

# PAStimes

Phoenix Astronomical Society  
[www.pasaz.org](http://www.pasaz.org)

February 2011  
Volume 62 Issue 6

PHOENIX ASTRONOMICAL SOCIETY — ESTABLISHED 1948

## CVEMS: The Newest Threat To Our Dark Skies

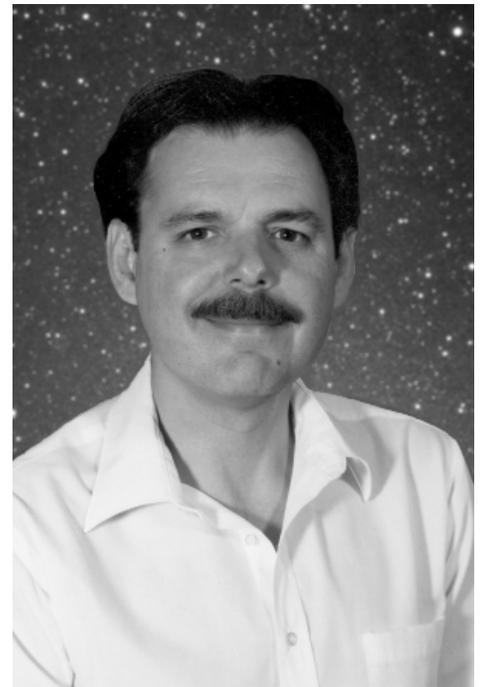
Dan Heim, Edited by Terri

Electronic billboards: They're officially known as CVEMS (Continuously Variable Electronic Message Sign) or EMD (Electronic Message Display). Some quick specs of the new sign at the Anthem Outlet Mall: 60 ft tall, two-sided, 12 ft x 40 ft HD LED display, 8 kW (if all white), \$300,000 cost, 8 second rotation of messages. Of course, it's unshielded, and unlike conventional billboards cannot be lit from above with the usual shielded lamps. It emits its own light, much of it above the horizontal. According to Maricopa Planning & Zoning, it greatly exceeds their recommended nighttime brightness levels. The display part of the sign goes black at 11 pm or midnight (seems to vary) and comes back on at 5 am or 6 am (seems to vary). Unfortunately, the sign is located within the City of Phoenix, which is free to ignore County restrictions. And when it does go off, it's just the display

part. All the other lights remain on, and it's still quite bright. And unshielded.

I [Dan Heim]am currently conducting an ongoing effort to learn more, and attempting to influence the Phoenix Office of Environmental Programs and the Planning & Development Department. I know I spoke about Light Pollution in the past to PAS, and was going to do the Weightlessness presentation at first, but there are some recent developments on the light pollution front that I'd like to present at this meeting. First and most importantly, these new electronic billboards with changing displays that we're starting to see all around town have apparently slipped through the cracks of current regulations, since those regulations were written before this new technology existed. They are creating huge issues for light pollution. The new electronic billboard by the Anthem Outlet Mall is now the brightest light I can see from my home in New River.

Continued on Page 4



## PAS Meeting Review of 1/6

By Terri, Event Coordinator

This was the most unusual PAS Meeting. Two days prior to the meeting, we were informed by Veronica, our guest speaker, that she can't make it to our meeting due to her daughter's extreme allergy symptoms. Thus, Veronica felt a need to stay by her daughter's side. In order to not cancel the meeting, Veronica agreed to hold the meeting over Skype. Isn't technology wonderful? I sent out an emergency email asking for help in setting up Skype, as I know that we have several PAS Members with equipment and knowledge on how to set this up. Tim Jones and Chris Johnson came to the rescue. In the end, Chris set up his equip-

ment and we were underway.

The meeting started right at 7:28pm sharp. Rod was already there, and ready to open the meeting. We just welcomed everyone, and since the Skype portion was already set up, we started the meeting early. This meant that the 50/50 raffle didn't happen, announcements didn't happen, in fact, most of the usual pre-meeting stuff - did not happen at this meeting.

Veronica did a great presentation on ASTRONAUTS FOR HIRE. There was input from the audience, and interaction through the whole night. At the end of her presentation, we opened it for Q & A, and when that finished, we were done about

8:15pm. The group decided to mingle and eat the snacks for about half an hour, and then we called it a night.

Many thanks to Veronica, who made the best of using Skype. I totally appreciate and thank Chris for making Skype work, and Tim for offering to assist.

If you wish to research the topic further, please visit the site [Astronauts4Hire.org](http://Astronauts4Hire.org). Veronica is the Vice President of the organization.

I wish to thank Bob Senzer for bringing such awesome snacks as the Moon Pie. There was candy, popcorn, chips, cookies, and pastries. Many thanks to Ed for several

Continued on Page 5

<u>President / Librarian</u>	Rod Sutter	602-971-9129	<a href="mailto:President@pasaz.org">President@pasaz.org</a>
<u>Vice President / Events Coordinator</u>	Terri Finch	602-561-5398	<a href="mailto:VicePresident@pasaz.org">VicePresident@pasaz.org</a>
<u>Treasurer</u>	Mike Marron	480-488-3031	<a href="mailto:Treasurer@pasaz.org">Treasurer@pasaz.org</a>
<u>Newsletter Editor</u>	Don Boyd	480-963-7189	<a href="mailto:Editor@pasaz.org">Editor@pasaz.org</a>
<u>PAS Host</u>	John Pulis	623-570-5308	
<u>Webmaster</u>	Chris Johnson	602-456-2456	<a href="mailto:Webmaster@pasaz.org">Webmaster@pasaz.org</a>
<u>Rocketry Liaison</u>	Jerry Belcher	623-328-9290	<a href="http://ahpra.org/launches.html">http://ahpra.org/launches.html</a>

## Upcoming February 2011 PAS Events

By Terri, Event Coordinator

**Feb 3:** PAS Meeting in Library at PVCC. 7pm to 9:30pm. Bring a Friend! Guest Speaker: Dan Heim - Topic: CVEMS - Light Pollution

**Feb 5:** Cuttin' Edge Observatory in Mayer. PAS Members ONLY. RSVP with Chris [webmaster@pasaz.org](mailto:webmaster@pasaz.org) the day before. Chris is up there from noon on Friday to noon on Sunday.

**Feb 6:** Bookmans Telescope Workshop in Bookmans backroom 3:30 - 5:30pm. Bring telescope and accessories. Come learn how to use your telescope by daylight. Then, check the PAS calendar for an upcoming Star Party, and bring your scope to learn how to use it by night. RSVP is required with Terri - [Events@pasaz.org](mailto:Events@pasaz.org) by noon, day of event.

**Feb 8:** Cancer Treatment Center Star Party. PAS Members only. 7pm to 9pm, RSVP is with Joe [jcollins79@cox.net](mailto:jcollins79@cox.net) by

day before. This is a paid event. Be sure you are on the PAStimes Star Tours Team to be paid for this event. PAS Volunteers also welcome.

**Feb 10:** PVCC Telescope Workshop 7pm - 10pm. Meet in G-147 to telescope by daylight, then move outdoors, and learn to use the scope at night. When you RSVP with Terri [Events@pasaz.org](mailto:Events@pasaz.org), please provide the number in your party, and what scope you will bringing that night so we have a teacher available to assist you with your scope. Handouts, "Meteorite Man", and Star Party telescope viewing will most likely be available as well.

**Feb 17:** Desert Mountain School Star Party 6pm - 9pm. This is a whole school star party. Details are on line in the forums. Help is requested. PAS Members Only. RSVP with Terri [Events@pasaz.org](mailto:Events@pasaz.org).

**Feb 22:** Cancer Treatment Center Star Party Back Up Date. PAS Members only.

7pm to 9pm, RSVP is with Joe [jcollins79@cox.net](mailto:jcollins79@cox.net) by day before. This is a paid event. Be sure you are on the PAS-times Star Tours Team to be paid for this event. PAS Volunteers also welcome.

**Feb 24:** Gavilan Peak School Star Party 6pm - 9pm. This is a whole school star party. Details are on line in the forums. Help is requested. PAS Members Only. RSVP with Terri [Events@pasaz.org](mailto:Events@pasaz.org).

**Feb 26:** Virtual Star Party at Chris's home in Goodyear. RSVP is required with Chris [Webmaster@pasaz.org](mailto:Webmaster@pasaz.org). Time frame for this night's session will be 7:30pm to 1:30am. Bring a snack and drink to share. PAS Members only.

**Mar 3:** PAS Meeting in G-147. Guest Speaker is Dennis Young. Topic is Astro-Scenic-Photography and more. 7pm to 10pm. Bring a Friend! \*\*\*

## Night Sky Network Awards

By Terri, Event Coordinator

Now is the time to join the PAStimes Star Tours group of PAS Volunteers, who participate both in paid Star Parties and in volunteer events.

The Night Sky Network is awarding NSN pins for 2011, based on volunteer hours and events helping PAS. The pins will be shipped January 31. They may not reach us in time for the February PAS meeting, so we will hold an awards ceremony at the March PAS meeting for those being awarded the pins. If you recall, about two years ago we also received the same pins and we did a mini awards ceremony.

How do you earn a 2012 pin for your help in 2011? Volunteer with PAS! Then, for each event at which you volunteer, you log your hours right on the Night Sky Net-

work site. After each event takes place, I will post it on the NSN site, where you can find it and log your volunteer hours.

Log as close as you can to the actual amount of time (fractions are allowed) from the time you leave your home, to the time you return. The volunteers with the most hours of participation will win the pins. I don't know if there is a limit for the number of pins that will be sent to PAS, but log your hours and we will find out at the end of 2011. Do not log PAS Meetings or Meeting of the Minds as volunteer time, unless you volunteered in some fashion such as photographer, and provided those photos to me for the newsletter, or you helped the guest speaker, or you helped set up or take down the handouts table. You can log all events you volunteer at that are done through PAS.

For the 2011 year, we will include all current PAS members who take the time to log their volunteer time. So, if you are at an event as a helper, or a scope, or a presenter, I will give you a login access and send you directions, and you can log your volunteer time. This begins in 2011, so let's work together to help you earn a volunteer pin. It's not just the pin, it is the recognition for your help during the year, doing and enjoying PAS events. Those not interested in earning a pin need not do the logging of their event hours.

Sign up today (current Star Tours members need not sign up again, you are already on the list). Let me know if you are interested in earning a pin. Your time should be rewarded! Thank you for being so much help to PAS!!! \*\*\*

# No February Meeting Of The Minds

By Terri, Event Coordinator

The February Meeting of the Minds has been canceled because Gavilan Peak School

wanted that date for their star party. Please consider volunteering for this event. It is always fun to do a star party for this school.

We will see you there!! RSVP will be with Terri. \*\*\*

## Lunar Eclipse Viewing Of Dec 20

By James Robert Allen, edited by Terri

Terri writes: As some of you know, we had planned to have a Total Lunar Eclipse Event on December 20, 2010 at PVCC, but it was canceled due to heavy cloud cover. A day later, I received this email from James

and I felt it was worth sharing with everyone.

James writes: We were there at PVCC, and we moved over to PV Park from about 12:15 to 1:00; the clouds never "cleared." There were clear spots and wispy clouds off

and on. We didn't have anything capable of getting a photo, just binoculars. There was an obvious color change at totality; very nice. I think the best I've ever seen. Kids loved it. It was 65 degrees. \*\*\*

## Members' Night On Sept 1, 2011

By Terri, Event Coordinator

Several PAS members have asked why we don't have Members' Night within PAS, at the monthly PAS Meetings. So, I have decided that every September PAS Meeting will be Members' Night.

Here's what we will do for that night. I have set up a forum thread here: <http://www.pasaz.org/forums/showthread.php?p=1221#post1221>. Members who wish to present something about astronomy, space, or rocketry, can sign up for a presentation of 5, 10, 15, or maybe 20 minutes. The time frame will be based on how many presenters we have, and how much time

they wish to present. This thread is for the September 1, 2011 PAS Meeting.

The policy will be "first come, first listed". We will make a list of the presenters to announce in an email and through the newsletter. I need to know the TITLE of your presentation, or topic, if you don't have a title planned, plus your A/V needs and how long an amount of time you'd like to have for your presentation. If your presentation is longer than the time that is available, we can bounce you to another night, to do that same presentation, or have you as a special presenter at a Meeting of the Minds. I will fill in the time allowed, and the mem-

bers will present in the order they signed up.

I hope that every September we can have a group of members who would like to share astronomy and space related topics with the other members. And if you find that you have a presentation that may take an hour, let me know and I will schedule you as a guest speaker, for a night when we don't have a guest speaker scheduled yet, and the floor will be yours. We love to have new folk presenting to PAS. We hope to see this idea grow into something fun we do each year. Be a part of it! Sign up today in the forums or via email with me at Events@pasaz.org. \*\*\*

## Meteor Shower Party At Mike's Review Dec 13

By Terri, Event Coordinator

After I rushed home from teaching this night, I loaded the car with chairs, warm jackets, binoculars, drinks and snacks, picked up William, then off to pick up Kevin. We didn't get to Mike's until 9:20pm. I was bummed that we were later than we should have been. But luckily the party was on the far side of the house, and so we arrived without destroying anyone's night vision. When we got there, everyone was in chairs, facing east and enjoying the

show. We planted ourselves in our chairs and started viewing. It wasn't long before the cold breeze blowing under our chairs made us very cold. The temperature read 64 degrees, but it felt colder to me. We enjoyed some really awesome meteors though. Then the party moved indoors for a bit while everyone took turns using the bathroom, and then we got warmed up and went out again. Outside, only 20 minutes later, we were too cold once again. So, we moved indoors, and Mike built a huge fire in his

fireplace. It warmed up the house nicely. When 11pm came, William wanted to get home, as he gets up at 4am. So, we talked for a bit more, and gathered our stuff, got Kevin and departed for the night. As we were leaving around 11:20, we said good night to Mike, who was helping Judy set up her cot. She had decided to sleep outside that night. Judy later told Joe Collins that about an hour after we left she saw a fantastic four-way criss-cross shower of meteors! We missed out! \*\*\*

## Centennial High Star Party Review Jan 11

By Mike Marron

There were about a hundred parents and students at the Centennial High School Star Party, and about half came inside to listen to me rattle on about meteorites. Several people recognized me from the last event, and one guy brought hematite stones, hoping they were meteorites. During a quiet

period, an eight-year-old boy and his father wanted to know about quantum physics, so I pulled out my "toys" and gave a quick physics lesson on quantum strings, electromagnetism, neutrinos, electrons, protons, neutrons, isotopes, and ionization. I am guessing he will end up an inspired student like the one who remembered me from

kindergarten, who is now taking ASU physics classes. A Hawaiian father liked my explanation for the formation of Hawaii and called me a wise man in Hawaiian. Let's hope that one of the students really gets an asteroid for me and I get my one percent. \*\*\*

# Az Cardinals Prep School Star Party Review Dec 10

By Terri, Event Coordinator

It was a chilly evening, but not as cold as last year. Last year, we did this event in November and it was very cold. This year, a warm but not winter jacket did the trick. We arrived and found Don waiting at the gate. Assuming the gate was locked, I called Nick, our contact at AZ Cardinals Prep School. He didn't answer, so I wandered over to the gate, found it unlocked, and opened it for Don and me to go through. As the rest of the Telescope Team arrived, we all came to park on the grass, and we held the event on the parking lot area. I think I liked the parking lot area better than the grass, as it wasn't as cold on the feet. The pizza was already there, so we ate first. As we ate, some of us finished and went off to set up our scopes. It was after 6:30 when the last of us set up, but the crowd was patient. They just loved Bruce's 20" scope and saw Jupiter right away. Don moved over by me, and so we were last to get organized. The sunset was AWESOME!

The night progressed with only a few people to start, but as the night went on, I would guess we had 300-350 people there. The clouds had the sky for some of the night

so Jupiter and the Moon were the main objects. Don later showed the Perseus Double Cluster. Since I was doing prizes and questions, I asked William to keep the scope on the Moon. I filtered it with a Red filter and they all seemed to like that. There were several kids who hung out by me as I was giving out prizes. I would ask a question and give a prize related to the question. So, I asked a question about constellations, and for each correct answer, I gave a constellation card. For the Moon book, I asked questions about the Moon. For the red flashlights, I asked questions about what planets are visible that night. And then I also gave away PAS bookmarks. I had fun, but it was tiring. We also gave away raffle tickets to those who attended, kids only, and if they went to talk to Meteorite Man, and came back with some new info they could tell me about, they earned extra tickets. Good thing I brought a new roll of tickets with me. Jonathan was an awesome person to have around. He asked tons of questions and gave me tons of answers, and collected all 12 of the constellation cards. He stuck with me the whole time. Then, it was time for the raffle. MANY MANY thanks to Tim Jones

for picking up a starter scope from Fry's Electronics and splitting the cost with PAS to donate it to one of the kids from the school through the raffle tickets. Also, we donated one meteorite. The raffle was at 8pm. Right after the raffle, everyone left. Orion won the telescope and Jackie won the meteorite. Congrats to Orion and Jackie!!!

I wish to send many thanks to all the Telescope Team members who joined us: Bruce Wurst, Bette Wurst and William Finch ran the handout table, Don Boyd, Tim Jones, Gilbert Gomez, Mike Marron with his meteorites, and Sam and Frank Insana. No donations were collected for gas money, but the hand out table was nearly bare by the end of the event.

And I wish to thank Nick for inviting us to hold the event, and for providing pizza and water. The meal was just enough to keep us content and was easy and quick to eat, and then we were able to go set up our scopes. Thanks to all!!

We (Nick and I) are considering setting up another event to view Saturn. Watch for an announcement on this idea in upcoming issues, or check the PAS website Calendar at [www.pasaz.org](http://www.pasaz.org). \*\*

## CVEMS: The Newest Threat To Our Dark Skies

From page 1

Also, I took part in a MAG (Maricopa Association of Governments) stake-holders committee representing the local amateur astronomy community. They had called SAC looking for a volunteer to participate; since I had recently given my Light Pollution presentation to SAC, they nominated me and I gladly accepted. Working with other stake-holders (including several professional astronomers), we drafted a "model lighting ordinance" that, although not enforceable, is held up as an example, ready to enact, for any municipality in the County. It was exciting and gratifying to be able to participate in that process. This is what I wish to share with the PAS Members at the February 3 PAS Meeting. \*\*\*

Dan Heim, the guest speaker at the February PAS meeting, is the president of Desert Foothills Astronomy Club. He has written three Night Sky books. He was very involved as the PAS President before starting the DFAC club in the New River area. Dan publishes a weekly Focus online column "Sky Lights" with questions and answers, photos, links, and more at:

[www.thefoothillsfocus.com/SkyLights.asp](http://www.thefoothillsfocus.com/SkyLights.asp).

\*\*\*

For the February meeting we are back in the library rather than Room G-147.,



This is the sign Dan is talking about in the first paragraph of this article.

Photo courtesy of Dan Heim

## Telescope Workshop Of Jan 13

By Terri, Event Coordinator

PAS members participating were Don Boyd, Rod Sutter, Bob Senzer, Terri and William Finch, Mike Marron, and Frank Insana. I wish to thank the PAS volunteers for helping with this event, as well as the attending public who also made this event such a great success. The attending members of the public were: 1. Phil & Nina, 2. Lynn & Shane & Gabe, and 3. Kraig. We had RSVP's from five telescope owners, but only three of them showed up. Maybe we will see Rich and Justin another time.

The event started with Rod already sitting by the telescope dome at the picnic table. William and I joined him and were chatting when Don joined us. Then Frank showed up with his binoculars on a tripod. Dave came to open the door to G-147 and we went inside. Rod stayed outside with the first two telescope owners: Phil and Lynn.

Rod and Frank wandered indoors about the time I had gotten all the handouts neatly placed on the table, and asked Dave for use of the Dobsonian scope. So, they wheeled it out and Frank showed Jupiter. After a while, the people needing help with their scopes moved indoors with the rest of us, and Rod left.

Inside, as usual, Mike was the center of attention and stole the show. He shared the Earth's crust example along with his meteorites. You have to see it to understand what I am referring to; but it was very interesting and kept the attention of Phil, Nina, Lynn, Shane and Gabe for quite a while. Kraig joined us at the table and we just sat there and enjoyed what Mike had to show.

As we were packing up, the handouts were finding their way into everyone's hands and I was happy about that. There are photos in the Photo Gallery for this event. I took several, so enjoy!

When the event was over, we were out of G-147 around 9pm, and the PAS TEAM went to Village Inn for a snack. It was a good time, good food, great people, and we really enjoyed it. Got done there around 11pm. Wasn't too late of a night, and it was

very productive and everyone seemed to enjoy themselves a whole bunch. Many thanks to Dave for hosting this event in G-147 and lending us the large Dobsonian scope to show Jupiter. \*\*\*



## Bookman's Telescope Workshop Dates In 2011

By Terri, Event Coordinator

The flier will be updated as soon as the December 2010 Bookman's event goes past. Here are the verified, schedule Bookman's

dates for 2011. Feb 6, Mar 6, Apr 3, May 22, June 12, July 10, Aug 14, Sep 11, Oct 9, Nov 13 & Dec 11. Put them in your calendar and help Don & I share the wonders of

enjoying a telescope, by assisting at these Workshops. Your help is greatly appreciated. \*\*\*

## PAS Meeting Review of 1/6

From page 1

of those items and to Sam for the popcorn, which was all gone by the time I got there at 7:28pm. The plates were brought by me,

and the water was donated to the club by Ed Wurst.

Overall, it was a very brief meeting, quick and to the point, and everyone was

intrigued and interested in the topic being presented. See you at the next PAS Meeting. Bring snacks to share! \*\*\*



# Arizona Sky

By Leah Sapir

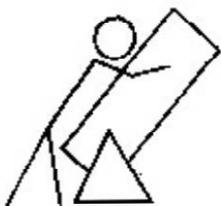
One of the gems of the winter sky is the Pleiades. Follow Orion's belt to the right, past the V-shaped head of Taurus the bull, to find this lovely star cluster. Its brightest stars are visible to the naked eye; many more can be seen in binoculars or a small telescope. The cluster includes several hundred stars.

The Pleiades cluster is about 430 light years away, and about 12 light years across. Some of its stars are surrounded with a beautiful nebulosity (visible in very dark skies or in photographs), which was once thought to be the remains of the nebula where the stars formed. But it turns out that the stars and the surrounding nebulosity are moving in different directions. As they fly through space together, the stars of the Pleiades are simply travelling through a dusty area and lighting it up for us as a reflections nebula. The "dusty area" is part of the Taurus-Auriga Dark Cloud, a huge dark nebula of dust and gas. Only small parts of it are illuminated by stars.

Nine of the stars in this cluster have common names. Of these, the five brightest form a tiny "dipper" shape visible to the naked eye. In the picture shown here, the bowl of the dipper is tilted and resembles a diamond shape, surrounded by nebulosity, with Maia at 12:00, Electra at 3:00, Merope at 6:00 and Alcyone at 9:00. Atlas, which forms the "handle" of the "dipper", is left of Alcyone. Pleione is the slightly fainter star just above Atlas. Celaeno is the fainter star above Electra; Taygeta is above/right of Maia; and Asterope (also called "Sterope") is the pair of stars above/left of Maia.

All of these are type-B blue stars, with a surface temperature ranging from 12,000 to 14,000 degrees C, a mass of 3 to 6 solar masses, and a radius of 3 to 10 times that of the Sun. Some of them are still fusing hydrogen, and some are starting to run out of hydrogen in their core and beginning the transition to the giant phase, where they will be fusing helium instead. Alcyone is the brightest, with a luminosity 2400 times that

of the Sun. Electra is 1225 times the Sun's luminosity, Atlas is 940 times, and the others have luminosities ranging from 200 to 660 times that of the



The Pleiades: Star Cluster with Nebulosity

Image credit: Dario Salerio and [www.astronomy.fm](http://www.astronomy.fm)



NGC 1514: The Crystal Ball Nebula in Taurus  
Image credit: NASA/JPL-Caltech/UCLA/DSS

# Arizona Sky

Sun. Much of this light is in the ultraviolet range.

All of the stars but Maia are rotating very rapidly: Pleione is spinning at 200 miles per second (165 times the Sun's rate of rotation), Merope at 175 mps (140 times the Sun's rate), and the others at speeds ranging from 80 to 130 mps (60 to 100 times the Sun's rate). Pleione's extremely high rate is close to the speed that would cause the star to disintegrate.

As a result of the rapid rotation, each of the stars is wider at the equator and compressed at the poles, and each is casting out a disk of hydrogen at its equator. The stars' light passing through the hydrogen disk produces emissions lines in the stars' spectra, just like an emissions nebula, and they are therefore known as "Be" (B-emission) stars. Pleione, the fastest, on occasion casts off a complete shell of gas, brightening as it does so. Over the past hundred years, Pleione has alternated between being an ordinary B-star, a Be-star, and a "shell star" for periods of 16 to 30 years in each stage. Currently it is in the "Be-star" stage, and it actually has not one but two equatorial disks of hydrogen, aligned at a 30-degree angle to each other.

Not to be outdone, slow-moving Maia is a "mercury-manganese star". Its slow speed of rotation allows various elements to circulate to the surface, where we can detect them in the star's spectrum.

Most of these stars have close companions, less than 5 AU from the primary (i.e. closer to the primary than Jupiter's distance from the Sun). Alcyone also has several companions about 1/4 to 1/3 of a light year away: they can be seen in the picture slightly above/right of Alcyone.

A charming asterism near Alcyone is the chain of stars extending down from Alcyone towards the bottom of the picture. The top stars are blue-white, but the bottom ones are yellow. This line of stars has been nicknamed "Ally's braid", and is visible in binoculars.

While the nine named stars and other "main-sequence" stars are the prime attraction in the Pleiades, the cluster also includes a large number of white dwarf stars. White dwarfs are usually the last stage in the lifetime of smaller stars – the remaining core of the star after it has gone through the red giant and planetary nebula stages. Only stars with less than 1.4 solar masses will

become a white dwarf; larger stars will explode as supernovae instead when they reach the end of their lifetime.

But smaller stars last longer than large stars (billions of years for small stars compared to millions for the large ones). So how could this cluster have so many white dwarfs? The stars of the cluster all formed at the same time, and its blue stars are still going strong. There wouldn't have been time yet for smaller stars to reach the white dwarf stage.

Apparently the white dwarfs started out as large B-type stars, but over time they lost most of their mass in various ways – either by a brisk stellar wind, or by mass loss to binary companions, or by material cast off in their rapid rotation – which reduced their mass to the level at which they could become a planetary nebula, and their core would remain as a white dwarf.

The cluster also includes a large number of brown dwarfs. These are dense spheres of hydrogen, ranging in mass from about 15 to 80 times the mass of Jupiter (1.5 to 8% of a solar mass), that form along with other stars by condensation from a nebula, but do not have sufficient mass at the time of their formation to begin hydrogen fusion. Brown dwarfs radiate a small amount of infrared light, due to gravitational contraction and a small amount of fusion of deuterium (a type of hydrogen that has both a proton and a neutron in its nucleus; deuterium undergoes fusion a bit more easily than ordinary hydrogen). Brown dwarfs generally have a radius slightly larger than Jupiter, but are much denser. And they carry much less mass than the smallest stars. Up to 1/4 of the stars in the Pleiades cluster might be brown dwarfs, but they contribute only about 2% of the cluster's mass.

The Pleiades cluster is about 100 million years old, and the stars will probably stay together for another 250 million years before drifting apart.

Not far from the Pleiades is a beautiful planetary nebula, NGC 1514, also known as the Crystal Ball Nebula. NGC 1514 is about 4000 light years away, and about two light years in diameter. It was discovered by William Herschel in 1790. Until that time, astronomers had explored various fuzzy objects, which were all referred to as "nebulae", and found that many of them were actually star clusters. By increasing the magnification and resolution of their

telescopes, the astronomers could resolve some of the "nebulae" into stars. Therefore, the general assumption was that as telescopes improved, all "nebulae" would eventually be resolved as star clusters, and their "fuzziness" was only due to their distance and the lack of better telescopes.

But when Herschel examined NGC 1514, he found that he could resolve the central star, but not the outer nebulosity. He reasoned that the outer layers could not be composed of stars, because if so, why could he resolve the central star but not the outer ones? He therefore concluded that this nebula was a star with an atmosphere. In 1791 he described it as: "A most singular phenomenon! A star of about 8th magnitude with a faint luminous atmosphere, of circular form, and about 3 minutes in diameter. The star is perfectly in the center and the atmosphere is so delicate, faint and equally throughout that there can be no surmise of its consisting of stars; nor can there be a doubt of the evident connection between the atmosphere and the star. Another star, not much less in brightness and in the same field as the above, was perfectly free from any such appearance."

Today we know that the central star of NGC 1514 is a spectroscopic binary – two stars so close together that we cannot separate them in a telescope, orbiting each other in less than 10 days per cycle. Only their spectra reveal that two stars are present. The central pair, or perhaps just the larger of the two stars, has expelled multiple shells of gas, creating the intricate structure seen in the picture. The shells are expanding at a rate of 30 miles per second. The blue-green color is a result of doubly ionized oxygen, which fluoresces when it is illuminated by ultraviolet light from the central stars.

A little closer to home, Jupiter is still putting on a show in the evening sky, but beginning to set earlier: 10 pm at the beginning of February, and 8:30 pm towards the end of the month. Saturn is now rising earlier: 11 pm in early February, and 9 pm at the end of the month. Venus is a morning star, rising around 4 am throughout the month. Mercury is visible in morning twilight during the first half of the month only; and Mars is too close to the sun for viewing.

Join us next time when we continue to explore the winter and spring constellations. And till then – wishing you clear skies, and happy observing!



# Planets in Strange Places

By Trudy E. Bell

Red star, blue star, big star, small star—planets may form around virtually any type or size of star throughout the universe, not just around mid-sized middle-aged yellow stars like the Sun. That's the surprising implication of two discoveries in 2006 from the 0.85-meter-diameter Spitzer Space Telescope, which is exploring the universe from orbit at infrared (heat) wavelengths blocked by the Earth's atmosphere.

At one extreme are two blazing, blue "hypergiant" stars 180,000 light-years away in the Large Magellanic Cloud, one of the two companion galaxies to our Milky Way. The stars, called R 66 and R 126, are respectively 30 and 70 times the mass of the Sun, "about as massive as stars can get," said Joel Kastner, professor of imaging science at the Rochester Institute of Technology in New York. R 126 is so luminous that if it were placed 10 parsecs (32.6 light-years) away—a distance at which the Sun would be one of the dimmest stars visible in the sky—the hypergiant would be as bright as the full moon, "definitely a daytime ob-

ject," Kastner remarked.

Such hot stars have fierce solar winds, so Kastner and his team are mystified why any dust in the neighborhood hasn't long since been blown away. But there it is: an unmistakable spectral signature that both hypergiants are surrounded by mammoth disks of what might be planet-forming dust and even sand.

At the other extreme is a tiny brown dwarf star called Cha 110913-773444, relatively nearby (500 light-years) in the Milky Way. One of the smallest brown dwarfs known, it has less than 1 percent the mass of the Sun. It's not even massive enough to kindle thermonuclear reactions for fusing hydrogen into helium. Yet this miniature "failed star," as brown dwarfs are often called, is also surrounded by a flat disk of dust that may eventually clump into planets. (This brown dwarf discovery was made by a group led by Kevin Luhman of Pennsylvania State University.)

Although actual planets have not been detected (in part because of the stars' great

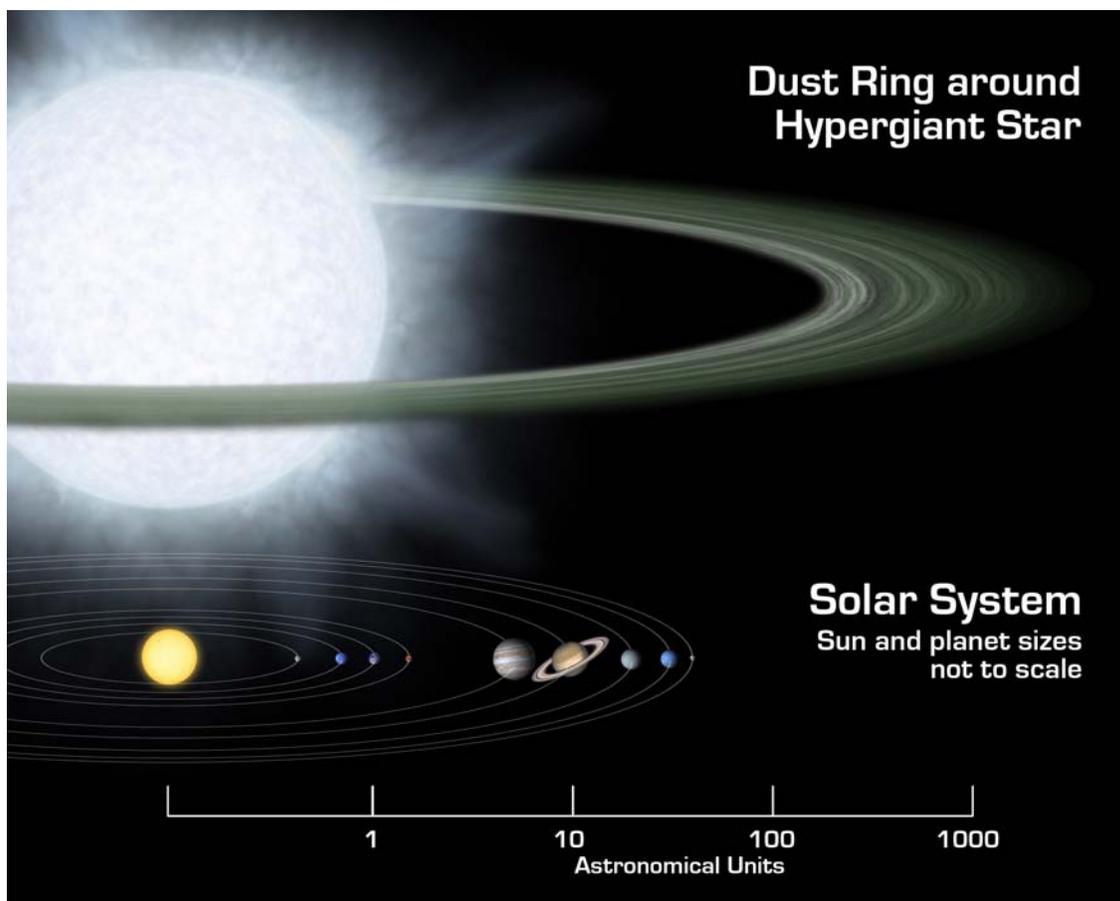
distances), the spectra of the hypergiants show that their dust is composed of forsterite, olivine, aromatic hydrocarbons, and other geological substances found on Earth.

These newfound disks represent "extremes of the environments in which planets might form," Kastner said. "Not what you'd expect if you think our solar system is the rule."

Hypergiants and dwarfs? The Milky Way could be crowded with worlds circling every kind of star imaginable—very strange, indeed.

Keep up with the latest findings from the Spitzer at [www.spitzer.caltech.edu](http://www.spitzer.caltech.edu). Kids and their grownup friends can enjoy beautiful images from Spitzer while playing Spitzer Concentration at The Space Place ([spaceplace.nasa.gov/en/kids/spitzer/concentration](http://spaceplace.nasa.gov/en/kids/spitzer/concentration)).

*This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.*



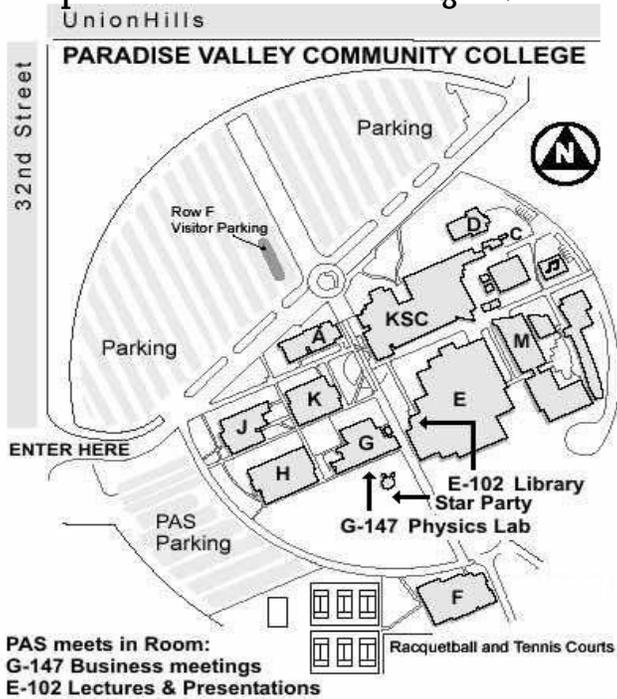
Artist's rendering compares size of a hypothetical hypergiant star and its surrounding dusty disk to that of our solar system.

# Map to PAS Meeting Location

# A Huge Thank You From Park Ridge School

By Alison Thammavongsa - Event was on Nov 17, 2010

Thank you so much to you and your team for coming out last night. The telescopes and Meteorite Man were a HIT! I can't thank you enough for taking time out of your evening to help out. Please pass this along to the other team member that helped out last night. I couldn't have done it without you. Thanks again. Alison \*\*\*



Please see page 2 for more information

## February

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3 PAS meeting	4	5 CEO
6 Bookman's Telescope Workshop	7	8 CTCA	9	10 PVCC Telescope Workshop	11	12
13	14	15	16	17 Desert Mountain School Star Party	18	19
20	21	22 CTCA Backup date	23	24 Gavilan Peak School Star	25	26 VSP
27	28					

### Ads in PAStimes

Ads in PAStimes run for a month and may be renewed on a month-by-month basis, if submitted by deadline, space permitting. Ads in PAStimes are FREE to members. All others are asked to make a small donation. Donations are to be sent to the Vice Prez who will forward them to the Treasurer.

Don Boyd  
PAStimes Editor  
701 W. Del Rio St.  
Chandler AZ 85225

To:

## PAS Speaker Line-up for 2011

By Terri, Event Coordinator

Mar 3 in G 147: Dennis Young "Astro-Scenic-Photography and More"

Apr 7: Richard Hill - Topic: TBA

May 5 in G-147: Dolores Hill "Touchy Feely Meteorites"

May 19 in G-147: Robert Piccioni "Einstein for Everyone"

We have an awesome line-up of guest speakers to finish out this PAS season. Should you have an idea for a future guest speaker, please send those suggestions to [Events@pasaz.org](mailto:Events@pasaz.org). I will do my best to get them as our next guest speaker. To find out more about our upcoming guest speakers, please visit this [link: http://www.pasaz.org/forums/downloads.php?do=file&id=8](http://www.pasaz.org/forums/downloads.php?do=file&id=8) \*\*\*

PAS is incorporated in the state of Arizona as a non-profit, scientific and educational 501(c)(3) organization. Our newsletter PAStimes is published monthly from September to May and distributed by US PS and the Internet. All Issues are available for download on our website [www.pasaz.org](http://www.pasaz.org) Ads for astronomy equipment are provided as a courtesy to sellers and buyers, and do not constitute any endorsement by PAS. All Photos by Don Boyd unless otherwise credited. All articles and photos are copyright their authors or PAStimes.

## What's Up For February?

By Rod Sutter, PAS President

Name	Date	Rise	Set
Mercury	02-1-11	06:31	16:37
Venus	02-1-11	04:20	14:33
Mars	02-1-11	07:27	17:57
Jupiter	02-1-11	09:45	21:47
Saturn	02-1-11	22:52	10:33
Uranus	02-1-11	9:36	21:33
Neptune	02-1-11	08:08	19:04
Pluto	02-1-11	407:49	17:57

All Times Arizona Time

February 15 2011

**Sunrise: 07:08**

**Sunset: 18:10**

**Q3: January 26**



**New: February 3**



**Q1: February 11**



**Full: February 18**

