PRESIDENT’S CORNER
By David Mathias, 2015-16 President

I am excited. Three little words that mean so much. Over the past 6 months, we’ve talked a lot, we’ve taken some chances, and the Society already has a few presents under the tree. Ebenezer Scrooge was shown the past, present and the future in a single night. Let’s ring in the season and toast to the New Year to come!

Cindy Bower, President and CEO of Canyon of the Eagles joined our Executive Committee meeting on December 7th. During an hour together, we clarified some Society concerns, we gained better understanding of our respective motivations, and we shared some ideas and dreams for the future of EEO. First, we are now in agreement that members may have access to the observing field at EEO at any time. Canyon of the Eagles retains the ability to hold activities for guests in the observatory on nights not reserved for Members-Only and Public Star Party nights, but our members are welcome to set up scopes on the field at any time.

Second, if members get drowsy while observing late into the night, they are welcome to rest in their vehicles, or even in the observatory structure. If you pitch a tent, light a fire, or engage in activities that look like camping to an outside observer, you are camping. Camping is still prohibited, and we still recommend that you depart the field before sunrise; but we want members to be able to enjoy the EEO experience and then arrive home safely.

Third, if you will be on the field when events are not taking place, please sign in at the COTE lodge. It is for your personal safety, and it is to address liability concerns of both COTE and AAS that someone know you are out there. Otherwise, sign in at the lodge is not required of members.

Cindy is well aware that the attraction of EEO helped sustain COTE as a business during the years of drought. The observatory and astronomical activities are consistent with COTE’s marketing focus on sustainable and responsible enjoyment of the natural beauty of the park; and she would like to see AAS and COTE attract outside funds to enhance and improve the observatory and scopes available to members and the public.

Under a crisp, dark and frankly, beautiful, sky on December 5th, representatives of AAS’ Executive Committee and membership “tried on” the plot of land that includes what was The Park Store on the edge of Lake Buchanan. This site and the buildings have been offered to AAS as a potential location for a new observatory and public education center. It is still very early in the evaluation process, but initial feedback from participants was generally positive. On the 7th, Cindy and the Executive Committee even discussed the possibility of retaining EEO in service while making new investments down by the lake.
Unlike EEO, which is in the middle of protected Preserve land, the lakefront site is within the Park area; and development and camping can take place there much more easily. Stay tuned for more to come.

Also in our bag of goodies for members is news that we are a bigger club than we realized. Treasurer Tara Krzywonski worked very hard to review and update our membership database. We are now better able to report both on memberships and members. We will be going into the New Year with close to 550 members!

I have donated two computers to the Society – more goodies! We will be using a notebook computer for presentations at Executive Committee and General Assembly meetings. A desktop computer and LCD monitor will become permanent features of the EEO observatory. Thanks go out to member Nathan Morgan and his business, PartsPeople, for donations of parts and labor to get the laptop working and supplied with cables and pointing devices.

Deeper in the bag are gifts you haven't seen just yet. Work continues on our new AAS website, thanks to very hard work by Joi Chevalier and Maurice Nelson. The Executive Committee has seen a couple of presentations of the work in progress, and the design and features are just first-rate. Also on the infrastructure front, Jim Chandler has helped us secure nonprofit organization software licenses from Microsoft through TechSoup. We are expecting to also upgrade from Quicken to QuickBooks, and obtain the business informatics title of Tableau. Thank you, Jim.

New Member at Large Carl Lindemann and Outreach Chair Dawn Davies will be putting AAS' name and mission into the public ears soon. They had a great time working with folks at KUT recording material for the SonicID radio feature. We may wind up with some public service spotlight coverage as well.

Early in the New Year, we will be reviewing the results of our member survey with Jim Spigelmire. The review will then inform the next “envisioning” session we hold as a club, probably in February.

And first thing in the New Year, we will be setting up the Nominations Committee to start building the slate of candidates to stand for election to the board next Spring. We will have lots of available slots; so, if service to the club and leadership are something you've considered, we want to hear from you.

Finally, I'd like to appeal to your generosity and sense of the season to make a donation in support of the Texas Dark Sky Festival to be held in Dripping Springs this March. As yet, we've not had the groundswell of support we hoped for. Texas IDA is an important partner of ours. We all suffer from light pollution here in the metro area, and supporting IDA activities is one of the most socially beneficial contributions we can make as individuals and a Society.

Last year, I called out the spirit of the beginner to the hobby in our holiday message. This year, as President, I'd like to call out the spirit of the holidays to thank everyone who has contributed to the success of the organization this year. In addition to the current board, thank you's go out to David Lynch, Steve Means, Katie Raney, Jim Sheets, Cindy Bower, our guest speakers, partners, advocates and friends. Together, we make it all happen!

Keep Krampus away from your eyepieces, and the very best to you and yours! See you at the Holiday Party!
Join your fellow astronomers for the Annual Austin Astronomical Society Holiday Party!

Friday, December 11
7:00 p.m. - 10:00 p.m.

This is a potluck dinner. Please visit the Holiday Party Discussion on the website for directions, to RSVP and note what you are planning to bring.

http://www.austinastro.org/holidayparty
EXECUTIVE COMMITTEE MINUTES
By Domingo Rochin, Secretary

October 5, 2015

The meeting was called to order at 7:03 PM. Present were President David Mathias, Vice-President Terry Phillips, Secretary Domingo Rochin, Communications Chair Joi Chevalier, Treasurer Tara Krzywonski, Outreach Chair Dawn Davies, Member Services Chair Jim Spigelmime, and Members-at-Large Katie Raney, Brian Lippincott, and Alan Carruth. Also present were Newsletter Editor Joyce Lynch, Member Ron Carman, and IDA rep Tim Brown.

OFFICER AND CHAIR REPORTS
President. David Mathias
1. It is announced that Katie is vacating her position because she is moving to Tyler, TX.
2. David moved “unfinished and new business” up front of all evening discussions.

1-old bus Motion to approve Maurice Nelson as new Webmaster was approved, and will report to Communications Chair Joi.

2-old bus Retreat: Another potential outside consultant is available. Or, do we want to pursue another course? Possibly move the date somewhere up to next year or next EC committee? Motion was approved to table the retreat to next year, with possibly late this year.

3-old bus Status of the holiday party: Dawn indicated that it is done! – just need to send out invitations.

1-new bus Opening new EC positions. Do we want to choose within EC or from the GA? It was approved to appoint Domingo Rochin to the position of Equipment Chair. The motion carried to approve Ron Carman as the new Secretary. The vacant position for Member-at-Large will be offered at the GA meeting.

1-new bus Membership renewals: Drop by Oct 31st if they have not renewed.

3-new bus Astro calendar shared with COE so that we can plan events for us –such as meteor shower viewing. Jim Spigelmime will take care of it.

1-new bus Need subcommittee to work on a comprehensive plan of security and safety. COE has security. However, we need a land base phone to get reception. David will get with Cindy on this issue.

Important Phone Numbers:
The following information is not part of the EC meeting minutes, but I have included it here as an informative note regarding the above need for security and safety:
800-977-0081 Toll free number for COE lodge
512-334-2070 Local phone number for COE lodge
512-756-8080 Burnet County Sheriff, EMS, and fire dispatch number
911 This will connect you to the TOW, Texas 911 Operator.

Vice-President. Terry Phillips
1. No new sites selected to replace COE or urban viewing.

2. Nothing new on the 25” scope work.

Treasurer. Tara Krzywonski
1. Tara handed out a written report. Things to note:
   a. Deposits total: $4,837.00 – entirely from membership renewals.
   b. Spending total $78.00 – EEO internet and Survey Monkey.
2. Do we publish the treasurer reports? – yes, in Sidereal Times. And up to recently, it was always on the web. Jim will show Tara how to do this.
3. We need to take some persons names out of the PayPal account, and e-Bay account has expired – Mark and Vic are in both accounts.

Outreach Chair. Dawn Davies
1. Request to move EC Discussions to the EC Groups. Joi to work on the issues finding an asynchronous form of communication in which one topic is in one forum.
2. Public Star Party is this Saturday, Oct 10th
3. Belterra is scheduled for Friday the 16th.
4. Laguna Gloria Art Center is scheduled for Oct 30-31st.
5. No one went to Burnet Ranch Star Party – mostly due to weather.
6. Girlstart outreach event first Thursday of every month. The next one is Nov. 5th – check.
7. Astronomy Off the Field is last Thursday of every month. Next event is Oct 29th.

Communications Chair. Joi Chevalier
1. Presented a comprehensive plan for communications strategies for AAS. It contains items such as defining different communication channels, AAS accounts, events vs editorial calendars, opportunities for revenues, increase GA involvement.
2. Current web site vs new proposed web site (aas.travin.com).
   a. Scale to the communication device
   b. Does not utilize the WA (Wild Apricot) format.
   c. Social media integration – interactive.
   d. Dynamically generate content.
   e. When administrators log in it takes you to separate WA tool layer.
3. Practical Astronomy for November to focus on web site demo.

Equipment Chair. Domingo Rochin
1. Just appointed. It is a leadership position.
2. Understands that training of operators for EEO is a priority.
3. Recoating of the 25” mirror is an ongoing project to get attention soon.

1 Archiving of non-renewing membership information will be done by Tara and Jim.
2 New member welcome letter to be drafted and sent out – posted for review.
3 Practical Astronomy will be presented by Lauren Gonzalez, liaison for AL (Astronomical League). She will discuss the services and certification programs that AL offers.
4 Survey: Data is posted. Look at it!
5 Donations for IDA Texas Night Sky Festival in March 2016.
   a. We should take advantage of WA forms to get donations.
   b. Create a fixed set of donation selections.
   New Business
   1. Ron presented an invitation from Scott White of Enchanted Rock SP to help with their star parties.
   2. David and Dawn briefly presented the proposal from Cindy to move the observatory to a new site within COE that is not part of the Preserve.
      a. What is the plan?
      b. What it takes to make the move
      3. Cindy has been invited to attend the November EC meeting as a guest.

Meeting was adjourned at 9:00 PM

CALENDAR OF EVENTS

10 December 2015
Outreach Opportunity
Belterra Community Star Party
6:00 PM - 8:00 PM
Belterra Community Center

11 December 2015
Holiday Party
7:00 PM - 10:00 PM

12 December 2015
Members Only Star Party
Canyon of the Eagles

12 December 2015
Outreach Opportunity
Manor Arts Council Star Party
5:30 PM - 10:00 PM
TerrAdorna, Manor TX

4 January 2016
Executive Committee Meeting

8 January 2016
General Assembly Meeting
7:30 PM
ETC 2.136 - UT Campus Engineering Teaching Center

9 January 2016
Members Only Star Party
Canyon of the Eagles

30 January 2016
Outreach Opportunity
Public Star Party
Canyon of the Eagles

Please see the AAS Calendar of Events webpage for more details:
http://www.austinstro.org/events

4 December 2015 • Sidereal Times
The meeting was called to order at 7:40 pm by President David Mathias with a quorum present. David asked visitors and new members to introduce themselves, as well as a few members who had not been to general meetings recently.

Joyce Lynch, newsletter editor, said that according to our Bylaws, the minutes need to be approved by the general membership before being published in the newsletter, and she will have a procedure to approve the minutes before inclusion in the newsletter. The minutes of the September general meeting were shown on the screens at the front of the room and approved by the membership.

Vice-President Terry Phillips announced that the club’s 25-inch Dobsonian scope is stored in the shed at Eagle Eye Observatory and its mirror needs re-coating, which should be done in the next few months. The program for the November meeting will consist of two short talks, and in December we will have our usual holiday party. He is working on programs for 2016.

Treasurer Tara Krzywonaki gave her report; our accounts currently total $30,253.48, and we have 436 currently active members. She showed a list of member benefits and also said she is taking orders for the 2016 RASC Observer’s Handbook.

Joi Chevalier, Communications Chair, gave her report and told how she intends to work closely with the webmaster to improve communications among members and with Canyon of the Eagles. She invited any interested members to see her if they want to help with the Communications Committee.

Dawn Davies, Outreach Chair, said there will be a members-only star party at COE on 10 October, and there will be star parties at Belterra on Friday, 16 October and Laguna Gloria on 30 October.

She is also seeking a site for Astronomy Off the Field on 29 October, and she is keeping a record of member hours to apply toward the AL Outreach Awards.

Domingo Rochin, new Equipment Chair, gave his report; he is looking for a place to have the 25-inch mirror re-coated, and he will work on the certification of observatory operators at EEO.

David reminded everyone that it is now past time to renew memberships and those that haven’t done so will be dropped from the membership roster. He is also open to any more suggestions from members as to a location for future general meetings.

In the absence of Tim Brown, Tara gave the IDA report.

David mentioned that due to a member relocating, we now have an open position for Member-at-Large on the Executive Committee. Members interested in this position should contact him. He also gave a brief summary of the pre-meeting discussion about COE and EEO.

Dawn announced the Holiday Party will be 11 December at Joi Chevalier’s home; more information will be on the website. Also, the Greater Austin area now has a planetarium located at the Austin Museum of Science & Technology in Cedar Park.

Vice-President Terry Phillips then gave the program on Earth Orbiting Satellites, after which the meeting was adjourned at 9:45 pm.

New Members

Recently our Treasurer has been working to update our membership database to list everyone in household memberships as individual members.

Because of this overhaul, we are unable to list the names of people who have joined in the last month as we usually do.

New members, consider yourself welcomed. You know who you are!
October 2015 Treasury Report
By Tara Krzywonski, Treasurer

Deposits

Dues payments
Checks $ 215.00
Paypal $1,961.67
Dues payments totals $2,176.67

Interest earned-checking $0.18
Interest earned-CD $0.25
Interest earned-CD $0.25
Total interest earned $0.68

Total other income $0

Deposit Totals October 1 - 31, 2015 $2,177.35

Expenses

COE internet $62.87

Expense Totals October 1 - 31, 2015 $62.87

Bank Balances
University Federal Credit Union Checking $21,158.59
University Federal Credit Union C.D. $ 5,807.39
University Federal Credit Union C.D. $ 5,788.20
University Federal Credit Union Scholarship $ 462.66

Total Cash $33,216.84

Total of 554 AAS members as of November 30, 2015
Total of 442 AAS memberships as of November 30, 2015
Astronomical League News
By Lauren Gonzalez, ALCor

News is pretty thin this month, though it was nice to see a couple AAS names in the awards pages of the newest AL Reflector magazine. We have a few more award recipients whose names apparently didn’t make the Reflector cutoff date, so those will hopefully be in the next issue.

I completed my Stellar Evolution list during the December Public Star Party at COE. I was also able to present Brent Burton with his Lunar Award, since he was unable to make the last GA meeting. Brent continues to make progress on his Messier list, and I am continuing on my Herschel 400. As of today, I have 177 of the 400, but I haven’t started into the galaxies in Virgo, Canes Venatici, Coma Berenices, Ursa Major, and Leo. In fact, only 42 of the objects of the 223 remaining on my list are not galaxies. It will be a busy spring for me. Contact me at LSROGERS16@GMAIL.COM and let me know what projects you are working on. Remember, for those of you already involved in outreach (or those who are considering it), you only need 5 events at two hours each to qualify for your first certificate and pin!

Wishing you warm winter observing.

Lauren Gonzalez presented Rob Pettengill his Stellar Outreach award.

Tara Krzywonski earned her Analemma award.

Photos by Joyce Lynch
Welcome to a month of frosty nights, brisk days, and so much seasonal fare that winter’s celestial parade seems to fade into the background, even for those who love the sky. But the universe is far bigger than the season; it doesn’t require our attention to go on about its business. So if you have some time this month, and some warm clothing, take a break and put the season in perspective: get out and look up, and realize we’re all a very small part of a much grander celebration. Enjoy!

Stock 23 rating EASY
open cluster in Camelopardalis
RA 03h 16.3m Dec +60d 02.1’
(2000)
Magnitude 7.0

This open cluster, also known as Lund 104, sits practically on the western border of Camelopardalis with Cassiopeia. The cluster is easily visible with binoculars and low power rich-field telescopes, forming an equilateral triangle with Gamma Persei and the Perseus Double Cluster.

Stock 23 was more or less unknown until the late 1970s when John Pazmino wrote about it in Sky and Telescope magazine. Since then it has sometimes been called Pazmino’s Cluster. Walter Scott Houston once wrote that it is strange that such a bright and obvious cluster isn’t included in the Messier, NGC or IC catalogs.

If you have 14x70 binoculars, you’ll see 4 stars between 7th and 8th magnitude forming an irregular trapezoid, with several faint stars scattered around it. The westernmost star in the trapezoid is double star ADS 2426, consisting of two 8th magnitude stars 7” apart. The cluster appears about 10’ across in a 10-inch class scope, with about 20 stars visible.

NGC 1398 rating MEDIUM
galaxy in Fornax
RA 03h 38.9m Dec -26d 20.2’
(2000)
Magnitude 9.8 4.5’x3.8’

With December here, perhaps it’s time for an observing trip down south to warmer climes. And what could be warmer than the southern constellation of Fornax, the Furnace? That’s where you’ll find face-on double-ringed barred spiral galaxy NGC 1398. It sits near the NW corner of Fornax, which the great celestial river Eridanus flows around on its way further south to Achernar. There are no bright stars near NGC 1398; the closest is 4th magnitude Alpha Fornacis roughly 8 degrees SW, so don’t expect easy star hops.

The galaxy is just visible in a 2.4-inch refractor as a patch 7’ east and a little north of a 9th magnitude star. It is moderately bright in a 6-inch scope, appearing about 1.5’ in diameter with a stellar nucleus just visible over the bright center.

NGC 1398 was discovered by Friedrich Winneke of Karlsruhe, Germany on December 17, 1868 while comet hunting. In large scope images the galaxy is highly symmetrical and unusual looking - gorgeous! It lies about 65 million light-years from Earth and is about 135,000 ly in diameter, making it about 35% larger than our own Milky Way galaxy. Its loose and dim outer arms are flocculent (fluffy), while its inner rings are well-defined and tightly wound, even appearing rope-like near the core. The bright central bulge features a prominent and interesting bar. NGC 1398 has had one known supernova explosion, northeast of its nucleus - SN 1996N, which reached magnitude 16 in March of that year.
NGC 1579 rating HARD
reflection nebula in Perseus
RA 04h 30.2m Dec +35d 16.6' (2000)
Magnitude 12.0

Located in southeastern Perseus near the border with Auriga, you’ll find NGC 1579 about 12’ east of an 8th magnitude star. A 10-inch class scope should be able to pick it up fairly easily at low power. You’ll see a diffuse nebulosity spreading irregularly through a 5x3’ area that’s elongated roughly N-S. Near the center is the brightest portion, which looks a lot like a 1.5’ diameter 12th magnitude galaxy. There are about 8 stars involved with the nebula, including a 12th magnitude star on the north side and a wide, faint pair to the south.

Located about 2100 light years away and about 3 light years across, NGC 1579 is a large dusty region that is currently forming new stars. It is also known as the “Northern Trifid” or the “Trifid of the North” because it appears similar to summer’s better known Trifid Nebula (M20 in Sagittarius). Like the Trifid, in large scope images NGC 1579 displays contrasting red and blue colors, with dark dust lanes prominent in the central regions. In both nebulae, dust reflects starlight to produce beautiful reflection nebulae.

Unlike the Trifid, however, the reddish glow in NGC 1579 is not emission from clouds of glowing hydrogen gas excited by ultraviolet light from a nearby hot star. Instead, the dust in NGC 1579 drastically diminishes, reddens, and scatters the light from an embedded, extremely young, massive star, itself a strong emitter of the characteristic red hydrogen alpha light. Such nebulae are called HII (ionized Hydrogen) regions. HII regions are usually clumpy and strangely shaped due to the powerful winds emanating from the stars within them. HII regions also have relatively short lives, furiously forming new stars until the immense winds from these bodies blow the gas and dust away, leaving just stars behind.

**Image of the Month**

**Congratulations!**

**NATHAN MORGAN**

**M31 Andromeda Galaxy**

9 RGB subs at 5 minutes each. Total integration of 45 minutes
Taken at Canyon of the Eagles
Double Cluster in Perseus

By Steve Means

Pflugerville, TX - 11/9/15
Scope: Stellavue SVA-130EDT-25SV, SFFR130 reducer/flattener
Mount: CGEM with Starizona Landing Pad
Camera: Canon 60D, Hap Griffen mod, IDAS D1 filter
Guide Scope: Stellavue SV60EDS APO
Guide Camera: Orion StarShoot
Guide Software: PHD2 Ver. 2.50
20 subs, 60 secs ISO200
Captured and Processed with Images Plus 6.50

Horsehead Nebula

By Nathan Morgan

Taken from my backyard using a HA 7nm narrowband filter.
29 subs at 15 minutes each.
Totals integration 7 hours 15min.
Members’ Gallery (continued)

Rick is wondering about the colors about the Moon. Weird lens flare, refraction of moisture? (Enlarge to see better)

Images by Rick Glasebrook

Rick is wondering if this photo shows gravity waves or altostratus undulatus clouds. If you have insight into either of these photos, e-mail Rick at g79frat@yahoo.com
Atlantic Sunrise and Pacific Sunset on the Moon in HDR
Luna in Gaia’s Shadow Revisited - By Rob Pettengill

After watching the complete total lunar eclipse in April of 2015 under clear skies, I was fascinated by the interplay of the earth’s shadow and the moon. I had a sense of the earth’s shadow as a physical space with edges, texture, and colors.

There are many differences between an eclipse and the normal terminator that defines the separation between sun light and darkness during the lunar month. At first, the intensity of light dims gradually across the moon as the sun is only partially obscured - the penumbral phase of the eclipse. Next the earth’s full shadow, the umbra, moves onto the moon. In the umbra direct view of any part the sun is hidden by the earth. The partially eclipsed moon looks very different than the normal gibbous, half or crescent shapes. The circular outline of the earth’s shadow is moving across a spherical moon. Rather than a stark line between light and dark, varied only by the lunar topography, an eclipse shows a soft line with many irregularities as the mountains and clouds of the earth’s atmosphere are projected, out of focus, onto the surface of the moon.

The earth’s shadow is never completely dark. Atmospheric refraction bends some sunlight into even the darkest parts. Air scatters higher frequency light more strongly giving us our blue skies. Leaving that blue behind, the light that makes it through our atmosphere is reddened. It is the red glow of every sunrise and sunset around the earth. This color varies from pale pink, to yellow-orange, to deep blood red as the moon moves deeper into the earth’s shadow. From the moon the black void of the nighttime earth will be circled by a glowing red ring of sunlight.

I made an HD time-lapse video of the eclipse to capture this, but even HD video loses much detail in the original images. This still image captures the moon at the beginning, middle, and end to totality. Made from my home in Austin, Texas, with a Questar 3.5” telescope and a Sony NEX-5N with an APS-C size sensor at prime focus (1400mm FL at f/16), the image is a high dynamic range stack of 24 images of the moon at 3 points in the eclipse: just before, during, and just after totality. Exposures range from 4 sec at ISO 800 to 1/10 sec at ISO 200.

In most eclipse image sequences the rotation of the earth obscures the relationship of the moon and the earth’s shadow as a whole. In this image, the position of the stars and the earth’s shadow is constant as the moon moves through the shadow. First and last images show a sliver of directly lit moon. These define the extent of the earth’s umbral shadow in it’s correct relationship and size to the moon - more than 3 times the diameter of the moon. Dusky rainbow like bands color the earth’s umbral shadow on the moon: light pink, yellow, orange and finally deep red. In this eclipse the colors just before totality come from sunsets over the South Pacific; those just after come from sunrise over the South Atlantic. https://www.flickr.com/photos/robpettengill/23180698176/
It was just over 20 years ago that the very first exoplanet was found and confirmed to be orbiting a star not so different from our own sun. Fast forward to the present day, and the stellar wobble method, wherein the gravitational tug of a planet perturbs a star’s motion, has been surpassed in success by the transit method, wherein a planet transits across the disk of its parent star, blocking a portion of its light in a periodic fashion. Thanks to these methods and NASA’s Kepler spacecraft, we’ve identified many thousands of candidate planets, with nearly 2,000 of them having been confirmed, and their masses and densities measured.

The gas giants found in our solar system actually turn out to be remarkably typical: Jupiter-mass planets are very common, with less-massive and more-massive giants both extremely common. Saturn—the least dense world in our solar system—is actually of a fairly typical density for a gas giant world. It turns out that there are many planets out there with Saturn’s density or less. The rocky worlds are a little harder to quantify, because our methods and missions are much better at finding higher-mass planets than low-mass ones. Nevertheless, the lowest mass planets found are comparable to Earth and Venus, and range from just as dense to slightly less dense. We also find that we fall right into the middle of the “bell curve” for how old planetary systems are: we’re definitely typical in that regard.

But there are a few big surprises, which is to say there are three major ways our solar system is an outlier among the planets we’ve observed:

All our solar system’s planets are significantly farther out than the average distance for exoplanets around their stars. More than half of the planets we’ve discovered are closer to their star than Mercury is to ours, which might be a selection effect (closer planets are easier to find), but it might indicate a way our star is unusual: being devoid of very close-in planets.

All eight of our solar system’s planets’ orbits are highly circular, with even the eccentric Mars and Mercury only having a few percent deviation from a perfect circle. But most exoplanets have significant eccentricities, which could indicate something unusual about us.

And finally, one of the most common classes of exoplanet—a super-Earth or mini-Neptune, with 1.5-to-10 times the mass of Earth—is completely missing from our solar system.

Until we develop the technology to probe for lower-mass planets at even greater distances around other star systems, we won’t truly know for certain how unusual we really are!

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit http://space-place.nasa.gov to explore space and Earth science!

I spend a lot of time observing in a revolving, collapsible, lean-back chair with my Canon 18x50 binoculars just scanning the sky, sometimes looking for specific objects and sometimes just looking and admiring rich star fields.

A couple of years ago, I stumbled onto a wonderful open cluster near Sagittarius that looked for all the world like an eagle coming in for a landing. But what really surprised me was that I could find no reference in any literature that described this appearance. In fact, at that time there wasn’t much literature about this cluster at all. It’s very obvious in my 18x50 binoculars, but completely “unobvious” in any conventional scope at 40-50x or more because of its size.

The center portion of this cluster is marked as NGC 6774, but an experienced observer marked it as difficult in a 13” scope(!) so I’m not sure what they were looking at - and the size is often listed as only 20’, when in fact the entire cluster covers some 2 degrees. Although originally discovered by John Herschel in the 1830’s it was then “rediscovered” in the 1960s by Jaroslav Ruprecht (hence the name Ruprecht 147), but until now few astronomers have paid much attention to it and I have yet to see any comments about its striking shape.

It turns out that this cluster is very interesting for stellar astrophysicists as it is relatively close (less than 1,000 lt-ys) but still quite old (some 2.5b years old), and the recent interest in exo-planets has significantly raised the awareness of this particular cluster. A recent article talks about this:


In that article is the comment: “To study the Ruprecht 147 cluster, which is much larger on the sky than most objects astronomers study, the Wright’s team had to use some specialized, wide-field cameras.”

I commented about this cluster several years ago on Cloudy Nights and several observers followed up sharing my surprise that it has not garnered more interest. I refer to this as the “Eagle Cluster” (as distinct from M16 - the “Eagle Nebula”). Take a look at this the next time you are out and see if you agree with me about its appearance of an Eagle coming in for a landing with its wings stretched open. At the very least, I think I can successfully argue that it looks a lot more like an Eagle than M11 looks like a Wild Duck.

I’ve included a general locator map along with a sketch of most of the brightest starts in the cluster which makes it easier to see where the idea of it looking like an eagle comes from:
**STAR OF WONDER: ARGUMENTS OVER THE CHRISTMAS STAR**

By Michael E. Marotta

The views expressed in this article are those of the author and not the Austin Astronomical Society.

In science, a good problem takes us far beyond the results of a single observation. The Christmas Star has been debated on many levels. The International Planetarium Society website (www.ips-planetarium.org) lists over 100 citations to the Star of Bethlehem. Some of those articles and letters were part of a multifaceted decades-long argument among at least five astronomers and one editor. Writing in *Archaeology* Vol. 51, No. 6 (Nov/Dec 1998), Anthony F. Aveni cited 250 “major scholarly articles” about the Star of Bethlehem.

Nothing pays the rent on a planetarium like the annual “Star of Christmas” presentation. What the so-called “star” was is only the first level of inquiry. Some astronomers question whether the presentation is appropriate at all, as it may only validate astrology, or endorse religion in general and Christianity in particular. Moreover, the evidence must belong to a class that is supposedly interesting to astrologers. After all, the Magi traveled to Bethlehem seeking the King of the Jews, “for we have seen His star in the East.” Something is always happening in the sky, but what is significant—and why?

Ideal, any such event is best corroborated with independent contemporary observations, perhaps from China or India, but at least from secular sources in the Roman expanse.

**Conjunction Junction**

For about 1500 years, the story of the Star of Bethlehem was accepted as historically accurate because it was divine truth. Miracles were not questioned. (The Church did investigate such claims, and even appointed a Devil’s Advocate to argue against them, but the outcome was seldom in question.) With the Renaissance, a new way of looking at the world evolved.

The scholarly tradition of explaining the Star of Bethlehem with scientific evidence apparently began with Johannes Kepler. In 1604, he published *The New Star in the Foot of the Serpent* (*De stella nova in pede serpentarii: et qui sub ejus exortum de novo iniit, trigono igneo…*). In that tract, he examined a triple conjunction, as well as a nova, which he attributed *casually* to the conjunction. He was not alone in that kind of a belief. Others expected the conjunction to cause a comet. Reviewing the facts in 1614, Kepler said that the Star of Bethlehem was a nova in 4 BCE caused by a triple conjunction in 7 BCE. (See “Common Errors in ‘Star of Bethlehem’ Planetarium Shows,” by John Mosley, *The Planetarian*, Third Quarter 1981.)

The triple conjunction of 7 BCE occurred in Pisces. Some astrological lore identified that constellation with Judaea. Other traditions give Pisces to the Libyans, among others. However, back in the 1960s, at the Cleveland Museum of Science, planetarium director Dan Snow, told us of the Pisces connection. So, for me, the Wise Men traveled to Judaea because of a rare conjunction in Pisces.

Josephus was born a Jew, and led forces in rebellion against the Romans. However, he surrendered to Titus Flavius Vespasianus, and was taken as his slave. When Vespasian became emperor, he gave Josephus his freedom. Those histories record the reign and death of Herod the Great, king of Judea, and a client of Rome, who lived from 74 or 73 BCE to 4 BCE. Josephus also tells of the appointment of Publius Sulpicius Quirinius as legate in Syria, to which Judea was annexed for taxation. That is accepted as 6 CE. Any candidate must fall within those dates.

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**Conjunction Junction**

For about 1500 years, the story of the Star of Bethlehem was accepted as historically accurate because it was divine truth. Miracles were not questioned.
Over the centuries, the Christmas Star has been explained as a comet, a meteor or meteor shower, but the conjunction theory has been the most popular.

According to Michael Walter Burke-Gaffney of the Royal Astronomical Society (also of the Society of Jesus), the popular tradition began with one Bishop Münter in 1831. It was Münter who first cited Kepler (wrongly), claiming a triple conjunction. The assertion lived on. Burke-Gaffney claimed that the popularizer Münter was widely read, though Kepler himself was not. (“Kepler and the Star of Bethlehem,” Burke-Gaffney, W., Journal of the Royal Astronomical Society of Canada, Vol. 31, p.417.) Personally, I am not sure who did and did not read Kepler. As far as I know, unlike Shakespeare and Bach, Kepler’s writing never suffered a hiatus.

The triple conjunction identified by Kepler is not alone.

“It has always been known that Christ was born shortly before the death of Herod, and that Herod died between the time of a lunar eclipse and the following Passover. … New research shows that this scenario is probably wrong—that Christ was probably born in 2 B.C. and that the Star was Jupiter or a series of conjunctions between Jupiter, Venus, and Regulus in 3 and 2 B.C. This new historical research involves a redetermination of the date of Herod’s death and the consequent readjustment in the date of Christ’s birth (Martin, 1978 and 1979).

“On August 1, 3 B.C., Jupiter became visible above the predawn eastern horizon as the ‘morning star.’ Twelve days later, at about 4:00 a.m., a very close conjunction occurred between Jupiter and Venus, the space between them narrowing to only 0.23 degrees. Five days later Mercury emerged from the glare of the sun and came into conjunction with Venus on the morning of September 1, their minimum separation being only 0.36 degrees.

“The fact that Jupiter became stationary among the stars on December 25 (and, by the way, directly midbodied to Virgo the Virgin) may well explain what Matthew meant in his Gospel when he said that the star came to a halt over the village Bethlehem…” (“The Star of Bethlehem Reconsidered: An Historical Approach,” John Mosley, IPS Planetarian Vol. 9 No. 2, Summer, 1980.)

That is just one of many such explanations. Dig into the literature and you will find that they often involve re-interpreting some historical evidence into a new matrix in order to support a new explanation of just what the Star of Bethlehem really was. It is commonly accepted that the Biblical verse about shepherds out with their flocks indicates that Jesus was born at almost any other time except winter. The December 25 date is not supportable, but remained an article of faith to astronomer John Mosley.

Money Talks

In 1999, Rutgers Press published The Star of Bethlehem: the Legacy of the Magi by Dr. Michael R. Molnar. In addition to his achievements as an astronomer, Molnar is a numismatist. He was attracted to a series of coins from Antioch in the first century of the present era. They show a star, a crescent moon, and a Ram, among other symbols and legends.

“Jupiter underwent two occultations (“eclipses”) by the Moon in Aries in 6 BC. Jupiter was the regal “star” that conferred kingships a power that was amplified when Jupiter was in close conjunctions with the Moon. The second occultation on April 17 coincided precisely when Jupiter was “in the east,” a condition mentioned twice in the biblical account about the Star of Bethlehem. In August of that year Jupiter became stationary and then “went before” through Aries where it became stationary again on December 19, 6 BC. This is when the regal planet “stooed over.” A secondary royal portent also described in the Bible. In particular, there is confirmation from a Roman astrologer that the conditions of April 17, 6 BC were believed to herald the birth of a divine, immortal, and omnipotent person born under the sign of the Jews, which we now know was Aries the Ram. Furthermore, the coins of Antioch and ancient astrological documents show that there was indeed a Star of Bethlehem as reported in the biblical account of Matthew.”


Molnar’s book goes into detail on the use of coinages as communication media in ancient times. His narratives are for the non-numismatist, as those assumptions are widely accepted by professionals in the field. People back then read coins the way we now read web pages: the symbols spoke thousands of words.

It is important to note that Jesus was not the only king, and his reign was not the only new age. Julius Caesar was assassinated March 15, 44 BCE. In May through July, a comet appeared, a singular event, not Halley’s or any other recurring comet. The people of Rome accepted it as obvious fact that the soul of Julius Caesar had ascended to the heavens. Julius Caesar was the first
historical Roman deified by the Senate. His adopted heir, Gaius Octavius, became at once Gaius Julius Caesar Octavianus, and also, Divi Filius: son of the divine.

Moreover, although he was born 23 September and therefore a Libra, Octavian Augustus took Capricorn as his personal symbol. Capricorn is the zodiacal sign of the winter solstice, of course, and therefore the symbol of the new year – ultimately, a new age.

Molnar’s book offers images of the Caesar Comet coin and Augustus’s Capricorn on a coin. The centerpiece, however, are the coins of Antioch (the Roman mint closest to Judaea) and the astronomical interpretation of them. It is important to understand that while some were struck during the accepted lifetime of Jesus, the series is broader than that. What was meant at the detail level to the people of the time must remain at least somewhat conjectural.

Is There a Wise Man in the Planetarium Tonight?

The Bill of Rights amending the federal Constitution prevented the central government from establishing a national church. Nonetheless, Massachusetts collected taxes for the Congregational church until 1833. They were not alone. Following the War Between the States, in order to be readmitted to the Union, the former states in rebellion modeled their new constitutions after those of Massachusetts and Pennsylvania. Both of those required a belief in God of anyone seeking to serve on a jury or hold elected office. In 1991, the state supreme court of South Carolina struck down that state’s religious requirements.

Generally, for a federally recognized right, such as the prohibition against cruel and unusual punishment, to be recognized in a state that does not explicitly do that, the federal Supreme Court must rule in a way that “incorporates” that right to the states. The Fourth, Fifth, Sixth, and Seventh Amendments have been incorporated to the states. The First Amendment is incompletely incorporated, as is the right to bear arms.

The U.S. Supreme Court has heard several cases involving so-called “creation science.” Those rulings defined the limits of what is permissible for public funds and religion. In 1971, the Supreme Court created “The Lemon Test” named for the plaintiff in Lemon v. Kurtzman, 403 U.S. 602 (1971). Writing for the Court’s unanimous (8 to 0) opinion, Justice William J. Brennan established a three-pronged test to determine whether or not government action in religious matters was allowable.

1. There must be no “excessive government entanglement” with religious affairs.

2. No law or action can either advance or inhibit religious practice.

3. Any government action must have a secular legislative purpose.

The Supreme Court, and lower appellate courts, heard many such cases over the past 35 years. The Lemon Test stands the test of time. If your planetarium is publicly funded, then the “Star of Christmas” cannot be a December holiday show. But what if your star theater receives no tax dollars? It may nonetheless be problematic.

Agreed, it brings in viewers. Allow me to suggest that Colorado is among several states that have liberalized laws regarding marijuana. How would you react to a Colorado planetarium that handed out marijuana cigarettes? It would surely bring in the crowds. They definitely would enjoy the show. But would that be advancing science?

Antioch Ram

“About 50 AD coin of Antioch in Syria shows Jupiter to west of Aries. (EPI KOUDRATROU = “of Quadratus (the name of the Roman legate). Year is Rho Delta = 104 of Roman rule.” Author’s collection.
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