


Photo: Judy Moody

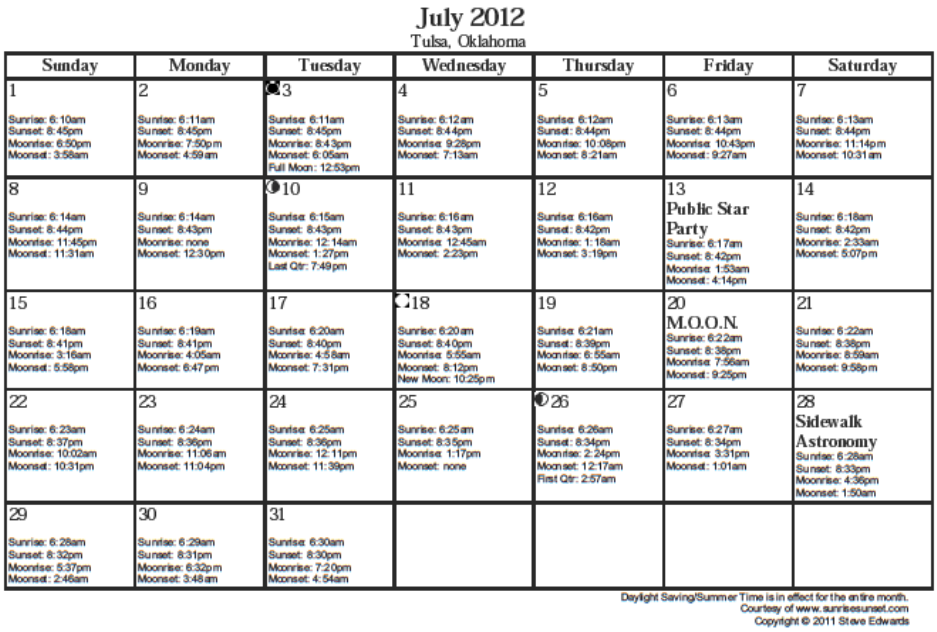

Photo: John Land


Photo: Tamara Green

These photos are just a mere sampling of what is in store! So please be on the lookout for and enjoy "IN PICTURES: The Transit of Venus of 2012", a Special Edition of the Astronomy Club of Tulsa Newsletter!

Thank you for your continued support!

Tamara



July 2012
Tulsa, Oklahoma

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 Sunrise: 6:10am Sunset: 8:45pm Moonrise: 6:50pm Moonset: 3:58am	2 Sunrise: 6:11am Sunset: 8:45pm Moonrise: 7:50pm Moonset: 4:59am	3 Sunrise: 6:11am Sunset: 8:45pm Moonrise: 8:43pm Moonset: 6:05am Full Moon: 12:53pm	4 Sunrise: 6:12am Sunset: 8:44pm Moonrise: 9:28pm Moonset: 7:13am	5 Sunrise: 6:12am Sunset: 8:44pm Moonrise: 10:08pm Moonset: 8:21am	6 Sunrise: 6:13am Sunset: 8:44pm Moonrise: 10:43pm Moonset: 9:27am	7 Sunrise: 6:13am Sunset: 8:44pm Moonrise: 11:14pm Moonset: 10:31am
8 Sunrise: 6:14am Sunset: 8:44pm Moonrise: 11:45pm Moonset: 11:31am	9 Sunrise: 6:14am Sunset: 8:43pm Moonrise: none Moonset: 12:30pm	10 Sunrise: 6:15am Sunset: 8:43pm Moonrise: 12:14am Moonset: 1:27pm Last Qtr: 7:49pm	11 Sunrise: 6:16am Sunset: 8:43pm Moonrise: 12:45am Moonset: 2:23pm	12 Sunrise: 6:16am Sunset: 8:42pm Moonrise: 1:18am Moonset: 3:19pm	13 **Public Star Party** Sunrise: 6:17am Sunset: 8:42pm Moonrise: 1:53am Moonset: 4:14pm	14 Sunrise: 6:18am Sunset: 8:42pm Moonrise: 2:33am Moonset: 5:07pm
15 Sunrise: 6:18am Sunset: 8:41pm Moonrise: 3:16am Moonset: 5:58pm	16 Sunrise: 6:19am Sunset: 8:41pm Moonrise: 4:05am Moonset: 6:47pm	17 Sunrise: 6:20am Sunset: 8:40pm Moonrise: 4:58am Moonset: 7:31pm	18 Sunrise: 6:20am Sunset: 8:40pm Moonrise: 5:55am Moonset: 8:12pm New Moon: 10:25pm	19 Sunrise: 6:21am Sunset: 8:39pm Moonrise: 6:55am Moonset: 8:50pm	20 **M.O.O.N.** Sunrise: 6:22am Sunset: 8:38pm Moonrise: 7:56am Moonset: 9:25pm	21 Sunrise: 6:22am Sunset: 8:38pm Moonrise: 8:59am Moonset: 9:58pm
22 Sunrise: 6:23am Sunset: 8:37pm Moonrise: 10:02am Moonset: 10:31pm	23 Sunrise: 6:24am Sunset: 8:36pm Moonrise: 11:06am Moonset: 11:04pm	24 Sunrise: 6:25am Sunset: 8:36pm Moonrise: 12:11pm Moonset: 11:39pm	25 Sunrise: 6:25am Sunset: 8:35pm Moonrise: 1:17pm Moonset: none	26 Sunrise: 6:26am Sunset: 8:34pm Moonrise: 2:24pm Moonset: 12:17am First Qtr: 2:57am	27 Sunrise: 6:27am Sunset: 8:34pm Moonrise: 3:31pm Moonset: 1:01am	28 **Sidewalk Astronomy** Sunrise: 6:28am Sunset: 8:33pm Moonrise: 4:36pm Moonset: 1:50am
29 Sunrise: 6:28am Sunset: 8:32pm Moonrise: 5:37pm Moonset: 2:46am	30 Sunrise: 6:29am Sunset: 8:31pm Moonrise: 6:32pm Moonset: 3:48am	31 Sunrise: 6:30am Sunset: 8:30pm Moonrise: 7:20pm Moonset: 4:54am				

Daylight Saving/Summer Time is in effect for the entire month.
Courtesy of www.sunrisesunset.com

UPCOMING EVENTS:

Sidewalk Astronomy	Sat, June 30	Bass Pro	8:30 PM
Public Star Party	Fri, July 13	ACT Observatory	8:00 PM
Members' Night	Fri, July 20	ACT Observatory	8:00 PM
Club Summer Star Party	Sat, July 21	TUVA	TBA

(Please note that the above ACT/TUVA Summer Star Party is MEMBERS AND THEIR FAMILIES ONLY. More details will come later.)

Sidewalk Astronomy	Sat, July 28	Bass Pro	8:30 PM

President's Message

By Ann Bruun

Greetings amateur astronomers. June was very active for our club. In addition to our usual sidewalk astronomy and public star party we also saw the Venus transit. It seems like we had been talking about the transit for so long and finally it was upon us. What a wonderful sight. We also had our BBQ up at the observatory, there was plenty of food and socializing.

This month we are planning a special members star party down at TUVA. Just a night to stay out and observer with other members of the club. Ron and Maura have graciously agreed to host the event. It will be a nice change of scenery and a good chance to catch up since the Messier Marathon could not be held there this spring. The event is planned for July 21 and it will be a potluck with the idea of staying out all night, or as late as you want to. More information about the event will be coming as it gets closer.

I know summer is a very busy time for everyone but it is also a great time to enjoy the cooler evening temperatures out under the stars. I hope to see you all at one of our upcoming gatherings.

Ann Bruun, President

Astronomy Club of Tulsa

Land's Tidbits

By John Land

Get your own VENUS TRANSIT CERTIFICATE from NASA and the Astronomical League. Did you witness the Transit of Venus?

The Astronomical League is providing two levels of certificates to those who viewed or photographed the event.

http://astroleague.org/PlanetaryTransit_Venus2012

The first certificate is for anyone participating. The second requires a bit more effort and some mathematics but the formulas are online with interactive applications. You must be an Astronomical League Member to earn the 2nd certificate. All ACT members are also League members. Note: the certificate downloads are about 30 meg each.

Regional Summer Astronomy Events

Star Bright – Star Light – Where shall I pitch my tent tonight?

Making plans for your summer travels. Here are a few places to pitch your tent.

Actually several also have more comfortable lodgings on site or nearby.

29th Okie-Tex Star Party

Sept 8th to Sept 16th

http://www.okie-tex.com/

Details for registration and meals at website.

Dozens of our Tulsa members join with more than 300 fellow astronomers each fall to marvel at the dark skies in the tip of the Oklahoma Panhandle. Al Nagler of Tel-Vue optics proclaimed it as one of the darkest sites in America. Get your registrations in early. Especially for the on site meals. Since the nearest eating places are nearly 40 miles away.

Nebraska Star Party July 15th to July 20th

http://www.nebraskastarparty.org/index.html

Heart of America Star party near Butler, MO

Oct 10 to Oct 14 http://www.hoasp.org/

Land's Tidbits, Cont'd.

Treasurer / Membership Report - John Land

The club has **111 members** including **15 new memberships** this year. Newest Members are:

Chris Underwood, Sam Davis, Norman Freihaut, Sammie Kraushaar,

Franklin Miller, Davis Taggart

In addition we have had **96** people request information on the website visitor section.

Checking Account $ 1,171.42 Savings Account $ 9,001.19
Investment accounts as of April 30 **$ 15,611.46**
Values will vary due to market values.

June 16 Club Cookout

A great time was had by all and closed out the evening with a fabulous sunset !

The Secretary's Stuff

By Tamara Green

Hello Members!

Since we are now into our summer months and there are no general meetings for me to take minutes for until September, there are no minutes for this edition of the newsletter! HOWEVER, there is a news item concerning a recent event in OKLAHOMA CITY involving a laser pointer and a POLICE HELICOPTER that I feel needs to be brought to everyone's attention. As far as Club members are concerned, I know I am preaching to the choir here, but for rank beginners to the Club and to Astronomy in general, and especially for our guests, this is something to be mindful of.

I have always said at our public star parties when I do the constellation tour with my own pointer that a laser pointer can be a valuable tool in the right hands and a deadly weapon in the wrong hands. I always tell our guests before even beginning my sky tour that laser pointers are ***NOT TOYS!*** When used in an irresponsible manner, there can be dire and even deadly consequences, such as blinded pilots and air crashes. There are also very dire legal consequences as well, so the below article is something we all need to share with both new members and guests so that we will not have any incidents of our own.

With this in mind, everyone should know and tell our guests especially, that we allow ABSOLUTELY NO ONE WHO IS NOT BOTH A.) A member of the Astronomy Club of Tulsa and B.) Over the age of 18 to handle, use, or even touch laser pointers while on Club property or at a Club-sponsored event, either public or private. No ifs, ands, buts, or exceptions! The below article with the accompanying web link should, hopefully, help to drive this point home. The below article was emailed to me by John Land, in the hopes that it would make it into the newsletter.

Person Charged in OKC for pointing a Laser at an Aircraft.

OKLAHOMA CITY—A federal felony complaint was filed late yesterday charging XXXXX XXXXXX, 20, of Oklahoma City, with two counts of aiming the beam of a laser pointer at an aircraft, specifically, the Oklahoma City Police Department helicopter, announced Sanford C. Coats, United States Attorney for the Western District of Oklahoma.
"Pointing a laser at any aircraft creates such a serious safety issue that Congress enacted a new statute in February to make it a federal criminal felony offense carrying penalties up to **five years in federal prison** and a **$250,000 fine**," said U.S. Attorney Coats. **"Lasers can distract, temporarily blind, or even completely incapacitate pilots, putting them and any passengers on board in grave danger. Pointing a laser at an aircraft is both a criminal act and a serious public safety concern."** _ _ _ _ _ _ _

Person Charged in OKC for pointing a Laser at an Aircraft, Cont'd.

On February 14, President Barack Obama signed the FAA Modernization and Reform Act of 2012. As part of that act, a new criminal offense was established for aiming the beam of a laser pointer at an aircraft in the special aircraft jurisdiction of the United States, or at the flight path of such an aircraft. The statute was enacted in response to a growing number of incidents of pilots being distracted or even temporarily blinded by laser beams.

Full article at:

http://www.fbi.gov/oklahomacity/press-releases/2012/city-man-charged-for-pointing-laser-at-oklahoma-city-police-helicopter?utm_campaign=email-Immediate&utm_medium=email&utm_source=oklahoma-city-press-releases&utm_content=106651

So let's all make an effort to share this valuable information and help keep everyone and each other safe.

Thank you and Clear Skies!

Tamara

The preceding article came from www.fbi.gov, June 15, 2012.

LIGO: LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY

Imagine a horse-race, except the horses are photons racing two and a half miles to a mirror and back for a five mile trip to the finish line. Then take the "photo finish" where the difference between the two can be measured to the degree of accuracy of 1/1000th of the diameter of a proton of an atom.

What you get is LIGO, the Laser Interferometer Gravitational-Wave Observatory, built to the tolerances to be able to do just that. There are two such facilities, one in central Washington, and the other, as a control, in Louisiana. I was fortunate to be able to tour the Washington facility near Hanford, Washington, recently while on vacation.

While pretty much everyone knows what gravity is, Newton, in 1687, contained the first statement of Universal Gravitation. He understood that gravity was a force that acts over distances without physical contact. He theorized that when a mass changes position, the entire gravitational field throughout the universe changes instantly.

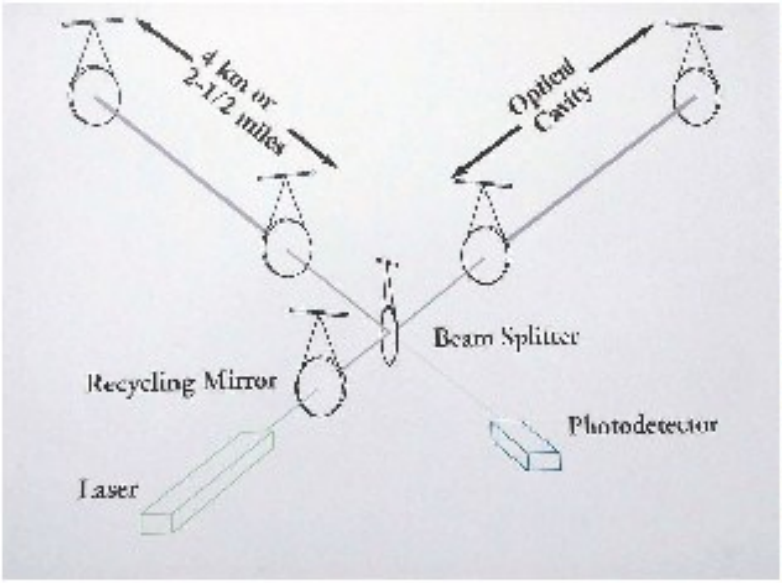
It took more than two hundred years for Eienstein to come up with his own theory-Relativity-to predict that gravity cannot travel faster than light, and thus he predicted that a change in gravitational field will travel through the universe at the speed of light rather than instantly as Newton had theorized. Any change of position of masses will make ripples through space-time itself. It is these "ripples in the space-time" that are known as "gravitational waves".

Gravity is the weakest of the four fundamental forces, and so the waves are very small. A "strong" gravitational wave, for instance, will produce displacements only on the order of 1/1000

the diameter of a proton in the space-time continuum. Waves of this magnitude are created when, for instance, two orbiting black holes are about to merge. These waves interact with matter by compressing objects in one direction and stretching them in the perpendicular direction.

LIGO was built to detect these waves. The effort is challenging. The instruments have to be completely shielded for all movement-even the slightest will create noise that will make the detection impossible. Then it has to be able to measure that small difference the wave makes on two light beams at perpendicular locations.

LIGO Control Room. The upgrade switched from PC's to Mac's.



The basic theory of the detector is based on two laser beams, split by a beam splitter, with one beam traveling at a perpendicular angle from the other. The beam is returned and focused upon itself from both angles, effectively canceling each other out if the beams are in phase, similar to the same effect found in noise-canceling headphones. Any changes in the phase of the light-caused by the change in length between the two beams of light caused by a gravitational wave-and photons will be detected by a photon-detector. The reason that the instruments must be well insulated from any movement is that movement will cause a similar and false effect. To be able to detect these very small differences, all the instruments must be constructed in a way the eliminates all movement, which is in and of itself an incredible challenge.

The first phase of LIGO went on-line in 2002, but because of hardware limitations, so far it was not successful in detecting any gravitational waves (at least from the analysis of the to date), so an advanced LIGO was funded and is now being constructed that, at least in theory, should be able to detect the waves that Eienstein predicated over a hundred years ago.

Advanced LIGO will have ten times the sensitivity of the original design and is expected to go on-line in 2014. Improvements in design include active movement inhibitors (as opposed to passive devices used in Phase I) and improvements in the instrumentation that will increase the sensitivity by a factor of ten. It will be able to remove vibrations to a factor of *100 million* to reduce noise and false detections. It is more than ten times more sensitive, and over a much broader frequency band, than initial LIGO. It will see a volume of space more than a thousand times greater than initial LIGO, and extends the range of compact masses that can be observed at a fixed signal strength by a factor of four or more.

So far, Eienstein has a perfect score in his predictions. If LIGO detects such waves, if he could be asked if he would be surprised, he would likely respond "I'd be surprised if it didn't."

For more information about LIGO and greater depth of the technical details, visit www.ligo.caltech.edu/

Advanced Active Suspension Prototype

Discovery, Awe, and Joy In Astronomy

Clyde Glandon, ACT Member

Alongside of the wonderful continuing advancement of scientific exploration and the technical features of our observation of the universe, remains the simple human experience of the beauty of the night sky and the stars.

In October of 2011, when several of the ACT members were helping the community celebrate the *International Observe the Moon Night* at the Tulsa Air and Space Museum, I set up my honking big Garrett binoculars for people to use. There was a little girl, I'm going to say maybe 6 or 7 years old, whose mother was taking her around to look through various instruments. She came to look through my binoculars and she could hardly wait as I adjusted the mount down so she could easily stand and look through the binoculars. She was dancing around as if she was waiting for Santa Claus.

She gazed at the moon for a few moments, standing still and quiet, and when she was done, she proceeded to run around in circles exultantly on the open area of grass nearby.

You see what I mean.

One may well have the same experience as an adult when looking at the Grand Canyon from Powell Point at sunset. Or standing on the east side of Jenny Lake and looking at Cascade Canyon in the Grand Tetons in the morning light. Especially for the first time.

I've been telling people this past year about what I call "doing astronomy backwards." By that I mean gazing at the night sky by scanning with binoculars and seeing what you find, without necessarily knowing what you are looking for. This may be a little difficult for those who have become familiar with most of the Messier objects.

But last summer at the OkieTex Star Party, I had only recently renewed my interest in astronomy and was unfamiliar (i.e. innocent, like the seven-year-old,) with most of the deep sky objects which are easily seen. Yes, I had long known M7 (my first love) since first seeing it with my new 20x80's in the 1980's. And I had tended to become relatively familiar with the night sky in the south.

In the early morning of the second day at Black Mesa, I was up while it was still dark, some time after 5:00 AM, and I started scanning east of Cassiopeia, and east of the Andromeda galaxy, and I started seeing first one then more, like a ladder of Galadriel's lanterns going up and down the eastern sky: one, two, three, four open star clusters. Whoa! The experienced members of the Astronomy Club can tell quickly what I was seeing, but I had never seen M38, M36, M37, and M35 before, didn't know of their existence, and I didn't know what they were in those first moments. I wrote in my journal later that morning: *Holy Jimi Hendryx. Excuse me, while I kiss the sky!*

I don't know if it is because I am mostly Irish or that it connects me with when my father taught us astronomy merit badge when I was 12, or whether it's because God does things to me, but these are the kinds of visual joys which can still light me up like the 7 year old girl. Antoine St. Exupery called it "looking with the heart."

But I know *this isn't just me*. It is all of us. And that is really something too. Isn't it?

Discovery, Awe, and Joy In Astronomy, Cont'd.

For further reading this summer: John Muir, *The Mountains of California*; Robert McCloskey, *Time of Wonder*; Madeleine L'Engle, *A Stone for a Pillow*; or any of various volumes of poetry by Mary Oliver or Jalaluddin Rumi.

GETTING TO THE POINTS
By Ron Wood

Veteran members of the Tulsa club are familiar with my telescope BART, so I thought I might discuss a couple of things I found interesting about my part in its construction. For those of you who haven't seen the scope, BART (Big Astronomical Reflecting Telescope) is a 24" Newtonian reflector with a clock drive, mounted on a trailer.

It was about 20 years ago that my friend Byron Melland, whom most of you have met, and I, built BART. Ten years before that Byron had built a similar 24" inch scope named Mira, which is now owned by David Chandler in California. David is familiar to many amateurs for his popular planisphere, "The Night Sky."

So, much of my role in BART's construction consisted of being the "gofer." However, Byron did give me two assignments with a little more responsibility, which I found enjoyable. The first was to determine the location of the points where the declination axis should be attached to the mirror box so that the scope would be balanced. The second was to locate the support points for the mirror in the 18-point flotation mirror cell.

We began construction by building the trailer, fork arms and optical tube assembly consisting of the mirror box and truss. We were then ready to mount the tube assembly in the fork arms. But the attachment points on the mirror box had to be precisely located so that the scope would be balanced on the declination axis. The problem was that the mirror was still being ground by Paul Jones at Star Instruments in Arizona; however, since he was able to tell us that it would weigh 62 pounds, we were able to continue construction by locating the balance points in the following way.

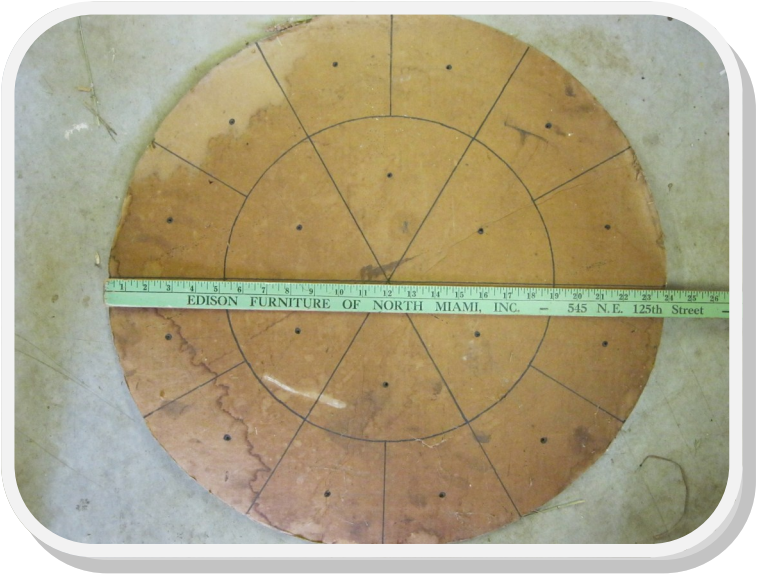
We began by laying the tube assembly on its side on the concrete floor with a length of steel pipe under the box at a right angle to the optical axis. We shifted the tube assembly forward and backward until it was precisely balanced on the steel pipe. Knowing this balance point and the weight of the mirror it was simple to calculate the location of the final balance point with the mirror installed. This approach proved completely satisfactory.

The location of the mirror support points in the cell proved to have an equally simple solution. The problem divides neatly into two distinct parts. Since there were to be 18 support points the first step was to divide the mirror into 18 segments of equal weight. The second step was to locate the center of gravity of each segment. The location of the support points in the cell should be directly beneath these centers of gravity.

I made the simplifying assumption that the mirror could be treated as a flat disc 24 inches in diameter with a uniform thickness of 2 inches. Of course the upper mirror surface is not flat but is instead a shallow paraboloid, .3 inches deep. This assumption was so useful and so clearly justifiable that I never gave it a second thought. In those days, before the location of centers of gravity for odd shaped objects could be found online, the alternative was an elementary but tedious calculation which Byron said David Chandler had done for Mira.

Getting to the Points, Cont'd.

So the problem was reduced to dividing the mirror into 18 segments of equal area and then locating the center of gravity of each segment. The mirror cell then provides a support point under the center of gravity of each segment. The construction of the cell assures that each point carries 1/18th of the weight of the mirror or a little less than 3.5 pounds. To do this a mirror pattern (see illustration) was cut from cardboard. The pattern was first divided by three diameters into six equal triangular wedges. Then a concentric circle of radius 6.9 inches was drawn to produce an outer annulus having six segments. Each segment of the annulus was cut in half to produce the final pattern with 6 inner triangular and 12 outer quadrilateral segments all having the same area.



The problem now was to find the centroids or centers of gravity for these two shapes. Formulae for both can now be found online, but we used an empirical approach. The two shapes were cut out and tacked to the wall so they were free to swing about the point of suspension. A plumb bob was also hung from the tack, and the line defined by the string was marked on the face of the cutout shapes. Then the process was repeated using a second point of suspension defining a second line on the shape. The intersection of these two lines marks the center of gravity of the segment and is shown on the pattern by the black dots on each segment. Done!

In preparing this article I became curious as to how much error in point location was introduced by my assumption that the mirror was a simple flat disk. I calculated the centroid location for one of the inner triangular shapes assuming a flat upper surface, then calculated again, assuming a parabolic upper surface. The error introduced in the location of the centroid by my assumption of a flat upper surface on the mirror was .001 inches....much, much less than the diameter of the pencil lead used to mark the location of the centroids on the pattern.

For the young (and young at heart) stargazers:

Check out these really cool pages from NASA's Space Place!

http://climate.nasa.gov/kids

http://scijinks.gov

http://spaceplace.nasa.gov

And for a cool article on the Venus Transit visit:

http://spaceplace.nasa.gov/venus-transit

These websites have a lot of really great information and cool activities for the kids too!

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MEMBERSHIP INFORMATION

Adult Membership, $45 per year. Includes membership in the Astronomical League, a Subscription to the Astronomy Club of Tulsa's "Observer" and a Subscription to the Astronomical League's "Reflector".

Senior Adult Membership, $35 per year. Includes all of the benefits of the Adult Membership, for those age 65 and older.

Student Membership, $30 per year with Astronomical League membership, $25 without Astronomical League membership.

The regular Adult and Senior Adult memberships allow all members in the member's family to participate in Club events, but only ONE voting member and ONE Astronomical League membership per family.

For additional Family memberships, $15 per family member with Astronomy Club of Tulsa voting rights, $20 per family member with Astronomy Club of Tulsa voting rights and Astronomical League membership.

Magazine Subscriptions, $34 per year for "Astronomy" and $33 per year for "Sky and Telescope".

For more information, contact Membership Chair/Treasurer John Land at 918-695-3195 or astroclubbiz@windstream.net.


Wishing you and yours a safe and happy
Independence Day!

THE ASTRONOMY CLUB OF TULSA INVITES YOU TO

MAKE PLANS THIS SUMMER TO JOIN US AT AN ASTRONOMY CLUB OF TULSA STAR PARTY!

OPEN TO THE PUBLIC

For more information please visit www.astrotulsa.com.

The Observer is a publication by the Astronomy Club of Tulsa. The Astronomy Club of Tulsa is a 501C 3 non-profit organization open to the public. The Club started in 1937 with the single mission to bring the joy and knowledge of astronomy to the community of Tulsa, OK and the surrounding area. Today our mission remains exactly the same. We travel to local schools, churches and many other venues with scopes and people to teach. Our observatory is located in Mounds and many public programs are offered there. To join the Astronomy Club of Tulsa please visit www.astrotulsa.com where you will find all the information necessary to become a member.