# The Spectrogram

*Newsletter for the Society of Telescopy, Astronomy, and Radio*

S*T*A*R ASTRONOMY CLUB http://www.starastronomy.org

January 2014
Edited By Rob Nunn
Compiled By M. Paci


## Inside This Issue




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**www.starastronomy.org**
*facebook.com/STAR.Astronomy*


## January 2014 Meeting

The next meeting of S*T*A*R will be held on Thursday, January 2nd at 8 p.m. at Monmouth Museum on the campus of Brookdale Community College in Lincroft, NJ.

This will be our annual winter social event. We will have a brief business meeting, but no speaker. Members bring their favorite dishes, and we spend the evening socializing and enjoying some delicious food. Please go to the club's website, forum area for more details and to post the dish you plan to bring.

The meeting will begin at 8:00pm at Monmouth Museum on the campus of Brookdale Community College in Lincroft, NJ. As always, we welcome visitors and those who may be new to Astronomy. If you are a visitor, please come at 7:30 PM so that we can get a chance to meet you and understand your interests before the regular meeting begins at 8 PM. You do not need a scope to attend, but if you have one and need help setting it up, please join us.

## February Issue

Please submit articles and contributions for the next Spectrogram by January 25. Please email to mcpaci@aol.com.

## Calendar

**January 2, 2014 – Club Social**

**January 10, 2014 – Monmouth County Winter Parks Program Wonders of the Night Sky, Manasquan Reservoir Environmental Center,**

**February 6, 2014 – Prof. Spergel from Princeton presents The Shape Of The Universe.**

**February 7, 2014 – Monmouth County Winter Parks Program Wonders of the Night Sky, Thompson Park**
**December 21, 2013 – Winter Solstice 2013**

**March 6, 2014 – The speaker is George Zanetakos "Imaging the Messier Objects".**

**April 10-11, 2014 North East Astro Imaging Conference ( NEAIC)**

**April 12–13, 2014 Northeast Astronomy Forum (NEAF)**

## *President's Corner*

***By Kevin Gallagher***

We hope this first edition of The Spectrogram for 2014 finds everyone in good health and good cheer and ready to start the New Year. Many of us will be getting to know our Christmas toys (Astronomical or otherwise). Many of us will be enjoying some time off around the Holidays to enjoy the company of our families and friends and many of us will be thinking about New Year's resolutions (like more observing?).

2013 provided us with some highlights that included a number of enjoyable club observing sessions at Dorbrook Park, a couple of night rocket launches from Wallop's Island, along with some early mornings looking for Comet ISON, but many enjoying Comet Lovejoy instead. Of course, there were a number of Outreach Events in which S*T*A*R members shared their love and knowledge of the night sky. We also added some new members and we welcome them into our community.

2014 begins with Jupiter ruling the moonless night, like the *Jove* of old. Venus is a beautiful crescent, setting soon after the Sun. Orion, Auriga and Taurus are well placed in the sky to enjoy all their beautiful objects. We hope you get to enjoy some time and some clear skies to bundle up and enjoy these sites.

We're looking forward to our new program with the Monmouth County Parks Department, among many other Outreach Events planned for 2014. We always need more volunteers for events, so please don't hesitate to join us. S*T*A*R would not exist, but for its dedicated volunteers, and we'd like to take this opportunity to thank all our members, but especially our volunteers for all the great work that they do on our behalf.

Please accept our best wishes for a healthy and happy 2014!!!

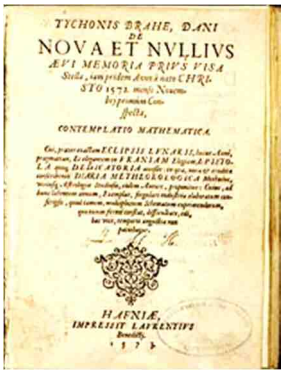
## December Meeting Minutes

***By Michelle Paci***

The December 2013 meeting of S*T*A*R Astronomy Club began at 8:06 pm on December 5th. It was attended by thirty-one members and non-members. President Kevin Gallagher chaired the S*T*A*R Astronomy Society club meeting. He began at 8:10 pm by presenting the evening's agenda. He also welcomed several first-time attendees: Bill, Andrew, and Sam. Kevin advised members to validate membership dues during the break and then promptly introduced the evening's speaker.

The evening's presentation was "Novas and Supernovas" as presented by S*T*A*R's Arturo Cisneros.

Arturo presented a fascinating talk on Super Novae. He began by explaining the origins of the name as deemed by Tycho Brahe in 1572 in his work "Stella Nova" meaning "new star."


TYCHONIS BRAHE, DANI
DE
NOVA ET NVLLIVS
ÆVI MEMORIA PRIVS VISA
CONTEMPLATIO MATHEMATICA
HAFNIÆ,

**Stella Nova. This book contains the "mathematical consideration" of Tycho Brahe about the new star, which was first observed in November 1572.**

Arturo went on to describe how Tycho kept the most accurate measurements for years. For twenty years Tycho recorded the positions of a thousand stars, and the planets, especially Mars and guarded them closely. It was only after Tycho's death in 1601 that his assistant, Johannes Kepler, was able to access Tycho's accurate positions. Kepler discovered that the planets revolved around the sun in ellipses, not in circles, as had been believed since antiquity. Tycho Brahe observed a new star in Cassiopeia, unfortunately he passed away in three years before the super nova that Johannes Kepler chronicled in 1604. This was the last supernova which has been positively observed in our Milky Way Galaxy. Supernovae are massive exploding giant stars.

Arturo then explained "Supernova Taxonomy" how present day astronomers have classified supernovae according to their light curves and the absorption lines of different chemical elements that appear in their spectra. There are Type Ia, Ib, Ic, and various Type II's. Arturo comically rectified the internet's Mr. Galaxy's explanation of the differences in Type Ia.

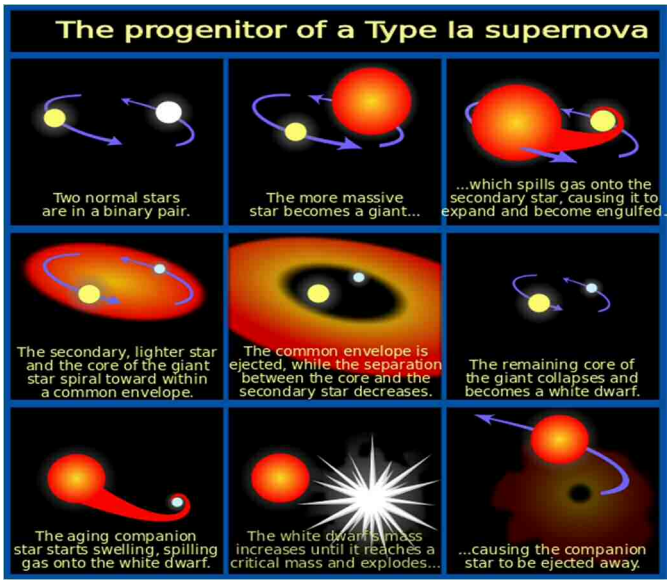
**Supernovae Classifications**

| SN Type | Characteristics | Guess at Progenitor |
|---|---|---|
| Ia | ◦ No hydrogen in spectrum<br>◦ Strong absorption at 6550 Å (Angstroms) near max light<br>◦ Late-time spectrum iron-group emission lines | ◦ White dwarf that accretes > Chandrasekhar mass<br>◦ Two white dwarfs that collide |
| Ib | ◦ No hydrogen in spectrum<br>◦ Absorption near 5700 Å, due to He (plus other He lines)<br>◦ Late-time spectrum emission from O-I, Ca-II | ◦ Massive star which has been stripped of H before core-collapse?<br>◦ Wolf-Rayet star? |
| Ic | ◦ No hydrogen in spectrum<br>◦ No helium in spectrum<br>◦ Late-time spectrum emission from O-I, Ca-II | ◦ Massive star which has been stripped of H before core-collapse?<br>◦ Wolf-Rayet star? |
| II-P (plateau) | ◦ Hydrogen in spectrum, with P-Cygni profile<br>◦ Light curve has plateau for 30-90 days soon after max light | ◦ Massive red supergiant |
| II-L (linear) | ◦ Hydrogen in spectrum weak or no P-Cygni profile<br>◦ Light curve falls linearly after max light | ◦ Less massive supergiant?<br>◦ Lost some of envelope? |
| IIb | ◦ Hydrogen in spectrum, but not much<br>◦ Helium in spectrum<br>◦ Late-time spectrum emission from O-I, Ca-II, plus H | ◦ Massive star which has lost MOST (but not all) of its H envelope (in binary?) |
| II-n | ◦ Hydrogen in spectrum, with narrow emission lines on top of broad emission features<br>◦ Slow decline in light curve at late times | ◦ Massive Star which sits in middle of massive stellar outflow? |

**Dr. Mike Richmond at the Astrophysics Department of Princeton University the various types of supernovae and their characteristics in his informative categorized SN Taxonomy chart**

Supernovae can be triggered in one of two ways: by the sudden re-ignition of nuclear fusion in a degenerate star; or by the collapse of the core of a massive star. Arturo first went on to elaborate on Type Ia supernovae which generally involve accretion in binary systems. Stars spend most of their lives with fusion in the core providing the energy they need to sustain their structure. As a star burns hydrogen (H) into helium (He), the internal chemical composition changes and this affects the structure and physical appearance of the star. The older the star, the greater the amount of helium in the core. The standard composition of a star's core is about 70% hydrogen and about 27% helium. Eventually as the helium accumulates in the core it will begin to turn into heavier elements such as carbon, oxygen, and eventually iron. Iron is the end point because the heavier elements require you to add energy. Our sun will eventually contract into a white dwarf no further fusion will take place at the core. White Dwarfs are very small (have a radius comparable to that of the Earth's), hot and dense. They are so hot that their peak emission is in the Ultraviolet range of the electromagnetic spectrum. Interestingly, more massive white dwarfs are also smaller and denser.

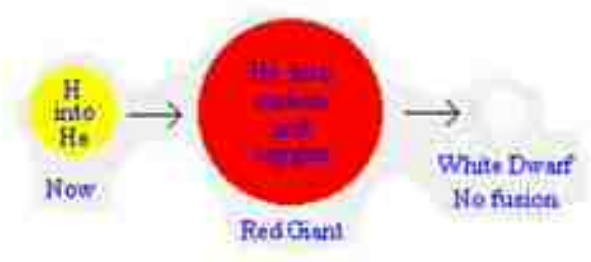
When the star becomes unstable and essentially the entire star is consumed in a gigantic thermonuclear explosion. This gives a mathematical limit, known as the *Chandrasekhar limit*, to how heavy a white dwarf can be which is about 1.4 solar masses. The




**Formation Of A Type Ia Supernova**
**NASA, ESA and A. Feild**

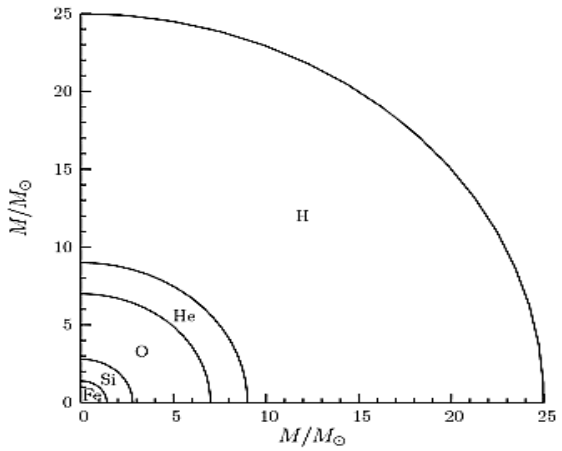
Chandrasekhar limit is named after Subrahmanyan Chandrasekhar an astrophysicist who, with William A. Fowler, was awarded the 1983 Nobel Prize for Physics for his mathematical theory of black holes, which was a key discovery that led to the currently accepted theory on the later evolutionary stages of massive stars.

In the 1930s, 19-year-old Chandra calculated what would happen if Einstein's special theory of relativity was applied to the processes that went on inside stars. At the time, scientists presumed that when a star burned up the last of its fuel, it would turn into a ball of ashes and turn cold - convert into a white dwarf. Chandra's mathematics showed that a white dwarf much heavier than the sun could not exist, but would undergo an eternal collapse into a tiny point of infinite density, until it slipped through a crevice in space and time, from which nothing could escape, not even light. It was the first irrefutable mathematical proof that black holes - as they were later named - had to exist. In 1972, the strong x-rays in the constellation Cygnus, called Cygnus X-1, trillions of miles away, was the first black hole to be identified. Many more have now been sighted. Despite Eddington's bitter attempts, 40 years after his initial discovery - Chandra was finally vindicated and Eddington proven wrong.Then we




turned our focus to stars with much larger masses. Arturo quipped that heavy stars have short lives not unlike observed in humans. Where the force of gravity tries to pull all of the star's matter toward the center. What keeps the matter from falling in is the outward pressure of the heated gas within. The two forces counteract each other, thus stabilizing the star. Most of the heat generated by a star comes about through nuclear reactions. The reactions are triggered when the high pressure and temperature within the star cause hydrogen atoms to fuse together to form helium atoms. When the star's core begins to run out of hydrogen, the denser helium at the center contracts, which generates more heat. This causes the helium atoms to fuse with one another to form carbon and oxygen atoms. These newly formed, heavier atoms displace some of the helium atoms from the center. Then the carbon and oxygen atoms to fuse into neon and magnesium, successively fuse into silicon and sulfur, which then ultimately fuse to form iron. With no further source of energy to counteract gravity, once the star reaches the Chandrasekhar limit, the huge iron core collapses. Immediately afterwards, the core collapses, releasing a huge amount of gravitational energy. While the core is collapsing, the energy release moves outward, creating a shock wave which initiates a cataclysmic explosion. The outer layers are blown away from the star. At the center of the explosion an exceedingly dense, rapidly spinning core is left behind. The compression has combined the core's negatively charged electrons with positively charged protons, forming neutrons. These neutrons, along with the previously existing neutrons, are all that remain. The massive star has evolved into a neutron star. A more massive star would have produced a black hole.

All Type II, Ib, & Ic will follow the path of a core collapse super nova. Arturo then went on to talk about an example of a type 2 super nova SN 1987A in the Large Magellanic Cloud. It was scientifically remarkable for a variety of reasons. It was the last supernova to be visible to the unaided eye in the night. Its proximity has allowed us to follow the story of the death of a giant star and, in the form of the outer rings and the identification of the progenitor star, and some of the events leading up to its destruction.




**The Onion Like Interior Structure Of A Population I Star Fundamentals of Neutrino Physics and Astrophysics By Carlo Giunti, Chung W. Kim**

Interestingly approximately 2.5 hours before visual observation, multiple neutrino detector experiments went off when the super nova occurred and it may possibly be a first indicator that another nearby supernova has gone off, before it has even been spotted in the skies. Core collapse super novas are seen only in star forming areas of the galaxy. Type Ia super nova do not emit significant amounts of neutrinos.

The amount of material ejected in novae is usually only about 1⁄10,000 of a solar mass, quite small relative to the mass of the white dwarf. Furthermore,

only five percent of the accreted mass is fused during the power outburst. That is enough energy to accelerate nova ejecta to velocities as high as several thousand kilometers per second—higher for fast novae than slow ones—with a concurrent rise in luminosity from a few times solar to 50,000–100,000 times solar. In 2010 scientists using NASA's Fermi Gamma-ray Space Telescope were surprised to discover, for the first time, that a nova can also emit gamma-rays. About 25 novae brighter than about magnitude 20 are discovered in the Andromeda Galaxy each year. Robert Owen Evans, a minister of the Uniting Church in Australia and an amateur astronomer who holds the all-time record for visual discoveries of supernovae has discovered forty supernovae. We then had a break. Dave Britz enthusiastically conducted the 50/50 drawing.

Following a 25-minute break, Ken Legal then presented Sky Happenings for December. Some of the objects Ken presented were: Comet Lovejoy, NGC 253 Sculptor, M31, Triangulum (sometimes informally referred to as the Pinwheel Galaxy, a nickname it shares with Messier 101), Jupiter on Dec 9th -10th, NASA's Juno Earth Flyby, and the Geminoid Meteor Showers.

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Kevin then began the club's business meeting giving a special thanks to member Ed Collett for his three-part article contribution to *The Spectrogram*. He then discussed our upcoming engagements with the **Monmouth County Winter Parks Program: Wonders of the Night Sky**. Please visit the club's web forum for additional information on the evenings proposed agenda. The hope is that by networking with the Parks Department and doing this program that we're doing Outreach and hopefully this will help to increase our membership. The sessions will figure in the Park Program Brochures, so the club will get some publicity from that alone. **The following members volunteered to be there: Kevin Gallagher, Ken Legal, Russ Drum, George Zanetakos, Dave Britz, Steve Siegel, Mike Kozik, and Al Wright**. Please also note that our regularly scheduled observing nights will be replaced with those two events for the months of January and February.

Kevin also mentioned we may get together to observe another rocket launch tentatively scheduled for 12/15th. December 13th. Additionally, our Club Social is coming up on January 2nd, please see the forum for what dish to bring. Rob Nunn suggested to better organize the menu similar to Jay's picnic methodology. Mike Kozik suggested that we have new moon observing nights for the club members. George mentioned some exciting objects that will be visible such as Orion's Nebula and some open clusters. Mike also suggested maximizing the APP's media coverage- he mentioned that he would reach out to his contacts at News12.

Kevin addressed the details of a new proposal for the Club's 25" Scope from Gordon Waite. Ken recommended a written contract, Steven Siegel motioned to accept the offer, George Z seconded the motion, the club voted, 23 were present to vote, and the motion was unanimously accepted.

Russ announced an upcoming STAR party on 3/6/2014 at Mill Lake in Monroe. The club is looking to organize future outreach events for the following: Messier Marathon, Astronomy Day (spring 2014: May 10th), and Astronomy Week.
Just in time for the holidays we are now offering STAR Membership Gift Certificates.

The meeting officially concluded at about 10:30 p.m. The meeting was then adjourned.

Kevin credited our involvement in the Night Sky Network for connecting us with *The Asbury Park Press* who showcased a two-page article on distant galaxies. The writers, Amanda Oglesby, Hart Sastrowardoyo, and Traci Watson, interviewed our very own President Kevin Gallagher. S*T*A*R was featured along side several of Kevin's direct quotes. In case you missed the terrific article in the paper here is a link to it online: **http://www.app.com/apps/pbcs.dll/article?AID=2013312020011**

# The Big Picture: GOES-R and the Advanced Baseline Imager *By Kieran Mulvaney*

The ability to watch the development of storm systems – ideally in real time, or as close as possible – has been an invaluable benefit of the Geostationary Operational Environmental Satellites (GOES) system, now entering its fortieth year in service. But it has sometimes come with a trade-off: when the equipment on the satellite is focused on such storms, it isn't always able to monitor weather elsewhere.

"Right now, we have this kind of conflict," explains Tim Schmit of NOAA's National Environmental Satellite, Data, and Information Service (NESDIS). "Should we look at the broad scale, or look at the storm scale?" That should change with the upcoming launch of the first of the latest generation of GOES satellites, dubbed the GOES-R series, which will carry aloft a piece of equipment called the Advanced Baseline Imager (ABI).

According to Schmit, who has been working on its development since 1999, the ABI will provide images more frequently, at greater resolution and across more spectral bands (16, compared to five on existing GOES satellites). Perhaps most excitingly, it will also allow simultaneous scanning of both the broader view and not one but two concurrent storm systems or other small-scale patterns, such as wildfires, over areas of 1000km x 1000km.

Although the *spatial* resolution will not be any greater in the smaller areas than in the wider field of view, the significantly greater *temporal* resolution on the smaller scale (providing one image a minute) will allow meteorologists to see weather events unfold almost as if they were watching a movie.

So, for example, the ABI could be pointed at an area of Oklahoma where conditions seem primed for the formation of tornadoes. "And now you start getting one-minute data, so you can see small-scale clouds form, the convergence and growth," says Schmit.

In August, Schmit and colleagues enjoyed a brief taste of how that might look when they turned on the GOES-14 satellite, which serves as an orbiting backup for the existing generation of satellites.

"We were allowed to do some experimental imaging with this one-minute imagery," Schmit explains. "So we were able to simulate the temporal component of what we will get with ABI when it's launched."

The result was some imagery of cloud formation that, while not of the same resolution as the upcoming ABI images, unfolded on the same time scale. You can compare the difference between it and the existing GOES-13 imagery here: http://cimss.ssec.wisc.edu/goes/blog/wp-content/uploads/2013/08/GOES1314_VIS_21AUG2013loop.gif

*Learn more about the GOES-R series of satellites here: http://www.goes-r.gov.*

*Kids should be sure to check out a new online game that's all about ABI! It's as exciting as it is educational. Check it out at http://scijinks.gov/abi*

*The Advanced Baseline Imager. Credit: NOAA/NASA.*
*Download photo at: http://www.goes-r.gov/spacesegment/images/ABI-complete.jpg.*


The Night Sky Network is a nationwide coalition of amateur astronomy clubs bringing the science, technology, and inspiration of NASA's missions to the general public. It is one of the NASA education goals as well to improve the American public understanding of astronomy. As members, we share our time and telescopes to provide you with unique astronomy experiences at science museums, observatories, classrooms, and under the real night sky.

## Check us out on the Night Sky Network:

http://nightsky.jpl.nasa.gov/club-view.cfm?Club_ID=1093

*Discover the Universe Guides now available!*
https://nightsky.jpl.nasa.gov/news-display.cfm?News_ID=611

## Massive stars mark out Milky Way's 'missing' arms *Phys.org December 17th, 2013*

A 12-year study of massive stars has reaffirmed that our Galaxy has four spiral arms, following years of debate sparked by images taken by NASA's Spitzer Space Telescope that only showed two arms.

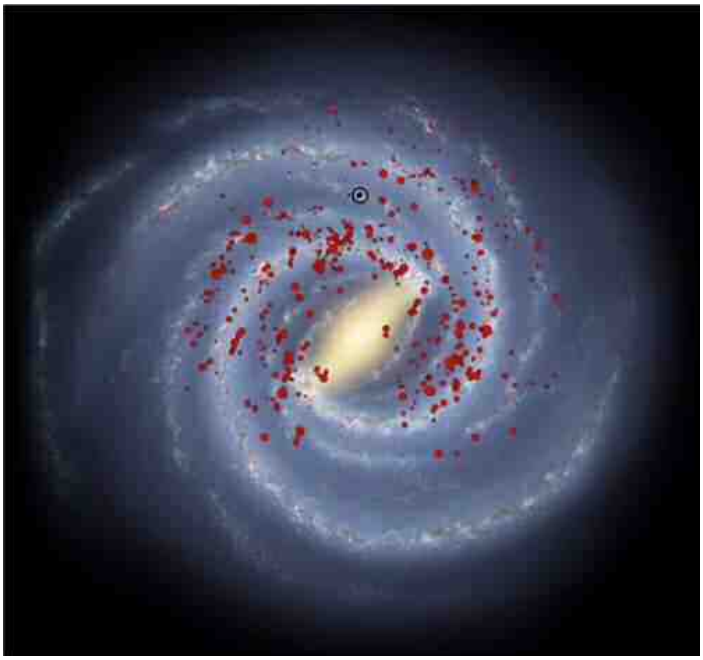
The new research, which is published online today [17 December] in the Monthly Notices of the Royal Astronomical Society, is part of the RMS Survey, which was launched by academics at the University of Leeds.

Astronomers cannot see what our Galaxy, which is called the Milky Way, looks like because we are on the inside looking out. But they can deduce its shape by careful observation of its stars and their distances from us.

"The Milky Way is our galactic home and studying its structure gives us a unique opportunity to understand how a very typical spiral galaxy works in terms of where stars are born and why," said Professor Melvin Hoare, a member of the RMS Survey Team in the School of Physics & Astronomy at the University of Leeds and a co-author of the research paper.

In the 1950s astronomers used radio telescopes to map our Galaxy. Their observations focused on clouds of gas in the Milky Way in which new stars are born, revealing four major arms. NASA's Spitzer Space Telescope, on the other hand, scoured the Galaxy for infrared light emitted by stars. It was announced in 2008 that Spitzer had found about 110 million stars, but only evidence of two spiral arms.

The astronomers behind the new study used several



**This shows the distribution of massive stars in the new study. Our location within the Galaxy is circled in black. Credit: J. Urquhart et al. Background image by**

radio telescopes in Australia, USA and China to individually observe about 1650 massive stars that had been identified by the RMS Survey. From their observations, the distances and luminosities of the massive stars were calculated, revealing a distribution across four spiral arms.

"It isn't a case of our results being right and those from Spitzer's data being wrong – both surveys were looking for different things," said Professor Hoare. "Spitzer only sees much cooler, lower mass stars – stars like our Sun – which are much more numerous than the massive stars that we were targeting."

Massive stars are much less common than their lower mass counterparts because they only live for a short time – about 10 million years. The shorter lifetimes of massive stars means that they are only found in the arms

in which they formed, which could explain the discrepancy in the number of galactic arms that different research teams have claimed.

"Lower mass stars live much longer than massive stars and rotate around our Galaxy many times, spreading out in the disc. The gravitational pull in the two stellar arms that Spitzer revealed is enough to pile up the majority of stars in those arms, but not in the other two," explains Professor Hoare. "However, the gas is compressed enough in all four arms to lead to massive star formation."

Dr. James Urquhart from the Max Planck Institute for Radio Astronomy in Bonn, Germany, and lead author of the paper, said: "It's exciting that we are able to use the distribution of young massive stars to probe the structure of the Milky Way and match the most intense region of star formation with a model with four spiral arms."

Professor Hoare concludes, "Star formation researchers, like me, grew up with the idea that our Galaxy has four spiral arms. It's great that we have been able to reaffirm that picture."

More information:
mnras.oxfordjournals.org/content/early/2013/11/13/mnras.stt2006

*Provided by University of Leeds*

## Birth of black hole kills the radio star *Phys.org December 20th, 2013 in Astronomy & Space*

**If matter and antimatter repel each other, the quick conversion of one into the other inside a supermassive black hole may look like a Big Bang.**

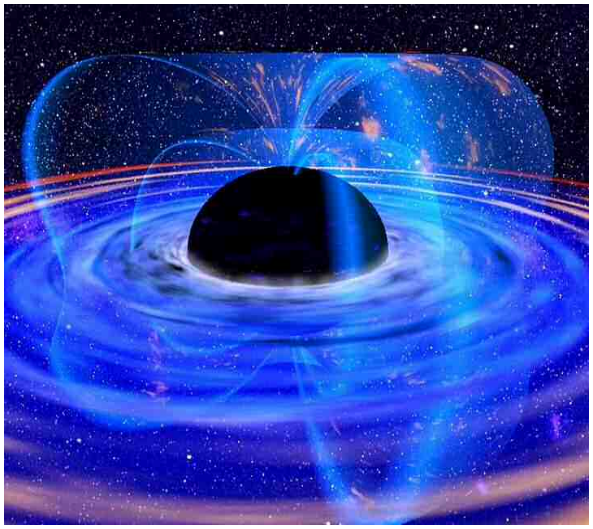
Astronomers led by a Curtin University researcher have discovered a new population of exploding stars that "switch off" their radio transmissions before collapsing into a Black Hole.

These exploding stars use all of their energy to emit one last strong beam of highly energetic radiation – known as a gamma-ray burst – before they die.

Up until now, it was thought all gamma-ray bursts were followed by a radio afterglow – a premise that a team of Australian astronomers of the Centre for All-sky Astrophysics (CAASTRO) at Curtin University and the University of Sydney originally set out to prove correct.

"But we were wrong. After studying an ultra-sensitive image of gamma-ray bursts with no afterglow, we can now say the theory was incorrect and our telescopes have not failed us," lead researcher and Curtin research fellow Dr. Paul Hancock said.

The technique used to create the ultra-sensitive image



**If matter and antimatter repel each other, the quick conversion of one into the other inside a supermassive black hole may look like a Big Bang. Image credit: NASA**

was recently published in The Astrophysical Journal.

It allowed for the stacking of 200 separate observations on top of each other to re-create the image of a gamma-ray burst in much better quality – yet, no trace of a radio afterglow was found.

"In our research paper we argue that there must be two distinct types of gamma-ray burst, likely linked to differences in the magnetic field of the exploding star," Dr Hancock said.

"Gamma-ray bursts are thought to mark the birth of a Black Hole or Neutron Star – both of which have super-dense cores. But Neutron Stars have such strong magnetic fields (a million times stronger than those of Black Holes) that producing gamma-rays are more difficult.

"We think that those stars that collapse to form a Neutron Star have energy left over to produce the radio afterglow whereas those that become Black Holes put all their energy into one final powerful gamma-ray flash."

New work is underway to test the team's theory and to see if there are other subtle ways in which the two types of bursts differ.

"We now have to take a whole new look at gamma-ray bursts – so far this work has shown that being wrong is sometimes more interesting than being right," Dr Hancock said.

Telescope facilities such as the Australia Telescope Compact Array in northern New South Wales and the Karl Jansky Very Large Array in the US both have observing programs to search for gamma-ray burst afterglows and have been recently upgraded to increase their sensitivity.
More information: The research report can be found at arxiv.org/abs/1308.4766

Provided by Curtin University

# The Good News About Winter

***13 Dec 2013 By Bill Pellerin, Houston Astronomical Society, The Astronomical League***

The good news about winter is that the skies are dark longer than they are bright (for those of us north of the equator); the bad news about winter is that it cold, often frightfully so, at night. More good news: when a cold front blows through, sometimes accompanied by bad weather, it's not uncommon to have very clear skies behind the front. Astronomers say that the 'transparency' of the sky is good. What's often not good is the steadiness of the air in the atmosphere, which astronomers call the 'seeing'. Poor seeing makes stars look like blobs and planets look like bigger blobs.
For me, living in the southern United States, the cold is a challenge. I can be driven inside by the cold temperatures faster than anything. In fact, it doesn't need to be that cold to be a problem. Astronomical observing does not require a high level physical activity. I'm either sitting at a map table (often with a computer-based map) or sitting at the eyepiece, or transitioning between the two. Much more of the time is sitting than transitioning.
What are some things you can do to make the cold weather tolerable?
If it's seriously cold outside, you shouldn't have the expectation that you're going to be able to stay out for all night or even several hours. There are the hearty souls who can do this, but for most of us observing in very cold weather is an exercise in futility. The coldest night on which I had scheduled an observing session was in New Mexico, some years ago, over a Thanksgiving weekend. It was 8 degrees F outside. I don't remember how many observations I made or what I observed, but I do recall spending a lot of time in the warming room at the site drinking coffee and trying to steel myself against the cold so I could go outside again. It didn't work.
The common advice is to dress in layers, and I suppose that's good advice. Wear everything you have because, as they say, it's the space between the layers that captures the warmth.
I have a ski suit that I bought at one of the sporting goods supply stores in January of 2009. The jacket consists of two pieces, an inner jacket and an outer jacket. These can be separated if using the two jackets simultaneously makes you too warm. I also have a pair of ski pants that I can pull on over my blue jeans and keep the lower half of my torso warm. In addition, I have a 'mad bomber' hat available from many sources. Just search for 'mad bomber hat' on the Internet and you'll find plenty of them.
Covering the ears is a problem for me because I need glasses to read star charts, but avoid glasses when looking through the telescope. The glasses are more difficult to take off and to put on with ear flaps. By the way, it's easy to tune-out the focusing problems of my eyes by adjusting the telescope, but if you have astigmatism you'll need a corrector on your eyepiece to deal with that. TeleVue is the only company that sells these, as far as I know and whether you need one or not depends on the size of the exit cone of your eyepiece. If stars have horizontal lines going through them on one side of focus and vertical lines going through them on the other side of focus, you likely have astigmatism. Check with your eye doctor or read your prescription.
I use mittens that have the tips of the fingers open so I can feel small parts (eyepiece screws, etc.) when I'm outside. The mittens have a fold-over pocket for the exposed fingers when the fine-touch capability isn't needed. The final piece of clothing I (sometimes) use is called 'moon boots' — very warm and furry inside and generally water resistant outside. Not good for doing a lot of walking, however. Some nice wool socks help.
I also use the chemical hand warmers, available from a sporting goods supply store. These are activated by contact with the air and they stay warm for several hours. I put them in the pocket of my jacket and put my hands in those pockets as needed to absorb the warmth. It feels good to wrap my hands around those warmers; they provide a good bit of relief from the cold. There are also chemical warmers for boots, but I haven't used them.
Walk around. It's always a good idea to get out of your chair and go for a brisk walk. Doing so will loosen you up and warm you up a bit. Worth the effort. You can take a break as well. At the Texas Star Party there's a snack booth that serves hot food and drinks all night. This isn't an endurance contest. Go inside a warm space to thaw out and have a warm beverage.

Another approach — (imagers only) — once you set up your telescope and camera and auto guider, etc., you can walk away from your setup and connect to your near-telescope computer from another computer (in a warm place). Software that does this is typically called 'remote control' software. These warm places could be your travel trailer, your car, your warm-room or even your house if your house and observatory are co-located. Some versions of Windows has the ability to be remote controlled built-in and there's a lot of software you can find that provides this functionality. You can always go to the telescope site if there is an adjustment that needs to be made or there is a problem that requires your intervention.

I heard of a guy who used a remote USB port device and moved his computer to his warm trailer. Using this remote USB capability he could control the telescope pointing, the imager, the guider, and the focuser.

Yes… doing one of these 'remote control' capabilities gets you out of the dark sky, but it also gets you into a warm place.

One thing that's getting more common these days is scripting your observing session and monitoring (or not) the operation of the script from your house or over the Internet from anywhere. Several commercial telescopes are online that allow you to script your targets, your exposure times, your filters, etc. and pick up your images in the morning. Hey, this approach lacks the 'romance' of being out at the telescope under the dark sky, but it also lacks the discomfort of being too cold.

I'm seeing more online telescopes, too. Many of these are much more capable than the setup I own. So, for a fee, I can use a high-end telescope on a high-end mount to capture some images of the sky. I use these to get data (images) on variable stars. While I can get down to about 15th magnitude with my setup, I can do much better with some of these remote telescopes. Again, you're not spending time under a dark sky, but you're getting the data or the images you want without owning the setup and without suffering through a cold night.

Keep warm, but keep observing.

*"Sure it's beautiful, but I can't help thinking about all that interstellar dust out there."*

**CREDIT: sciencecartoonsplus.com**

## Christmas Eve Spacewalk A Success For NASA *27 December 2013 by Jacob Aron*

Take a breather, spacewalkers. Working tirelessly over the holiday, astronauts equipped with snorkels successfully repaired damage to the vital cooling system on board the International Space Station.

The system circulates ammonia to keep internal and external instruments at the correct temperature. NASA had to power down parts of three ISS modules when the system malfunctioned on 11 December.

On 24 December, astronauts Rick Mastracchio and Mike Hopkins completed the second of three planned spacewalks to replace a failed pump module on the station's exterior. Although they were hit by a "mini blizzard" of toxic ammonia flakes that burst from a supply line, they finished the job ahead of schedule, eliminating the need for a third outing.

Snorkels on standby

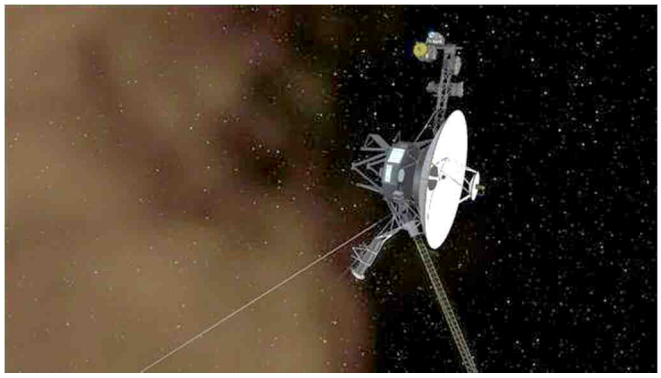
Hopkins was wearing the same spacesuit used last July by Italian astronaut Luca Parmitano, who nearly drowned when his helmet started filling with water. NASA investigators concluded that the most likely cause of the leak was contamination in the suit's cooling system, which blocked a filter.
Although the filter was cleared NASA didn't want to take any chances so instructed the astronauts to fashion snorkels from plastic tubes and Velcro. That would allow them to breathe air from lower in the suit in the event of a leak. As it was, their helmets remained bone dry.
While things went smoothly, the repairs meant delaying the first resupply mission for private company Orbital Sciences Corporation of Dulles, Virginia. Its Cygnus cargo craft is now scheduled to begin official deliveries to the ISS in January.
On return to the ISS, Hopkins thanked ground crew: "Merry Christmas to everybody. It took a couple of licks to get her done, but we got it."

## 6 Biggest Space Science Discoveries of 2013

**by N Taylor Redd, SPACE.com**
**December 28, 2013**

The year 2013 saw a wealth of discoveries, insights, and milestones that advanced the fields of astronomy and other space sciences. From extrasolar planets to extraterrestrial neutrinos, these finds have made sure that 2013 has been an unforgettable year.
Here's a look back at some of the most stunning space science revelations of the year:

### NASA's Voyager 1 Reaches Interstellar Space



**An artist concept of NASA's Voyager 1 spacecraft leaving the solar system to enter interstellar space.**

After almost 35 years of traveling, scientists reported this year that NASA's Voyager 1 spacecraft reached interstellar space in August 2012. Because the solar system doesn't contain helpful "You Are Here" signs to mark its boundary, scientists relied on a powerful solar eruption to determine the density of the molecules in space around the craft.
With the transition into interstellar space, Voyager 1 became the first craft to leave the solar system behind, making it a significant milestone in the annals of space exploration. It is currently about 11.66 billion miles (18.76 billion km) from the sun.

### Extraterrestrial neutrinos found in Antarctica

Physicists in Antarctica found the first evidence of cosmic rays from outside the solar system. The energetic rays themselves are difficult to detect, so scientists rely on the discovery of neutrinos produced as the cosmic rays interact with their surroundings. Of the billions of neutrinos that pass through a square centimeter of Earth each second, only a few actually interact with matter.
But using the IceCube Neutrino Observatory, an instrument buried in a cubic kilometer of ice beneath the South Pole, physicists were able to detect two neutrino events that originated beyond the solar system, the first definitive detections since 1987 (and events a million times more powerful than their predecessor). Although the event was too small to pinpoint the origin of the cosmic rays — suspects include supernovas, gamma ray bursts, and black holes — the detection opened the door to a greater understanding of some of the powerful events in the universe.

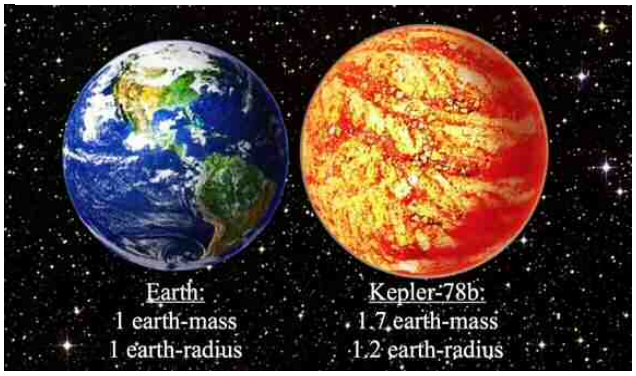
### Ancient Mars could have supported life

Only seven months after its spectacular landing on Mars, NASA's Curiosity rover discovered signs that ancient Mars could have supported life in the form of primitive microbes. The determination was made after instruments on the rover identified some of the key ingredients necessary for life in the rocks of Mars. Curiosity isn't searching for current life on Mars, only for signs of the Red Planet's potentially habitable environments in the past.

In December, the Curiosity team announced evidence of a freshwater Martian lake near the planet's equator that could have supported life for extended periods of time. The lake likely existed about 3.7 billion years ago, far more recently than scientists previously thought habitable environments existed on the Mars.

More recently, scientists have used NASA's Mars Reconnaissance Orbiter to determine that dark seasonal streaks near the equator could indicate the presence today of flowing salt water on Mars during the planet's warmer months. Previous signs of existing flowing

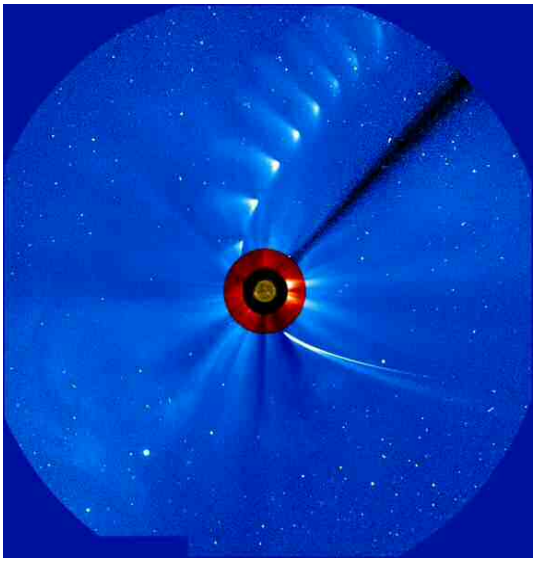
**Mastcam mosaic of the Yellowknife Bay formation. This is a view from the base of an exposed section up through Sheepbed, Gillespie Lake, and basal Glenelg members. Locations of drill holes and Alpha Particle X-Ray Spectrometer (A PXS) measurements are shown. Image released Dec. 9, 2013. Credit: Science/AAAS**




**Earth to Kepler 78-b, the most twin-like of the extrasolar**

water on the planet were limited to the poles, while the equatorial regions were considered completely dry. Altogether, Mars is shaping up to be a far more habitable place after the discoveries of 2013.

**Earth's almost-twin** At the end of October, scientists announced the discovery of Earth's closest exoplanet twin, in terms of size and composition. The planet, called Kepler-78b, is just 20 percent wider and 80 percent more massive than Earth, and boasts a similar density. But don't look for a twin environment on the rocky planet; it orbits its sun once every 8.5 hours, at a distance of about 900,000 miles (1.5 million km), with surface temperatures reaching more than 3,680 degrees Fahrenheit (2,000 degrees Celsius).
This discovery came shortly after the confirmed extrasolar planet count reached 1,000, a significant



**Comet ISON comes in from the bottom right and moves out toward the upper right, getting fainter and fainter, in this time-lapse image from the ESA/NASA Solar and Heliospheric Observatory on Nov. 28, 2013. The image of the sun at the center is from NASA's Solar Dynamics Observatory.**

milestone since the first planet outside of the solar system was found 20 years ago. But the number of these planets is sure to increase. Of the almost 3,600 planetary candidates announced by NASA'sKepler spacecraft, just over 150 have been confirmed.

But astronomers aren't simply content with increasing the number of extrasolar planets; they want to know more about the alien bodies. In early

**The death of the comet of the century**
Hailed as the "comet of the century" throughout 2013, Comet ISON passed by the sun on Nov. 28 before breaking apart. Discovered in September 2012, the orbit of the comet bore striking similarities to the Great Comet of 1680, which was visible in the daylight. From a distance, the comet's brightness suggested it had a large nucleus, which could provide an amazing show in 2013.
Skywatchers around the world tracked the comet as it came into view.

Comet ISON buzzed the sun on Thanksgiving Day (Nov. 28). But as the comet passed only 684,000 miles (1.1 million km) from the sun, the gravitational pull and intense heat of the star stripped the comet of its dust and gas, ultimately disintegrating it to the point where only telescopes such as Hubble were able to continue observing it.

Scientists determined that the comet's nucleus was smaller than was previously estimated, which contributed to its rapid destruction. But while the comet of the century may not have put on a great show, its long approach allowed professional and amateur astronomers alike time to prepare and capture a wealth of information, which will improve understanding of the composition and behavior of comets in the solar system.

**The Chelyabinsk meteor explosion**

On Feb. 15, 2013, a meteor exploded over Russia's Chelyabinsk region, detonating about 930 miles (1,500 kilometers) east of Moscow. Known as a bolide, the exploding fireball injured hundreds of people and damaged hundreds of buildings. The 56-foot (17-meter) rock generated the explosive power of more than 470 kilotons of TNT.

While most of the injuries from the unexpected explosion came from falling glass, the event focused

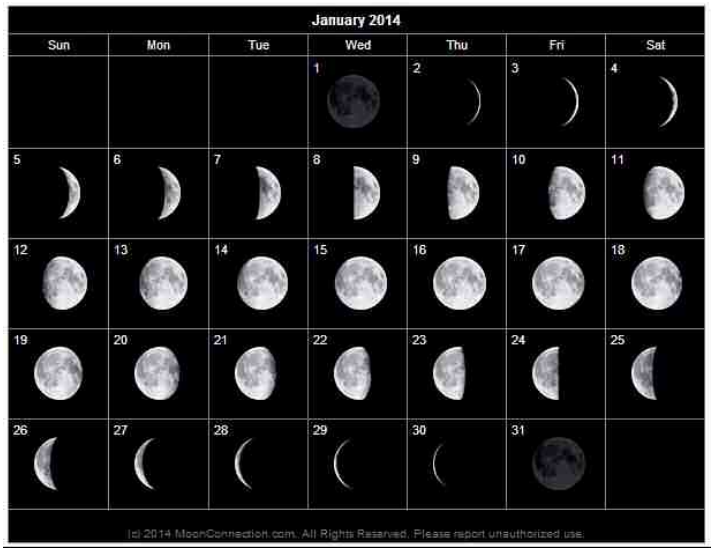
the attention of the world on potential threats from rocky bodies in space. Because smaller asteroids such as the one that caused the Russian explosion are both numerous and challenging to detect, most research to date has focused on larger bodies that would do far more damage if they collided with Earth..


**CREDIT: sciencecartoonsplus.com**

## *In the Eyepiece*

Here is a list of objects for this month. This is reproduced from www.skyhound.com with the kind permission of its creator and author of SkyTools Greg Crinklaw.

| Object(s) | Class | Con | RA | Dec | Mag |
|---|---|---|---|---|---|
| M35 & NGC 2158 | Open Cluster | Gemini | 06h08m51.9s | +24°20'28" | 5.6 |
| M38 | Open Cluster | Auriga | 05h28m39.4s | +35°50'24" | 6.8 |
| Sigma Ori | Multiple Star | Orion | 05h38m44.8s | -02°36'00" | 3.8 |
| M37 | Open Cluster | Auriga | 05h52m22.3s | +32°32'40" | 6.2 |
| The Trapezium | Multiple Star | Orion | 05h35m16.5s | -05°23'23" | 5.1 |
| NGC 2017/HR 1944 | Multiple Star | Lepus | 05h39m16.2s | -17°50'58" | 6.4 |
| Beta Mon | Multiple Star | Monoceros | 06h28m49.1s | -07°01'59" | 3.8 |
| NGC 2112 | Open Cluster | Orion | 05h53m52.2s | +00°23'32" | 9.1 |
| IC 418 | Planetary Nebula | Lepus | 05h27m28.2s | -12°41'50" | 10.7 |
| NGC 1931 | Open Cluster | Auriga | 05h31m24.8s | +34°15'12" | 10.1 |
| IC 2149 | Planetary Nebula | Auriga | 05h56m23.9s | +46°06'17" | 11.2 |
| NGC 1893 & IC 410 | Open Cluster in Nebula | Auriga | 05h22m41.1s | +33°23'49" | 7.8 |
| M50 | Open Cluster | Monoceros | 07h03m12.3s | -08°19'28" | 7.2 |
| The Crab Nebula | Diffuse Nebula | Taurus | 05h34m30.0s | +22°01'00" | 8.4 |
| NGC 2022 | Planetary Nebula | Orion | 05h42m06.2s | +09°05'10" | 12.4 |
| Hubble's Variable Nebula | Reflection Nebula | Monoceros | 06h39m12.0s | +08°44'00" | -- |
| H 3-75 | Planetary Nebula | Orion | 05h40m44.8s | +12°21'16" | 13.9 |
| IC 421 | Galaxy | Orion | 05h32m14.8s | -07°55'01" | 12.3 |
| NGC 1999 | Diffuse/Dark Nebula | Orion | 05h36m24.0s | -06°43'00" | -- |
| The Horsehead | Diffuse/Dark Nebula | Orion | 05h41m00.0s | -02°27'00" | -- |
| Abell 12 | Planetary Nebula | Orion | 06h02m21.4s | +09°39'07" | 13.9 |
| IC 443 | Diffuse Nebula | Gemini | 06h17m48.0s | +22°49'00" | 12 |
| The Cone Nebula | Open Cluster | Monoceros | 06h41m03.2s | +09°53'07" | 4.1 |
| NGC 2242 | Planetary Nebula | Auriga | 06h34m07.4s | +44°46'37" | 15.2 |
| K 2-2 | Planetary Nebula | Monoceros | 06h52m28.4s | +09°58'17" | 12.5 |



**Are you a S*T*A*R Member?**

S*T*A*R meets the first Thursday of each month, except July and August, at 8:00 p.m. at Monmouth Museum on the campus of Brookdale Community College in Lincroft, NJ. Meetings usually include a presentation of about one hour by a guest speaker, a break for refreshments and socializing, a description of interesting objects to view, and a discussion of club business.

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____

E-mail: _____

Preferred method of contact: □ Phone □ E-mail □ Text, Cell Carrier & # _____

Membership Type: □ Individual ….. $35 □ Family ….. $45 □ Student ….. $15

Please note: membership fees are collected on an annual basis, at the start of every fiscal year, which runs September through August.

Please send me information about subscribing at the discounted club rate to:
□ Sky & Telescope Magazine □ Astronomy Magazine

Do you have a telescope? □ Yes □ No □ Looking to purchase one

Interests:

| | | |
|---|---|---|
| □ Astronomy 101 | □ Astrophotography | □ Cosmology/ Astrophysics |
| □ Astronomy for Kids | □ Cosmic Events | □ Amateur Telescope Making |
| □ Observing | □ Star Parties | □ Equipment Recommendations |

Other:

How did you hear about S*T*A*R? □ Friend □ Newspaper □ Radio □ Poster □ Web □ Other:

Please mail your completed application, along with a check or money order
(made payable to STAR Astronomy, Society, Inc) for the above total amount to:
STAR Astronomy Society, Inc PO Box 863 Red Bank, NJ 07701

The club owns 8" f/8, 13" f/4.5 and 25" f/5 Dobsonian telescopes which are available for use by members. Because of its large size use of the 25" requires the supervision of two qualified operators. To borrow a telescope or become a qualified operator of the 25", please contact the Vice President.
For more information please visit: www.starastronomy.org

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