



Astronomy Club of Tulsa

OBSERVER

June 2005

<http://www.AstroTulsa.com>

ACT, Inc. has been meeting continuously since 1937 and was incorporated in 1986. It is a nonprofit, tax deductible organization dedicated to promoting, to the public, the art of viewing and the scientific aspect of astronomy.

What

The Astronomy Club of Tulsa Meeting

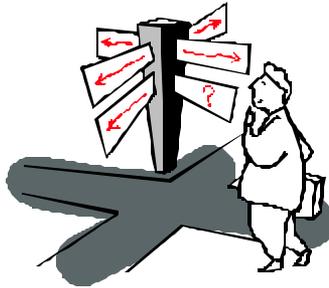
When

3 June 2005 at 7:30 P.M.

Where

RMCC Observatory

President's Message



Editor: We will not be hearing from our president this month because he is lost. If he was here I am sure he would be reminding everyone that there will be no meeting at TU during the months of June, July and August, and inviting all of the members to the next club star party on Friday, 3 June, and the Prairie Thunder at Pawhuska 4 June. See you there...

Night Sky Network/Prairie Thunder

By Neta Apple

Prairie Thunder is rapidly approaching! We have than a week until the event. Everything seems to be falling into place nicely. Several of us went to Pawhuska to look at the site and were surprised at how many people knew about the upcoming event. The whole community of Pawhuska is really going all out! They are thrilled that we are coming with our activities and telescopes! Their enthusiasm is infectious. We have a really great chance to share our love of the sky with a group of people who are going to be very receptive and eager! The only thing they have said negative was that they didn't get a big enough poster.

Don't forget that Lou Mayo will be attending our ACT star party at Mounds the night of June 3rd. For those not able to go to Pawhuska, this will give you a chance to meet and talk with him before he goes to Pawhuska on Saturday.

The event will be held at the municipal airport, about four miles west of Pawhuska on Highway 11. The rocket club plans to begin launching rockets at 9:00 a.m. on both Saturday and Sunday, June 4th and 5th. ACT will attend only on June 4. Some of our members plan to arrive Friday night and camp. We will need to be set up and ready to begin by 9:30 a.m. at the latest. We still need tables and shade canopies. If you have one of these items that we can use, please let me know (rnapple-ct@chouteautel.com).

We will have use of two hangars at the airport, one of which will house the Star Lab planetarium. If we have bad weather- let's not use the four-letter R word- we can still do our activities by moving into the other hangar. The town decided to install power on site at the airport so our power problems have been solved. We have also been given the use of a portable AC unit to provide climate control for the planetarium.

During the day we will have solar observing, the planetarium, and booths set up with activities for both adults and children. Lou Mayo has indicated that he will ship a NASA display booth that he will use all day as well. The Chouteau High School astronomy club will bring several students that will participate with activities and demonstrations during the day. Their teacher, Debbie Evans, the local NASA/JPL Solar System Ambassador, will have materials and activities for the public as well. Oxley Nature Center will be in attendance also.

We have coverage for the planetarium and plenty of telescopes for the solar observing, but could certainly use more help in the booths (hey, you would get to stay in the shade and you can see the rockets as well). E-mail me at the above address if you are interested or need more information.

Rocket launches will end at 5:00 p.m. leaving three hours to eat and prepare for the star party before Lou Mayo speaks about the Cassini/Huygens mission at 8:00 p.m. in downtown Pawhuska at the Constantine Theatre. Immediately after Lou speaks the drawing for the telescope will be held and, weather permitting, we will go back to the airport for the star party.

Great news!!!! Our friends at ASTRONOMICS have agreed to donate a 90 mm Konus refractor for us to use as a fundraiser at Prairie Thunder. The winner of this little beauty will for the cost of a small donation not only win the telescope, but will also be able to have some help in learning to use it that night at the star party, weather permitting. Family and members of ACT will not be eligible to win. We will have the chance to raise some funds to help care for our observatory, and at the same time introduce someone to the wonders of astronomy! Many thanks to Tony White for his persistence in working to get the telescope for us! Tony also split the cost of a pack of 25 star finders from Edmund Scientifics that will be given as door prizes. Be sure to thank him for his help and generosity when you see him.

I also want to thank Jane Johansson, Vince Moore, Alex Apple, and Gerry Andries for their help in setting up an astronomy display at the Zarrow Regional Library Branch of the Tulsa Public Library for the month of May. Jane generously offered the loan of her small reflector for the exhibit, Gerry brought his lunar globe, Alex loaned me his Cambridge Star Atlas, and Vince brought some nice Prairie Thunder posters that we could use. Combined with some nice images, NASA posters and NASA paper models these items will no doubt catch the eye of many who visit the library. We were also allowed to leave a few club flyers and NSN star maps at the circulation desk for library patrons to



read or take home.

Kudos also goes to Tim Davis, Steve Chapman, Gerry Andries, Randy Henry, and last but not least Richard Apple, (who drove all the way from Kansas City, MO) for their help at the Chouteau School star party in April. I have had wonderful feedback from those who attended that night. Great job!

Our latest NSN kit, The Black Hole Survival Kit, has arrived, but I have been too busy with preparations for Prairie Thunder to do more than just glance at it. It is much more sophisticated than previous kits and will take a bit more practice before I can show you how mass affects the fabric of space and several other clever demonstrations with the materials.

I look forward to seeing everyone at Pawhuska next weekend! This will be such a great event!

Dear Astronomy friends

From John Land

Summer is upon us but don't let the short summer nights discourage you from enjoying the night sky. Saturn is still a grand sight low in the NW until the end of June and Jupiter dominates the southern sky. A spectacular Twilight Triple conjunction awaits us at the end of June with Saturn - Venus and Mercury playing tag for nearly a week. See details in upcoming June newsletter. Leo and Virgo are well placed for observing several dozen galaxies accessible to small or med-sized telescopes.

We will start off summer with a BANG! The Astronomy Club of Tulsa has TWO astronomy events coming up next weekend June 3rd and June 4th.

On Friday June 3rd is our regular club observing night at our Observatory near Mounds Oklahoma. Plan to arrive by 8:00 PM and enjoy the sunset - visit with Louis Mayo from NASA and do some observing. See map and details at end of letter.

Rocket Launches starting around 9:00 AM on Saturday June 4th. Our astronomy club is participating with the Tulsa Rocketry Club www.tulsarocketry.org in a regional amateur rocket launch near Pawhuska Oklahoma about 40 minutes NW of Tulsa. They have clearance from the FAA to launch rockets up to altitudes of 20,000 feet! There will also be opportunities for the kids to purchase and make small rocket kits. Vendors and snacks will be available for purchases on site.

The Tulsa Astronomy Club will be running an inflatable planetarium - doing several astronomy activities and some solar observing during the day. That

evening Louis Mayo from NASA will be speaking at the Pawhuska Constantine Theater followed by a dark sky telescope night open to the public. You may come all day or just come in the afternoon and evening for the astronomy part. The rockets launch ends at 5:00 PM but resumes again on Sunday at 9:00 AM. There are no astronomy events scheduled Sunday.

MANY MORE DETAILS and a MAP to Pawhuska are available on our [www. AstroTulsa.com](http://www.AstroTulsa.com) website or at http://tulsarocketry.org/highfrontier_directions.htm click on map to enlarge

Friday June 3rd Club Observing Night

During the summer months club members and their guests gather for a summer star party. We start gathering about 7:30 to 8:00 PM. Some people like to bring a few snacks and have a little picnic before hand. It is recommended that you bring your own drinks, as the rural water is not very tasty. We have plenty of folding chairs and a picnic table but you are welcome to bring your own lawn chairs or tarp or blanket to sit on. The observatory has a restroom. Insect repellent is recommended in the summer months but please do not spray them near the telescopes. Children and youth must be supervised and remain on the observatory grounds.

You don't need a telescope to enjoy a star party. The club has a 16-inch telescope in the dome and most club members are willing to share the view through their telescopes. Telescopes are often set up to check for sunspots before sunset. This month's star party may be a bit different since several of the club leadership will be setting up for the event in Pawhuska on Saturday. We will be depending on our regular members to make any guests welcome.

Map to observatory at <http://www.astrotulsa.com/Resources/Maps/rmccmap.asp>

To get to the observatory take Highway 75 South toward Okmulgee. Turn WEST (Right) on 241st St South (across from Duck Creek Indian Casino) Continue on 241st about 6.5 miles (Its a dirt and gravel mixed road). As you reach the west end of 241st it turns up a steep hill to the right. When you reach the top of the hill it turns into a paved road. Continue on pavement about 1 mile and you will see the observatory on the top of the hill. Children are welcome at both events but must be supervised and must stay on observatory grounds. Insect repellent is beneficial in the warmer months.

Lands Tidbits

by John Land

Welcome to our new members: **Chris Bidwell, Sherry Upton, John Allen**

A NEW GUEST SIGN IN SECTION on the Website is already bring the club new contacts for potential new members.

Dues changes: At the May 20 meeting the new dues was approved. The new dues are as follows:

- **Adults \$ 35 per year includes Astronomical League Membership**
- **Students \$ 15 without League membership.**
- **Students \$ 20 with League membership.**

Student shall be defined as a person 25 or younger actively taking courses at a college or trade school or persons still in High school or below. Adult Students over 25 may join at the student rate for one year if enrolled in an Astronomy course in an area college.

Changing EMAIL - When you change your email or mailing address be sure to send me the new information so I can update the club records. You can use the "Join" feature on the club web page to make changes.

We now have an automated on line registration form on the website for new AND renewal memberships plus magazine subscriptions. You simply type in your information and hit send to submit the information. <http://www.astrotulsa.com/Club/join.asp> You then print a copy of the form and mail with your check to:

Astronomy Club of Tulsa, 25209 E 62nd St, Broken Arrow, OK 74014

Magazine Subscriptions: If your magazines are coming up for renewal, try to save the mailing label or renewal form you get in the mail. Do NOT mail renewals back to the magazine! To get the club discount you must go through the club group rate.

- Astronomy is \$29 for 1 year or \$55 for 2 years. www.astronomy.com
- Sky & Telescope is \$33 / yr www.skyandtelescope.com Sky and Telescope also offers a 10% discount on their products. NIGHT SKY is \$18 / yr A exciting new bi-monthly magazine for beginning or casual astronomers. <http://nightskymag.com/>

Address Corrections- Email changes - Questions: You may forward questions to the club call our message line at 918-688-MARS (6277) by email membership@astrotulsa.com. Please leave a clear message with your name, phone number, your question - along with address or email. Please make an email subject lines that address your question.

One Magical Night

By Tim Davis

Hello everyone. I just wanted to relate to you a story about a recent night of observing where all the conditions came together in just the right way to result in a near perfect night to spend looking at all the wonderful winter sights in the night sky. That day was Sunday, February 13. Now, normally, I won't go out to the observatory on a Sunday, what with having to go back to work the next morning, but this night was just too good to pass up. The conditions leading up to this night were these: the day before, Saturday, had been rainy and cool, so the rain was "cleaning" out the air, a front had passed through after that shifting the winds around to the northwest, this was bringing in much drier air from the mountains. These down slope winds also raised the air temperature, so we had a 70-degree day in February! After seeing how all these conditions were coming together right on top of Oklahoma, and after checking the visible satellite loop, which was clear, I knew it would be a night not to pass up.

I called my observing buddy, Jerry Mullennix, that afternoon and asked him if he wanted to join me out at the observatory. Even with it being a Sunday night, it didn't take much arm-twisting for him to agree to come out. So we arrived a little before 6:00 PM, got our gear set up, watched the sunset and waited for darkness to fall. And when it did, WOW! What an incredible sky it was. Even with a 20% crescent moon out, the sky was just so dark and stable from horizon to horizon. We both were amazed at how little sky glow there was looking north to Tulsa. When those conditions that I described before all come together that way, especially the very dry air, this is perfect for minimizing the sky glow. I'm sure everyone can remember how much there is on one of those humid summer nights, where the glow can extend up to near Polaris. Well that night, it couldn't have been more than five degrees above the horizon, and much dimmer than usual as well.

After we picked our jaws up off the ground, we set about getting in some observations. Jerry was taking a tour of some the sights with the guided tour of his Celestron 8" go-to scope, including M81, M82, Orion, the double cluster in Perseus and many others. I spent some time working on my Messier observing list with my 12.5" dob, getting the clusters M41, 46, 47, 50 and 93 logged in. If you've never seen M46, I suggest you check it out, a very interesting cluster with a planetary nebula in front of it. We also looked at many others, including the Moon and Saturn. Saturn is in an ideal position now in the early evening placed high in the sky to get some wonderfully stable and detailed views. We finally wrapped it up around 9:30 and headed home. We both agreed that we could have stayed out all night on a night like that, but with work bombing ahead the next morning, we had to call it a night.

So, for all of you that don't like getting out in the winter, or on a work or

school night, or for whatever reason, I urge you to keep an eye on the weather conditions, and every so often, when it looks like those will work out just right, do whatever you can to get out and observe. If you do, you just may be rewarded with a magical night under the stars.

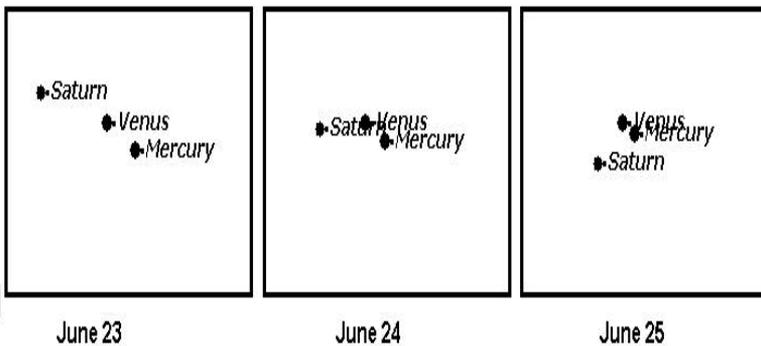
Twilight Triple conjunction

From John Land

A spectacular Twilight Triple conjunction awaits us at the end of June with Saturn - Venus and Mercury playing tag for nearly a week. The event will end with the closest with Venus and Mercury within the same eyepiece for over five days. In fact this is may be the best opportunity to observe Mercury easily in many years. I cannot recall a time these two bright planets were so close together.

To witness this event you'll need a good view near the horizon NW at about 10 degrees of Altitude and an azimuth of 290 degrees. (20 degrees north of west) You can start practicing this weekend by observing Saturn by itself around 10:30 PM. Venus is already visible in the NW at sunset and Mercury will join the show by mid-June.

In the images below the time is 9:15 PM about 40 minutes after sunset and the altitude of the planets is around 10 degrees above the horizon.

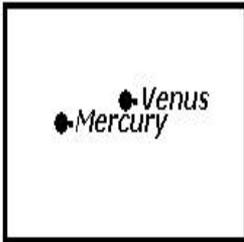


June 23 the three planets will all fit easily in a pair of binoculars being within a 4 degree circle.

June 24 Planets within 2.5 degrees and Venus and Mercury within 1 degree. They will remain within 1 degree of each other until July 3rd

June 25 Closest triple conjunction. All planets within 1.5 degrees

June 26 to 28 - Venus and Mercury within 1/2 degree easily fitting a high power eyepiece



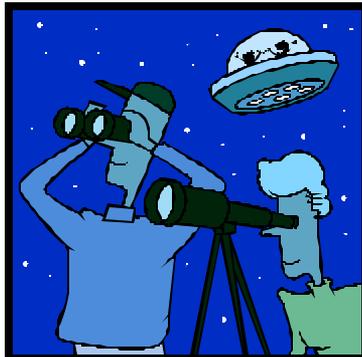
June 27



July 3

June 27 Closest approach of Venus and Mercury only 8 arcmins apart ! An arcminute is 1 / 60th of a degree. This would be a great day to try a daytime observation since they are within 5-arcmins between 2:00 and 4:00 PM Extreme Caution must be taken to avoid the sun. Since the sun is 23 degrees away place your telescope in shadow still having the planets in view.

JULY 3 The Grand Finale - Venus and Mercury will Bracket the M 44 Beehive Cluster. Some of the brighter stars in the Beehive may be visible even at such a low angle.



DAVID'S ASTRO CORNER

David Stine

"Crash of the Century"

We are just a month away from what may be the crash of the century. The Deep Impact spacecraft is rapidly approaching Comet Tempel 1 and on the morning of July 4th it will crash onto the comet's surface. The latest update is for this to occur at 12:52a.m. CST. Will we be able to see this from Tulsa? Possibly, but it will be very low on the western horizon, less than 10 degrees above the horizon. You need an unobstructive view to the WSW of the horizon. The good thing is the comet should be fairly easy to locate prior to impact as it will be just a few degrees from the bright star Spica and will be viewable by dark that night. So you can lock on to the comet a few hours before impact. Now I say easy, but if you have never looked for a 10th Mg. comet you will have some problem finding it, that is why I urge you to start observing this comet now so you will be used to what it looks like when the eventful night arrives. You can find a very nice chart of the comet's locations from now through July 22 at <http://encke.jpl.nasa.gov/images/9P/9Pchart05.jpg> Also for a detailed Ephemeris that will give you daily coordinates of Tempel 1 go to <http://cfa-www.harvard.edu/iau/Ephemerides/Comets/0009P.html>

You also will need a dark location like the observatory and I am sure there will be many of us gathered that night for the Deep Impact Star Party. Some members are even planning to travel farther West as the comet will be higher in the sky at impact, but to get a better view you would have to go west of Texas into New Mexico or farther west. Now just what will you see. First after you find the 10th Mg. comet you will see a very dim very small fuzz ball with possibly the coma elongated and with high powers maybe a small tail, but comet tails are very hard to identify. But if you watch this fuzz ball through your telescope right up to impact, then that's the moment you have been waiting for. Most estimates are that the comet at impact and before your eyes will brighten 3 or 4 magnitudes. That will be like a piece of cotton being lit by a match. Now that will be something to see. If we are real lucky there are some comet theorists that say the comet could brighten to 0 Mg. So how long will the comet remain bright? Most and I say most comets that have a sudden outburst which this would be, can remain bright for days, weeks and even months. So if the comet is too low or something like low clouds, atmospheric haze, etc. blocks our view of the impact, most likely the next night when it will be higher in the sky at dark, the comet will still be possibly naked eye. No one knows for sure just what will happen for sure. The exciting thing is that it's never been done before and you are getting to observe something that has never been seen in the history of mankind, crashing an object into a comet, now that's exciting. Think about it, not even your famous astronomers back in time like Galileo or even Einstein witnessed such an event. As the spacecraft gets closer there will probably be adjustments so times for impact could change, but for updates you can go to <http://deepimpact.jpl.nasa.gov/press/050513jpl.html> for the latest and

also can subscribe to an e-mail service that will keep you updated on the mission or watch for my Astro Alerts.

"Comet C/2004 Q2 (Machholz) Update"

Another comet is making news. Remember Q2 which we watched naked eye earlier this year? Well it is now around 10th Mg and traveling through Ursa Major. The big news is that recently an observer noticed a new tail was forming in the direction of the sun. This was unusual that the tail should be in the other direction away from the sun. This structure extends more than 15 arc min toward the sun and is at PA 290 degrees. This is more than likely an anti-tail. It will be interesting to watch to see if a narrow gas straight tail and long develops as Earth crosses the comets orbital plane.

"A New Light In The Sky"

Most of you have watched an Iridium Satellite flare up to many magnitudes as it passes over or have seen the bright International Space Station fly over, well in a few weeks on June 21st we will be able to start watching for another bright light in the sky. A Russian nuclear submarine will be launching a rocket that will send the first Solar Sail Cosmos 1 into orbit around the Earth. This will be the first international, privately funded space mission in history. How this affects us is Solar Sail will fly over Tulsa and be as bright as the brightest stars in the sky. Heavens Above will add Cosmos 1 to their list of objects that they track and after it is launched and comes over Tulsa, I will be sending out an Astro Alert, so be watching. Just what is a Solar Sail? It is a spacecraft without an engine and is pushed along by light particles from the Sun. Because it has no fuel it keeps accelerating over almost unlimited distances and is the future of space travel and is the only technology now in existence that can one day take us to the stars. If you want to get updates on this mission you can sign up at http://www.planetary.org/solarsail/ss_email.html

Here is something to think about; If you lived at the South Pole you could see an Iridium Flare every 9 minutes.

"Mars is Coming"

Remember when Mars came the closest to Earth a couple of years ago and we had thousands of people at our Mars Watch view the planet, well its coming again and it won't be that much farther away from us at its closest approach only 43 million miles from us. By the time you read that last sentence we are now 25 miles closer to Mars. We are racing toward Mars at 23,500 miles per hour and now you are 50 miles closer. Mars is already an awesome sight in the morning sky if you haven't looked at it recently shining almost twice as bright at a 1st Mg. star. Each night as we draw closer the planet will become brighter until October when it will outshine everything in the sky except the moon. Its closest approach comes on October 31st, Halloween, Monday night, rising at sunset and hangs overhead at midnight, and outshines Sirius, and the giant Jupiter king. What a sight. If you remember Mars never got real high at its record close encounter with Earth during Mars Watch, now it will be high

overhead. Are you ready for Mars Watch II? We should be able to start seeing polar caps and dust storms by mid-summer and by September your neighbors will be asking, "What is that red thing in the sky?"

The exciting Prairie Thunder is this weekend. Don't miss this exciting event. Look for more details in this newsletter and at our website www.astrotulsa.com.

That's it from my corner this month, what an exciting summer lies ahead, crashing a comet, solar sail flying over Tulsa, Prairie Thunder, Mars approaching, and more, keep your eyes skyward until next month.

An Invitation

From Rocky Keys

I have an invitation to anyone that wants to see the design of our Roll Off Observatory. It is 12 by 12 and has a 14 by 14 roof. At this time it is opened and closed by two sets of ropes, I plan to motorize in the future. We have installed of course several items in structure to support normal observing. I have two monitors and a VCR with microphones and cameras to monitor inside, also capable to display video from our new Meade DSI camera onto the larger monitors. I am ready to hook up audio from observatory with room video and Scope video which will be transmitted on cable channel 60 439.525 MHZ. This transmission will be from an 80 ft. tower and high gain antenna with purpose of transmitting our pictures and audio to the Clubs observatory. Thought this might add a little entertainment on visitors day. Anyway just having fun as this transmission could be picked up by others in my area or even back to Tulsa with the right antennas as I can run up to 50 watts pep continuous and more intermittently. The room is also equipped with Shortwave radio to monitor WWV and of course the ATOMIC clock is mounted above Radio. Posters are on walls with reference information to aid in object selection and identification.

We did learn to make sure that all electronics on the new computer scopes must be disconnected from power and even removing all hand controllers and cords to eliminate current flowing on these wires during close lightning strikes and discharges. Our Meade 14 had to be sent back as the main board had several traces burned as well as the main regulator failed. Not sure what else may be wrong. I was testing and left hooked up and left for a 4 day trip only to return and find that a storm had passed through leaving its mark! Normally I would have checked the next day and made sure everything was turned off. AT this time we have a 10 Meade LX 90 on pier.

This was the second time I have talked to Meade service and found them to be a little weak in their ability to deal with problems. If you need more info give me a call. ROCKY

ASTRONOMY EVENTS

May31 - Aug14

HEADS UP: There are no lecture meetings at Tulsa University during the summer months.

NOTE: Tentatively scheduled dates below are bracketed with question marks. The number of persons expected is in parenthesis.

EVENTS AT RMCC OBSERVATORY:

JUN

- 03 Fri 08:00 Club Star Party
- 10 Fri 08:00 Big Brothers and Sisters (20)
- 13 Mon 08:00 ORU Summer Science Kids Camp (30)
- 18 Sat 08:00 Family and Friends (10)

JUL

- ? 03 Sun 08:00 Deep Impact Tempel 1 at 01:52 AM of July 4th ?
- 08 Fri 08:00 Club Star Party
- 09 Sat 08:00 Back Up for 07/08

AUG

- 05 Fri 08:00 Club Star Party
- 06 Sat 08:00 Back Up for 08/05
- 13 Sat 05:00 Tulsa Bicycle Club (Will camp)
- 14 Sun ??:?? Tulsa Bicycle Club

EVENTS AWAY FROM OBSERVATORY

MAY

- 20 Fri 07:30 Regular Club Meeting at TU Keplinger Hall

JUN

- 04 Sat 09:00 AM Prairie Thunder Rocket Launch & Star Party (1000+) at Pawhuska Airport
- 05 Sun ??:?? Prairie Thunder Rocket Launch at Pawhuska Airport
- 21 Tue 04:30-08:00 Tulsa area Cub Scout Day Camp (120) at 193rd E. Ave on 101st St.

Gerry Andries
 Observatory Group Director
 Astronomy Club of Tulsa

www.
AstroTulsa.
com

Astronomy Club of Tulsa

Membership Application/Renewal Form

PLEASE PRINT

Name: _____

Phone: (918) _____ - _____

Address:

City / State / Zip _____ / _____ OK _____ / _____

E-mail address - print clearly

Check Lines below : For faster economical delivery you are notified by email when the Club newsletter is posted on the web. Email saves the club mailing expenses.

____ NEW MEMBER _____ RENEWAL

____ Adult Membership with Astronomical League Membership (\$35)

____ Student with Astronomical League Membership (\$20)

____ Student Membership without AL Membership (\$15)

Student shall be defined as a person 25 or younger actively taking courses at a college or trade school or persons still in High school or below.

Adult Students over 25 may join at the student rate for one year if enrolled in an Astronomy course in an area college.

____ Sky & Telescope Subscription (\$33) / year also includes 10% discount on most Sky & Tel products

____ Astronomy Subscription (\$29) / year (\$55) / two years

* Magazine rates may change / prices available with membership only. The Student discount is intend for persons whose primary focus is education and not employed full time.

Make check payable to:

Astronomy Club of Tulsa - 25209 E. 62nd St - Broken Arrow, OK 74014

Email at membership@astrotulsa.com - or call 918-357-1759

How did you hear of the Astronomy Club of Tulsa?

How long have you been interested or active in astronomy?

Do you have a telescope? _____ Type

What astronomy club activities would you like to participate in?

Have you been a member of other astronomy clubs?

Where / when

Astronomy Club of Tulsa membership (\$35/year) includes membership in the Astronomical League and subscription to ACT's "Observer" and AL's "Reflector". "Astronomy" (\$29/year) and "Sky and Telescope" (\$33/year) are also available through the club. For more information contact John Land at 918.357.1759. Permission is hereby granted to reprint from this publication provided credit is given to the original author and the Astronomy Club of Tulsa Observer is identified as the source.

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Astronomy Club of Tulsa

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