

# THE OBSERVER

## East Valley Astronomy Club

### From the Desk of the President

by Steven Aggas

Several months from now (it's the perfect time to put these things on your calendar!) we will have the All Arizona Star Party. AASP is scheduled for October 28 and 29, 2011, the Friday and Saturday after the New Moon. The moon is only 2 days old on 10/28 and should set fairly early and only slightly later the next night.

As expected, by then the Monsoons will have dissipated leaving us with cooler, dryer air... The location is the same as last year on BLM land, known as the 'Antennae Site'. It's located a couple of miles south of I-10 at the Hovatter Road exit (#53), about 90 miles west of Phoenix. Complete directions and maps are on the web site.

Next thing for your calendar is club elections! Nominations occur in

October and elections are held during the November meeting. The positions available, based upon preferences and the two-year limit imposed by the club's constitution, are president, treasurer, a couple of spots on the board of directors, and, someone to take on the meeting refreshments job. We'll have the complete list to you soon. I encourage everyone to consider helping the club by participating in one of these positions thereby creating the meetings and events you want to see.

The Citizen Scientist program, a program developed to investigate the science that can be done on the 16" scope at GRCO, is up and running! If you are interested in joining, send me an email; [President@evaonline.org](mailto:President@evaonline.org), and I'll add you to

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### UPCOMING EVENTS:

*Public Star Party - August 12*

*General Meeting - August 19*

*Local Star Party - August 20*

*Deep Sky Observing Night - August 27*

*Check out all of the upcoming club events in the Calendars on page 8*

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### The Backyard Astronomer

#### Grand Canyon North Rim Star Party by Bill Dellings

**M**y wife Lora and I attended the last four nights of the GCSP at the North Rim. It was our 12<sup>th</sup> visit there since 1996, the other four being at the South Rim. We should buy a condo up there.

As usual, the telescopes were set up on the veranda between the lodge and edge of the Canyon, not a

whole lot of room. Each night there were about eight to ten scopes set up, the largest being SAC's Steve Dodder's 20" Dob. Steve has been the North Rim coordinator for several years now.



Before making the trip up there, I discovered, to my dismay, that having delayed contacting him to reserve a spot on the veranda, they had enough

telescopes already. But he welcomed me nevertheless adding that perhaps someone might no-show and I could then swing into action. Sounded good to me, the North

Rim in any fashion is better than a sharp stick in the eye.

Relieve! Before leaving, Steve emailed that the Park wanted to try something new:

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# The Backyard Astronomer

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having a few scopes a short distance from the Lodge at the Bright Angel Trailhead. Would I be interested? Sure! So off we went with our CRV packed with my trusty C-8 and 17 tons of equipment.



All four nights were clear with some intermittent pestering winds. On the trailhead I had the company of Jan and Wheeler, and their 16" Dob. For three nights we enjoyed a steady but reasonable flow of visitors. It was a welcome change from the crush of humanity one normally experiences on the space-challenged veranda. Jan and Wheeler had a beautiful location with an excellent view of the south. I had a good southwest window that was perfect for Saturn all night. But trees reduced my southern exposure such that I could only view it between two large trees, just enough, happily, to fit the entire constellation

of Scorpius.

Viewing it under those conditions was reminiscent of using a transit telescope!

I got a big charge out of the reaction of people who observed Saturn in my telescope. That little C-8



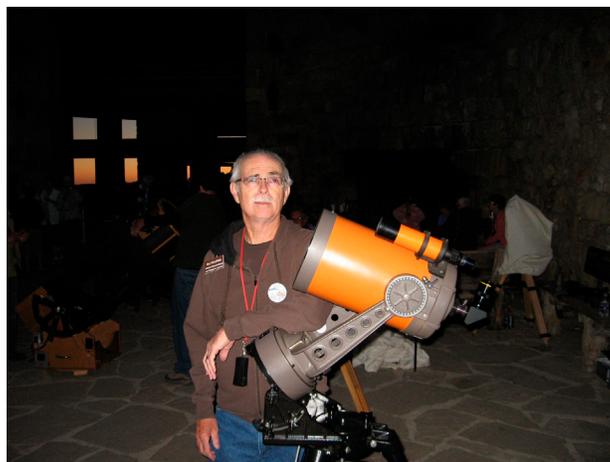
gave remarkably sharp images of the ringed planet at 160x and 200x. I got plenty of the common remarks: "It looks like a picture!" "Looks like a cartoon!" "You've got a slide in there!" "No! That's not really Saturn, is it?"

During the day we had a solar observation session from 10am to about 1pm. SAC president Chris Hanrahan had a PST on deck. Linton Rohr, another SAC member, set up his Lunt 60mm H-Alpha scope and impressive meteor collection. I had a Lunt 80mm H-Alpha scope on hand. We did a land office business. Unfortunately, Linton's 60mm Lunt got blown over by the wind the last day. I only did two hours because of the heat. Though I wore protective clothing and a wide brimmed hat, I still suffered burned lips for a week. Next time I'll use heavy duty lip balm.

A highlight of the trip this year was numerous sightings of the Kaibab Squirrel, a large critter with a long fluffy white tail, only found on the North Rim. Oh yes, the supernova in M51 in Steve Dodder's 20" was a thrill too, though it was dimmer than I expected. EVAC's Tim Sexton saved the day (or should I say night?) by repairing a broken wire on my 12 volt battery – thank you Tim!



The last night I was going to be alone on the trailhead as the 16" couple had left. Steve invited me down with the rest of the troops and it was good to mingle again with fellow stargazers. Over 400 people looked through my telescopes during our stay. At the North Rim I often joke I have the smallest telescope there. This year someone said, yeah, but you had the biggest solar scope here!



**MARK YOUR CALENDARS EARLY...**

**2012 GRAND CANYON**

**STAR PARTY**

**JUNE 16<sup>TH</sup> - 23<sup>RD</sup>**

# Stellar Clusters (Part One)

by Henry De Jonge IV

## Introduction

Most if not all stars are thought to be born in groups or clusters, (at least before they become separated) so that the understanding of clusters can shed light on many facets of stellar and galactic formation and evolution. Clusters are groups of stars that are physically associated and they come in a variety of sizes and shapes. We will examine and discuss various types of star groupings and clusters. Groups of stars can be classified many ways usually depending upon size.

There are stellar associations, clusters, and of course galaxies.

## Stellar Associations

A stellar association is a group of stars that were formed together but are more loosely linked than a star cluster. They usually lie in the spiral arms of galaxies, are usually comprised up of newly formed stars and help define the shape of the spiral arms. An OB association, T association, and R association are examples.

An OB association is a group of stars that share this spectral type. They are usually massive, hot stars that have just been formed or are in the process of forming. An OB association is usually not very dense, commonly having just tens or hundreds of members. Due to their great brightness they can be seen at great distances and also if there are any low mass members they will be faint and hard to see over the glow of their larger mass members. The Great Nebula in Orion is a classic example of an OB association, even close enough that we can see some low mass members.



*The Orion Trapezium OB Association*

These associations are known for their powerful stellar winds and can often be seen in the gas rich spiral and irregular galaxies. Due to the high average mass these associations are also known as a rich source of SN. These associations are thought to be a primary breeding

ground for the major-

ity of stars in the Milky Way. They are not usually long lived with lifetimes extending only a few tens of millions of years at best. The nearest OB association to us is the Scorpius-Centaurus association, which is about 400 light years from the Sun.

A T association is a region of recent and active star formation generally of relatively low mass stars and sun like stars. These stars are in the pre main sequence portion of the HR diagram and are often called T Tauri stars. These low mass stars are formed throughout the clouds of T associations, with an occasional high mass star usually being detected. These stars offer us a view of what our early Sun was like and the forma-

tion of planets.

These young stars can also have tremendous stellar winds, accretion disks, bipolar outflows, protoplanetary disks, and are usually quite variable in their brightness. The nearest example is the Taurus-Auriga T association about 140 parsecs from the Sun. Other examples of T associations include the R Corona Australis T association, the Lupus T association, and the Chamaeleon T association.

R associations are groups of stars that illuminate reflection nebulae and are similar to OB associations but of smaller size and mass, usually 3-10 solar masses in total size. These associations have many low mass stars that do not exert enough activity to push out all the original gas from whence they formed, thus reflecting their radiation. These small associations are very numerous in spiral galaxies. An example of an R-association is Monoceros R2, located about 830 parsecs from the Sun

We must realize that the delineation of these groups is not always clearly defined and that sometimes the stars do not fall into our nicely defined groupings. We also know that most associations are only temporary.

## Clusters

There are many types of clusters such as embedded clusters, moving clusters, galactic, (or open) clusters, super star clusters, and globular clusters. Clusters are usually larger than associations and have their own unique properties. Sometimes the smaller clusters can also be defined as associations or have imbedded associations within them.

An embedded cluster is a small group of stars in the process of formation still embedded in the ISM from which they formed. They are best seen in the IR wavelengths. A famous example of an embedded cluster is the Trapezium cluster.



*HST images of the Trapezium cluster in optical on the right and IR on the left.*

A moving cluster is a group of stars close enough to Earth to have their distance measured by parallax and all moving in approximately the same direction. By projecting the spatial motion of the cluster back in time it will tend to converge on a single point. The direction of this convergent point is parallel to the motion of the cluster. Observing parallax of the individual stars within the cluster will give a value for the average parallax and therefore the distance of the system. The closest moving cluster is the Ursa Major Moving Group which includes most of the stars in the Big Dipper asterism. This now dispersed open cluster is about 80 light years distant and is thought to

*Continued on page 4*

# Stellar Clusters

*Continued from page 3*

have formed about 500 million years ago. It seems to be moving in the direction of Sagittarius. Thus the Big Dipper appears to be an older grouping of related stars unlike most other constellations. Another close moving, (open) cluster is the Hyades.

## Open Clusters

The cluster groupings are open clusters, (also known as galactic clusters), super star clusters, and globular clusters.

Open clusters are loose and irregularly shaped star clusters that contain a few tens to a few thousand stars. Their mass represents about 10,000-30,000 solar masses at the high end. Basically they are a locally enhanced region of stellar density compared to the surroundings. Some well known open clusters are the Pleiades and the Hyades.



*The Pleiades open cluster*

The stars in open clusters are gravitationally bound and are also thought to arise from the same molecular cloud although many members are seen to move independently within the cluster to an extent. This loose attraction can also cause members to become expelled from the cluster and opens it up to deeper disruption from passing gravitational influences. The boundaries of these open clusters are generally not well defined and can be a bit "fuzzy". A typical radius is about 10 light years and the stellar distribution within the cluster is varied. They also they lack the smaller concentrated center like a globular cluster. As a result their maximum lifetimes are on the order of only tens of millions of years.

Many types of stars can be found in these young clusters especially massive O and B stars, main sequence variables, and the famous Cepheid variables. Typically these clusters are found in the galactic plane and can be used to trace the spiral arms of galaxies. The Milky Way is thought to contain some several thousand open clusters.

Some examples of open clusters are Pis 24 in the central cavity of NGC6357, of which one of the largest molecular clouds therein has a mass of hundreds of thousands solar masses. This open cluster is about 2 million years old, contains about a dozen O type stars and many OB stars. The distance is estimated to be about 1.7-2.6 Kpc. There is a tremendous amount of obscuring dust in this cluster as many of the "hid-

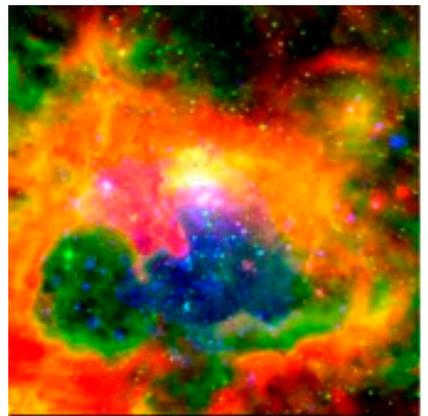
den" stars were detected via IR and X-ray imaging. Thus it is a region of active and intense star formation and one can see how the massive stars of Pis24 have blown out a huge bubble in the cluster.

Open clusters that are relatively close can offer us an opportunity for many direct measurements and observations which can then be used to test various theories. For example in the open cluster M34 about 470 pc distant, they recently have monitored the rotation rates for over 100 stars photometrically in an attempt to determine a gyrochronology age of about 240Myr. This compares with the HR age of 177-251 Myr. (See the article on stellar gyrochronology for a fuller explanation).

Another example of an open cluster is NGC 3532 about 490 pc distant, a rich cluster which has a great number of faint low mass stars with an age of about 300Myr, +/- 100Myr as determined by the HR method.



*Full optical view of NGC 6357*



*NGC 6357 image in X-ray from Chandra*



*HST image of Pis24-1 in the core of NGC 6357*

The total mass of this cluster is at least 2,000 solar masses or about 1900 stars of which about 27% are known to be binary. It also has a collection of about half a dozen white dwarfs, and about a dozen giant stars.

Open cluster observations can also lead to new mysteries. Just recently in the young open cluster NGC 2632, at least 10 binary systems were discovered including a contact binary. This is a young cluster with an age of about 300-500 million years. Typically contact binaries are found in older clusters of

many billions of years old due to the powerful stellar winds of young star formation. One thought is that perhaps there is an unseen 3rd companion star that is causing this to occur?

There are actually relatively few open clusters that have been observed in detail despite their

*Continued on page 13*

*The Observer*

## August Guest Speaker: Bill Peters

This month Bill Peters will be our guest speaker. Bill will talk to us about Meteors and Meteorites.

A meteoroid is a suggested term for a sand- to boulder-sized particle of debris in the Solar System. The visible path of a meteoroid that enters Earth's (or another body's) atmosphere is called a meteor, or colloquially a shooting star or falling star. If a meteoroid reaches the ground and survives impact, then it is called a meteorite.

Many meteors appearing seconds or minutes apart are

called a meteor shower. The root word meteor comes from the Greek *meteōros*, meaning "high in the air".

Neither the Minor Planet Center nor JPL uses the term *meteoroid*.

As of 2011 the International Astronomical Union officially defines a meteoroid as "a solid object moving in interplanetary space, of a size considerably smaller than an asteroid and considerably larger than an atom".



*A multicolored Perseid meteor striking the sky just to the right from Milky Way. Image courtesy of Mila Zinkova.*

☾ **FIRST QUARTER MOON ON AUGUST 6 AT 04:08**

● **FULL MOON ON AUGUST 13 AT 11:58**

☾ **LAST QUARTER MOON ON AUGUST 20 AT 14:55**

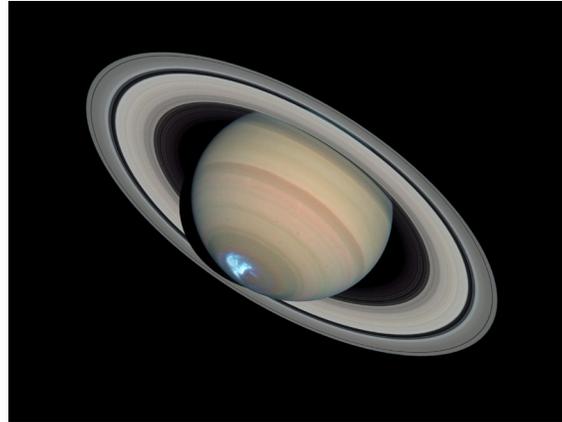
○ **NEW MOON ON AUGUST 28 AT 20:03**

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# Upcoming Meetings

August 19  
 September 16  
 October 21  
 November 18  
**December 16**  
 January 20

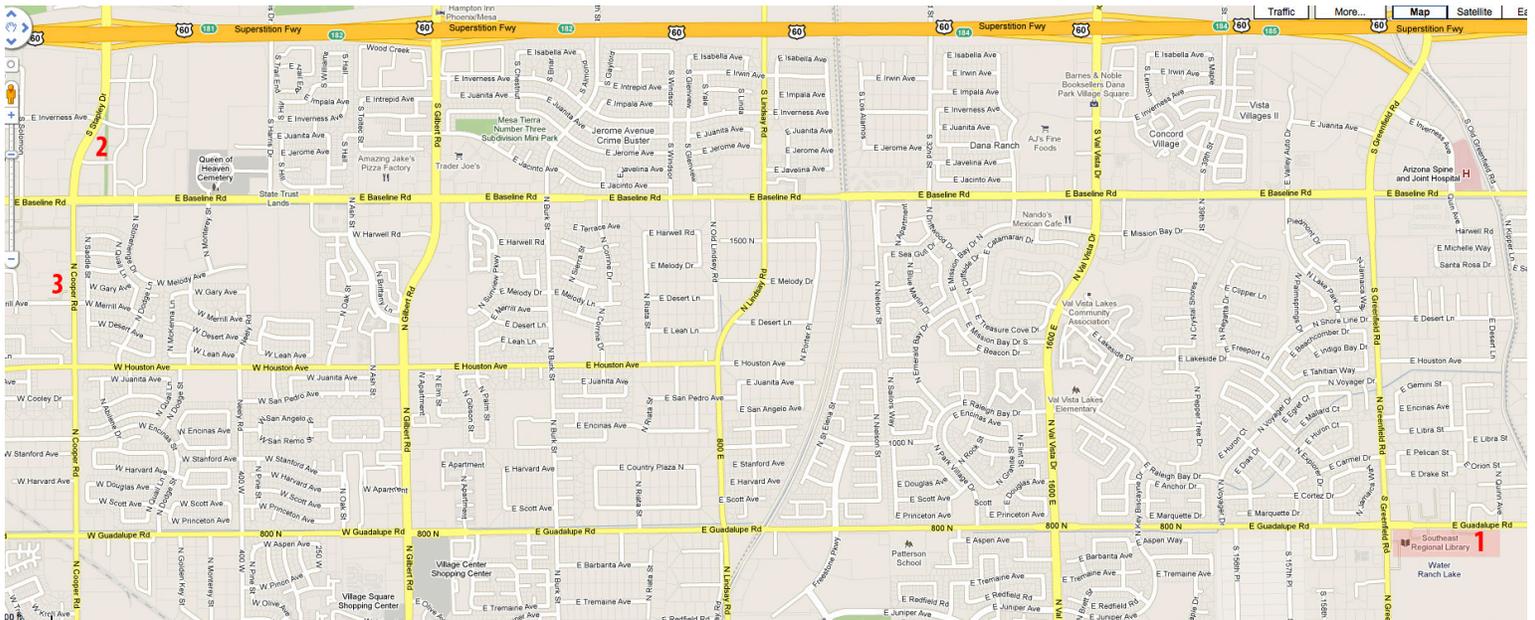
The monthly general meeting is your chance to find out what other club members are up to, learn about upcoming club events and listen to presentations by professional and well-known amateur astronomers.

Our meetings are held on the third Friday of each month at the Southeast Regional Library in Gilbert. The library is located at 775 N. Greenfield Road; on the southeast corner of Greenfield and Guadalupe Roads. Meetings begin at 7:30 pm.

All are welcome to attend the pre-meeting dinner at 5:30 pm. We meet at Old Country Buffet, located at 1855 S. Stapley Drive in Mesa. The restaurant is in the plaza on the northeast corner of Stapley and Baseline Roads, just south of US60.

Likewise, all are invited to meet for coffee and more astro talk after the meeting at Denny's on Cooper (Stapley), between Baseline and Guadalupe Roads.

**Visitors are always welcome!**



**2** Old Country Buffet  
 1855 S. Stapley Drive  
 Mesa, Az. 85204

**1** Southeast Regional Library  
 775 N. Greenfield Road  
 Gilbert, Az. 85234



**3** Denny's  
 1368 N. Cooper  
 Gilbert, Az. 85233



## AUGUST 2011

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	<b>12</b>	13
14	15	16	17	18	<b>19</b>	<b>20</b>
21	22	23	24	25	26	<b>27</b>
28	29	30	31			

**August 12** - Public Star Party & SkyWatch at Riparian Preserve

**August 19** - General Meeting at SE Library

**August 20** - Local Star Party at Boyce Thompson

**August 27** - Deep Sky Observing Night. Head out to your favorite dark sky site and observe!

## SEPTEMBER 2011

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8	<b>9</b>	10
11	12	13	14	15	<b>16</b>	<b>17</b>
18	19	20	21	22	23	<b>24</b>
25	26	27	28	29	30	

**September 9** - Public Star Party & SkyWatch at Riparian Preserve

**September 16** - General Meeting at SE Library

**September 17** - Local Star Party at Boyce Thompson Arboretum

**September 24** - Deep Sky Observing Night. Head out to your favorite dark sky site and observe!

# East Valley Astronomy Club -- 2011 Membership Form

Please complete this form and return it to the club Treasurer at the next meeting or mail it to EVAC, PO Box 2202, Mesa, Az, 85214-2202. Please include a check or money order made payable to EVAC for the appropriate amount.

**IMPORTANT: All memberships expire on December 31 of each year.**

Select one of the following:

- New Member
  Renewal
  Change of Address

**New Member Dues** (dues are prorated, select according to the month you are joining the club):

- |   |   |
|---|---|
| <input type="checkbox"/> <b>\$30.00 Individual</b> January through March  | <input type="checkbox"/> <b>\$22.50 Individual</b> April through June       |
| <input type="checkbox"/> <b>\$35.00 Family</b> January through March      | <input type="checkbox"/> <b>\$26.25 Family</b> April through June           |
| <input type="checkbox"/> <b>\$15.00 Individual</b> July through September | <input type="checkbox"/> <b>\$37.50 Individual</b> October through December |
| <input type="checkbox"/> <b>\$17.50 Family</b> July through September     | <input type="checkbox"/> <b>\$43.75 Family</b> October through December     |
- Includes dues for the following year*

**Renewal** (current members only):

- \$30.00 Individual**
 **\$35.00 Family**

**Name Badges:**

- \$10.00** Each (including postage) Quantity: \_\_\_\_\_

Name to imprint: \_\_\_\_\_

**Total amount enclosed:**

*Please make check or money order payable to EVAC*

- Payment was remitted separately using PayPal
  Payment was remitted separately using my financial institution's online bill payment feature

Name:

Phone:

Address:

Email:

City, State, Zip:

Publish email address on website  
 URL:

How would you like to receive your monthly newsletter? (choose one option):

- Electronic delivery (PDF) *Included with membership*
 US Mail **Please add \$10 to the total payment**

**Areas of Interest** (check all that apply):

- |  |   |
|--|---|
| <input type="checkbox"/> General Observing   | <input type="checkbox"/> Cosmology        |
| <input type="checkbox"/> Lunar Observing     | <input type="checkbox"/> Telescope Making |
| <input type="checkbox"/> Planetary Observing | <input type="checkbox"/> Astrophotography |
| <input type="checkbox"/> Deep Sky Observing  | <input type="checkbox"/> Other            |

Please describe your astronomy equipment:

Would you be interested in attending a beginner's workshop?  Yes  No

How did you discover East Valley Astronomy Club?

**PO Box 2202**  
**Mesa, AZ 85214-2202**  
**www.evaonline.org**

All members are required to have a liability release form (waiver) on file. Please complete one and forward to the Treasurer with your membership application or renewal.

# Liability Release Form

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**In consideration of attending any publicized Star Party hosted by the East Valley Astronomy Club (hereinafter referred to as “EVAC”) I hereby affirm that I and my family agree to hold EVAC harmless from any claims, liabilities, losses, demands, causes of action, suits and expenses (including attorney fees), which may directly or indirectly be connected to EVAC and/or my presence on the premises of any EVAC Star Party and related areas.**

**I further agree to indemnify any party indicated above should such party suffer any claims, liabilities, losses, demands, causes of action, suits and expenses (including attorney fees), caused directly or indirectly by my negligent or intentional acts, or failure to act, or if such acts or failures to act are directly or indirectly caused by any person in my family or associates while participating in an EVAC Star Party.**

**My signature upon this form also indicates agreement and acceptance on behalf of all minor children (under 18 years of age) under my care in attendance.**

**EVAC only recognizes those who are members or invitees and who also have a signed Liability Release Form on file as participants at an EVAC Star Party.**

---

*Please print name here*

---

*Date*

---

*Please sign name here*

**PO Box 2202  
Mesa, AZ 85214-2202  
[www.eastvalleyastronomy.org](http://www.eastvalleyastronomy.org)**

## New GOES-R to Give More Tornado Warning Time

by Dauna Coulter and Dr. Tony Phillips

So far this spring, more than 1,400 tornadoes have struck the U.S. Some of them have cut jaw-dropping trails of destruction across the countryside and, tragically, across inhabited communities, too. Hundreds of lives have been lost in the onslaught.

Throughout the season, the National Weather Service has routinely issued tornado alerts. In the case of the Alabama

tornadoes of April 27th, forecasters warned of severe weather five full days before the twisters struck. Because they couldn't say precisely where the twisters would strike, however, many of their warnings went unheeded.

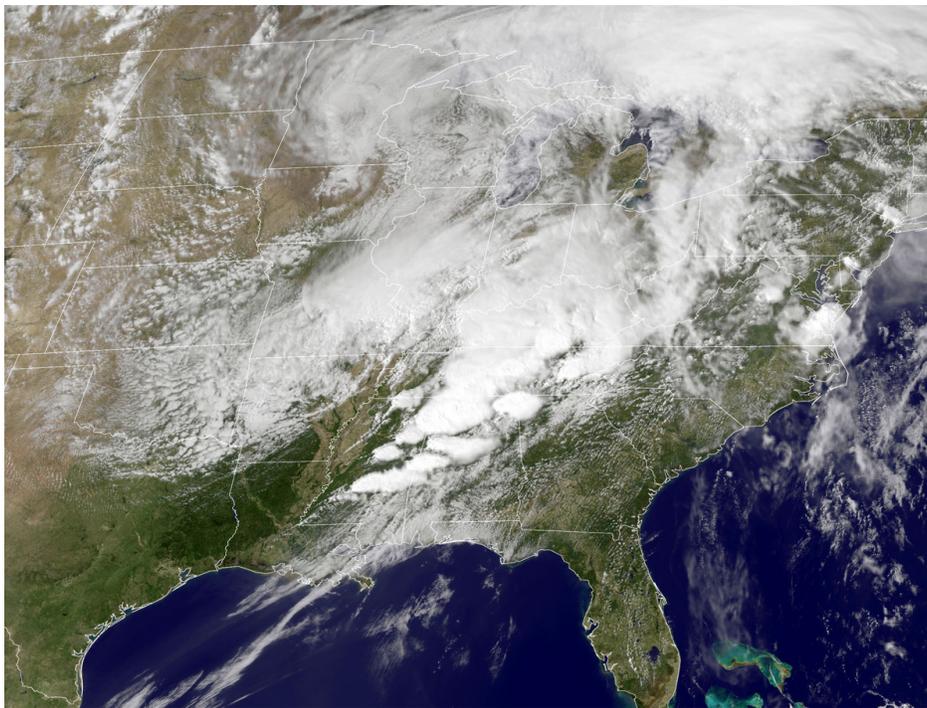
"If people get a hurricane warning, they often evacuate the area," notes NOAA's Steve Goodman. "But we react differently to tornado warnings."

Perhaps it's because tornadoes are smaller than hurricanes, and the odds of a direct hit seem so remote. Recent pictures from Tuscaloosa, Alabama, and Joplin, Missouri, however, show the perils of playing those odds. Goodman believes that more precise warnings could save lives.

To fine-tune tornado warnings, NOAA will soon launch the first in a series of next-generation weather satellites – GOES-R (Geostationary Operational Environmental Satellites-R series). The spacecraft is brimming with advanced sensors for measuring key ingredients of severe weather including winds, cloud growth, and lightning.

"GOES-R will be the first geostationary spacecraft to carry a lightning sensor," says Goodman, the GOES-R Program Senior Scientist. "Studies show that sudden changes in the total lightning activity correlate with storm intensity—and with tornadoes."

The lightning mapper will detect and map not only cloud-to-ground lightning, but also bolts within and between clouds. The kind of cloud-to-ground lightning we see from our front yards accounts for only 15-20 percent of total lightning. To get a clear idea of a storm's intensity, meteorologists need to know about all the lightning—a view GOES-R can provide.



*This GOES image shows the storms that spurred the intense April 27 tornado outbreak in the southern U.S. Animation showing the development of weather can be seen at <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=50347>.*

All by itself, the lightning mapper will provide 7 minutes more lead time in tornado warnings, according to Goodman. GOES-R's state-of-the-art instruments will also improve long-range forecasts.

"The satellite's Advanced Baseline Imager (ABI), for instance, will provide a much clearer picture of clouds," says NOAA research meteorologist Tim Schmit. Compared to lesser instruments already in orbit, ABI can better detect super-cold "overshooting

tops," evidence of enormous energy and upward velocity that correlate with subsequent severe weather.

"Accurate advanced notice of high-risk tornadic conditions can cue officials to close schools and businesses even before tornadoes are actually detected," says Schmit.

Forecasters doubt tornadoes can ever be predicted with 100% accuracy. The twisters are just too capricious. GOES-R, however, is a step in the right direction.

Find out more about GOES-R's unprecedented capabilities at <http://www.goes-r.gov>. Young people can learn more about tornadoes and all kinds of other weather at <http://scijinks.gov>.

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

# If It's Clear...

by *Fulton Wright, Jr.*

## Prescott Astronomy Club

**AUGUST 2011**

*Celestial events (from Sky & Telescope magazine, Astronomy magazine, and anywhere else I can find information) customized for Prescott, Arizona. Remember, the Moon is 1/2 degree or 30 arcminutes in diameter. All times are Mountain Standard Time.*

Comet C/2009 P1 (Garradd) continues to put on a show this month. Interesting things happen on August 1, 19, and 26. See Astronomy, August 2011, p. 42 for details.

On Friday, August 5, the Moon is at first quarter phase and sets at 11:08 PM.

On Saturday, August 6, all night, the asteroid 1 Vesta will be at opposition and at its brightest (magnitude 5.6). It will be of special interest because a spacecraft will be in orbit around it, mapping its surface. You might also want to look for it on August 30. It will be a bit dimmer (magnitude 6.2) but only 10 arcminutes from the 4th magnitude star Psi Capricorni. It should be pretty bright for the whole month. See Sky & Telescope, August 2011, p. 53 or Astronomy, August 2011, p. 43 for finder charts,

On Saturday, August 6, after about 8:00 PM, you can observe

my favorite 3 craters on the Moon. Ptolemaeus, Alphonsus, and Arzachel are strung out near the terminator as you head south from the Moon's equator. Notice the increasing prominence of central peaks and Ptolemaeus's hexagonal shape. The next night (the 7th) you can find Plato in the north, Clavius just coming into view in the South, and the Straight Wall south and planetary west of Arzachel. Notice that the Moon is in Scorpius, just half a degree from M 80 (which will be hard to see because of the Moon's glare).

On Saturday, August 13, at 7:08 PM (12 minutes before sunset), the full Moon rises spoiling any chance of seeing faint fuzzies or most of the Perseid meteors which are at their peak tonight.

On Sunday, August 21, the Moon is at last quarter phase and rises at 11:26 PM.

On Saturday, August 27, from 10:26 PM (shortly after Jupiter rises) till 12:41 AM (Sunday), you can see Ganymede's shadow on the far southern part of Jupiter.

On Sunday, August 28, it is new Moon so you have the whole night to hunt for faint fuzzies.



## From the Desk of the President

*Continued from page 1* the email groups of the topics of interest. The next meeting is on August 14<sup>th</sup> from 3 to 5pm at the Library. We discuss spectroscopy, photometry, occultations, and astrometry, and, by the next meeting, we should have certain pieces of equipment to begin testing them on the telescope. Join us, we'll learn something together.

At our next General Assembly meeting in August we will have Mr. Bill Peters presenting an interesting talk on meteor-

ites and meteors! Please join us August 19<sup>th</sup> to hear about not only how to spot a genuine space-rock but easy tests you can do to verify it!



# Stellar Clusters

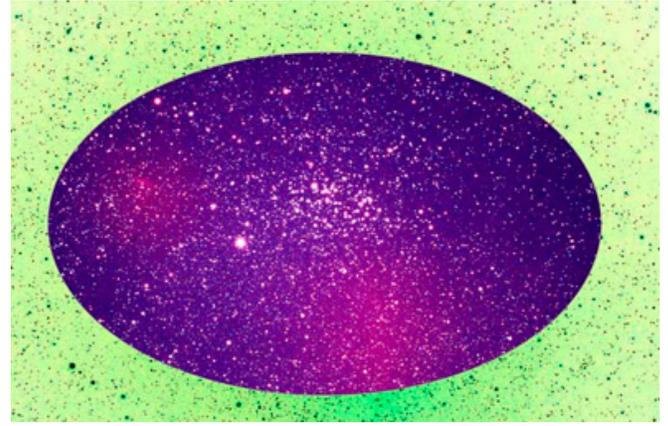
*Continued from page 4*

number and general nearness. There are active programs in operation by astronomers today, to observe and catalog open clusters in detail on an ongoing basis.

## Summary

We see that stellar associations and clusters, like stars, come in many sizes and usually have distinctive properties associated with these sizes. Open clusters that are relatively close by can be observed and studied to test theories and raise new questions for future study.

One new idea that is being discussed is comparing the open cluster networks in galaxies to the complex networks and theories usually applied to other complex networks like the internet, biological, and social networks. This application may help us in finding new open clusters and better understanding



NGC 3532



M34 as seen in the IR

their physical interactions with each other and their host galaxies. There is still much that remains to be understood about stellar birth and evolution as it pertains to associations and open clusters.

So far we have discussed the relatively smaller stellar clusters in part I. We will continue our discussion of clusters by examining super star clusters, globular clusters, and some general properties of clusters in part II.

**Do you like getting involved with the general public and sharing both your knowledge and love of astronomy?**

**Would you like to learn the operations of an amateur observatory?**

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**Then please volunteer to join the staff at Gilbert Rotary Centennial Observatory**

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**I Want You  
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**As one of the many benefits to becoming an East Valley Astronomy Club member, we have an 8 inch Dobsonian reflector with eyepieces available for monthly check-out to current EVAC members. Have any questions, or interested?**

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480-433-4217**



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