

THE OBSERVER

East Valley Astronomy Club

From the Desk of the President by David Douglass

I think EVAC has set a new record. We actually had an election in November! There were five Board seats open, and there were seven candidates. Congratulations to the newly elected Officers, and Board Members for 2013. Election results are on page 4 of this issue of the Observer.

The December 21st EVAC meeting is the annual Holiday Season Pot Luck. There will not be a regular meeting, this is purely a social gathering.

The January 2013 meeting for EVAC will be very special. Dr. Michael Barratt, a two time ISS visitor, will be our speaker. He traveled to the ISS via Russian Soyuz in 2009 for a 199 day stay, and also traveled on the last flight of the Shuttle Discovery in 2011. The January meeting will be devoted entirely to Dr. Barratt's presentation. We are going to have a seating problem. We believe we can seat about 250 people, with standing room for another 50. Admission to this meeting will be by reservation, with

The Backyard Astronomer Arizona Astronomy Expo 2012 by Bill Dellings

Talk about being a kid in a candy store, I was in telescope heaven at the first annual Astronomy Expo in Tucson November 10th and 11th.

The fun began even before entering the Tucson Convention Center as an array of Hydrogen alpha and white light telescopes greeted me. Nothing like getting warmed up for a telescope show by viewing the sun in a 6" HA scope! It was to be all uphill after that.

The program listed about 80 vendors

first come first served reservations being allowed for 2012 or 2013 dues paid EVAC members. Not all seats are for EVAC. About 50 seats will be allocated to SAC members (part of the arrangement with NASA).

There will be a second presentation by Dr. Barratt on Saturday morning, for those who could not get seating for Friday night. Additionally, a Saturday afternoon presentation is going to be offered by the Town of Gilbert, open to the public, by reserved seating. See a separate article in this issue for more information. EVAC will attempt to get an email to all 2012 and/or 2013 dues paid members with complete details.

I will be out of state during the last half of December, and will miss the Pot Luck. I hope everyone has a joyous Holiday season, and I look forward to seeing everyone at the January meeting(s). Until then, remember, check the details for attending in January, and "Keep Looking Up"!

and I believe most if not all of them were there. It was a pleasure to see up close and personal many of the beautiful telescopes and accessories from those ads in the astronomy magazines.

Some of my favorites were the large aperture Plane Wave CDK reflectors, Astro-Physics 175mm (6.9") and 130mm (5.1") APO refractors on their respective 1600 and Mach 1 equatorial mounts. The 175mm refractor on their new 1600 mount and Eagle folding

Continued on page 4

UPCOMING EVENTS:

Local Star Party - December 8

Public Star Party - December 14

Deep Sky Observing Night - December 15

Holiday PotLuck - December 21

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

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The Backyard Astronomer

Continued from page 1 pier on display had a package price of \$43,000. Ouch!

On the other end of the price spectrum was a gorgeous compact Stellarvue 70mm refractor in a soft carry bag for \$400. Celestron, Meade, Vixen, and Lunt also had a beautiful array of equipment displayed.

EVAC's Ed Thomas of Deepspace Products was present and I chatted with him about his products. Perhaps the most unusual thing I saw was an Explore Scientific 3", 30mm eyepiece with matching 3" to 2" diagonal. It was interesting to meet the people behind the products who I had only spoken to previously by phone or email, like Tanya (OPT), Rikki (Lunt), Wayne (Starlight Instruments), Vic Maris (Stellarvue), Kevin (Woodland Hills), Art Ciampi (TNR) and Brian Deis of Vixen Optics.

I also spotted and chatted with many of the "usual



suspects" from EVAC and SAC.

For years I'd been reading with envy the reports of the Northeast Astronomy Forum (NEAF) but had been reluctant to attend because of the distance involved. Now we have our own version of NEAF only 100 miles away. How much did I spend? Only \$36 on a Rigel red dot finder. However, I did win a Lunt 6" F6 white light refractor valued at \$950 in the event's raffle. I shall return!



EVAC Holiday Pot Luck Dinner

Friday, December 21st 7:30 pm

As is the club's custom, the December general meeting will be replaced by a Holiday Pot Luck dinner. EVAC will provide the meat, soft drinks, utensils and plates. Please bring a side dish or a dessert to share.

The festivities this year will be held at the site of our monthly meetings, the Southeast Regional Library in Gilbert.

Revisiting M31

by Henry De Jonge IV

Introduction

Next to the Milky Way the galaxy M31, (aka NGC 224) or the Andromeda Galaxy is one of my favorites. We have known a lot about this galaxy since it was first officially recorded in 964AD by the Persian astronomer Al-Sufi as a little cloud. It can be seen by the naked eye in a relatively dark spot and is a favorite among viewers of the heavens. However recently new knowledge has been discovered about M31 and it would be good to briefly review some of this enlightening new information about an old favorite. As usual many new questions are also brought about.

Some Brief Basics

M31 is a large spiral galaxy about 780 Kpc distant from us or about 2.574 Mly. It contains about one trillion solar masses, (Vs. the roughly 200-300 billion solar masses of the MW) and is in the range of at least 200,000ly in diameter which makes it a bit larger than our own Milky Way, (MW). This very large diameter has been increased from that of past years due to the discovery that the main disk of M31 is actually much larger than earlier thought, as many more stars even though they are spread out from the main disk, were found to actually be part of the galaxy's main disk. Our own galaxy may also be larger than we think due to this effect but this has yet to be verified. It is classified as a SA(s)b galaxy and the bulge may also have a barred shape like our MW.

One should bear in mind that these mass estimates only include the known "normal" matter and do not include any contributions from DM. Due to more stars M31 is a bit brighter than our own MW by about 25%. It is believed that M31 formed like most galaxies, (and the MW) by the gradual accretion of smaller groups of hundreds of proto galaxies, stars, dust, and gas, all regulated by the scaffolding of DM and the still unknown influence of BHs. The disk of M31 is estimated to be about 6- 8Gyr old.

M31 played a key role in defining the Universe as we know it today by being the galaxy that Hubble used in 1925 in identifying Cepheid variables and determining that the Andromeda nebulae was in fact a totally separate and distant galaxy in its own right. This immediately opened up our Universe

and began our serious study of galaxies.

M31 has over a dozen small satellite galaxies with 2 main companions, M110, (aka NGC205) and M32, (NGC 221). M110 is a dwarf spheroidal galaxy with a low amount of dust and gas



and yet seems to be experiencing some star formation. It was seen by both Messier in 1773 and Caroline Herschel in 1783 and has not yet shown evidence of having a BH in its center. M32 is a dwarf elliptical galaxy satellite around M31 and is thought to be an ancient collection of stars about the same age as the oldest members of M31 and the Milky Way. It is larger than M110. M32 also contains very little

dust and gas and has definitely been acted upon many times by past gravitational galactic interactions with M31 and like M110 is pretty much stripped of its gas. It was first described by LeGentil in 1749. However it is thought that M32 contains a relatively large BH at its center of about 1.5-4 million solar masses, which would be fairly large for such a small galaxy. However M32 would have definitely been larger in the past before numerous M31 gravitational interactions dominated it.



M32 above and M110 below



M31 is part of our Local Group and the largest member with the Milky Way next in line. If we look at the largest 3 galaxies in the Local Group then M33, (aka the Triangulum Galaxy which is about 800Kpc from the MW like M31 and with about 10% of the mass of the MW) is next and we note that all 3 are spirals. We also know that M33 and M31 are gravitationally bound as partners, just as M31 and the Milky Way are bound. In fact there is a large neutral H bridge between these M31 and M33. It is about 50-115 Kpc long, stretching at least halfway between these galaxies, and is thought to be the remnant of a past gravitational interactions between them. However there remains much more investigation of this bridge in order to come to a more

complete understanding. Thus the 3 large spirals, M31, M33, and the Milky Way are in fact all gravitationally bound into a single system and will in the future experience more gravitational interactions.

M31 has more x-ray sources than the Milky Way both in number and luminosity-

Continued on page 13

January 18: a Very Special EVAC Meeting

Advance Reservations Required

The January 18th, 2013 EVAC meeting will be a special event; there will not be any regular business conducted. The entire meeting will be devoted to our featured speaker, Dr. Michael Barratt, MD MS, NASA Astronaut.

Dr. Barratt has been to the ISS twice. His first trip was in 2009, via a Russian Soyuz, and was for a 199 day stay. His second trip was about the last flight of the Shuttle Discovery in 2011. He has some remarkable stories to share with us, including many photos, and movie clips.

We will have a seating problem. The library meeting room will seat about 250 people. The exact number of seats will be tested in the coming days. There should be room for perhaps another 50 people, in standing room conditions. EVAC has about 150 dues-paid members (2012 and/or 2013 and/or Life). We are allocating 200 seats for EVAC, and 50 seats for SAC (part of the arrangements with NASA). All guidelines stated below are subject to change as needs arise.

When asked at the October meeting, about how many people would come to this meeting, there was a large show of hands. When asked how many might bring another family member, there was also a large show of hands.

Thus, we have scheduled two (2) meetings. The first will be Friday evening (normal EVAC time). The second will be the following morning (Saturday, January 19th). And there will be a third presentation on Saturday afternoon (January 19th), which will be hosted by the Town of Gilbert and open to the public with seating by reservation.

Dues-paid EVAC members (2012 and/or 2013 and/or Life) can request advanced reservations for this event. However, we must initially limit the number of reservations to 2 seats per member for the Friday evening presentation. Reservations will be granted on a first come-first served basis. Advanced reservations for Saturday morning will also be first come-first served, but will have a limit of 5 seats per request.

On January 2nd, an assessment will be made of the number of reservations for both events, including the 50 seats allo-

cated to SAC for Friday evening. At that time, any available seating or standing room only space will be made available to dues-paid EVAC members (2012 and/or 2013 and/or Life) and SAC members for unrestricted numbers of seats, until the allocation is full. On January 10th, any remaining seating or standing room will be made available to any EVAC members. Reservations will continue to be made during the entire process on a first come-first served basis, based upon email date stamps.

EVAC members must have their dues paid (as posted by the EVAC Treasurer on the evaonline.org website) at the time of the reservation. There will be no formal EVAC meetings between now and the presentation. Thus, dues must be paid by US Mail, or by PayPal online at the evaonline.org website. You can verify your dues-paid status, by looking at the following link: <http://evaonline.org/member-directory.asp>

Please note that the website list shows about 311 current or former members of EVAC. There are 49 names that expired at the end of 2011. 112 names expired prior to that, a separate matter that we will be looking into. You can find your dues-paid status in the far right column.

To request seating, send an email to President@evaonline.org showing the members name, and requested number of seats (or standing room). You will receive an email acknowledgement when the reservation is confirmed. **You must check-in by 7:20 PM on Friday evening, or 9:20 AM on Saturday morning to guarantee your admission. After those times, remaining space will be released to those seeking admission without reservations.**

When information is available on the booking (reservation) process for the Town of Gilbert presentation, that information will be sent via email to the EVAC list server, and a link will also be posted to the information on the evaonline.org website.

Any questions about this event should be emailed to: President@evaonline.org

2013 EVAC Officers & Board Members

The elections are over and the votes have been tallied. Here are the club officers for 2013:

President: David Douglass
Vice President: Ed Thomas
Secretary: Marty Pieczonka
Treasurer: Ray Heinle

Board Members:
David Hatch
Ron Barstad
Bob Alba
David Shiel
Alex Rivera

January Guest Speaker: Dr. Michael Barratt (M.D., M.S., NASA Astronaut)

Dr. Michael Barratt was born in Vancouver, Washington but considers Camas, Washington to be his home town. He and his wife have five children. Personal and recreational interests include writing, sailing, boat restoration and maintenance, family and church activities.

Dr. Barratt earned a B.S. in Zoology from the University of Washington in 1981; M.D. from Northwestern University in 1985. He completed 3-year residency in Internal Medicine at Northwestern University in 1988 followed by a Chief Residency year at Veterans Administration Lakeside Hospital in Chicago in 1989. Dr. Barratt then completed residency and Master's program in Aerospace Medicine at Wright State University in 1991. He is Board certified in Internal and Aerospace Medicine.

Organizations: Aerospace Medical Association and the American Association for the Advancement of Science.

Special Honors: W. Randolph Lovelace Award (1998), Society of NASA Flight Surgeons; Rotary National Award for Space Achievement Foundation Nominee (1998); Melbourne W. Boynton Award (1995), American Astronautical Society; USAF Flight Surgeons Julian Ward Award (1992); Wright State University Outstanding Graduate Student, Aerospace Medicine (1991); Alpha Omega Alpha Medical Honor Society, Northwestern University Medical School, Chicago, IL (1988); Phi Beta Kappa, University of Washington, Seattle, WA (1981).

Experience: Dr. Barratt came to NASA JSC in May 1991 employed as a project physician with KRUG Life Sciences, working on medical systems for Space Station Freedom. In July 1992, he was assigned as NASA Flight Surgeon, working in Space Shuttle Medical Operations. In January 1994, he was assigned to the joint U.S./Russian Shuttle - Mir Program, working and training extensively in the Cosmonaut Training Center, Star City, Russia, in support of the Mir-18/STS-71 and subsequent missions.

From July 1995 to July 1998, he served as Medical Operations Lead for the International Space Station (ISS). A frequent traveler to Russia, he worked with counterparts at the Gagarin Cosmonaut Training Center and Institute of Biomedical Problems as well as other international partner centers. Dr. Barratt served as lead crew surgeon for the first expedition

crew to ISS from July 1998 until he was selected as an astronaut candidate.

Dr. Barratt serves as Associate Editor for Space Medicine for the journal, Aviation, Space and Environmental Medicine and is senior editor of the textbook, Principles of Clinical Medicine for Space Flight. NASA Experience: Selected as a mission specialist by NASA in July 2000, Dr. Barratt reported for training in



August 2000. Following the completion of 2 years of training and evaluation, he was assigned technical duties in the Astronaut Office Station Operations Branch.

Assigned to long duration flight training in 2005, Dr. Barratt launched on Soyuz TMA-14 on March 26, 2009, to the ISS and served as a member of Expeditions 19 and 20. This time period included the transition from three to six permanent ISS crewmembers, two EVAs, two visiting space shuttles and the arrival of the first Japanese H-II Transfer Vehicle (HTV). Completing 199 days in space, Dr. Barratt landed on October 11, 2009.

STS-133 (February 24 to March 9, 2011), was the 39th and final mission for Space Shuttle Discovery. During the 13-day flight, the Discovery crew delivered the Permanent Multipurpose Module (PMM) and the fourth Express Logistics Carrier (ELC) to the ISS. The mission's two spacewalks assisted in outfitting the truss of the station and completed a variety of other tasks designed to upgrade station systems. The mission was accomplished in 202 Earth orbits, traveling 5.3 million miles in 307 hours and 3 minutes.

Currently, Dr. Barratt manages the Human Research Program at NASA Johnson Space Center. This program guides applied research oriented toward mitigating the most prominent health and performance risks associated with human spaceflight.

☾ **LAST QUARTER MOON ON DECEMBER 6 AT 08:32**

○ **NEW MOON ON DECEMBER 13 AT 01:42**

☽ **FIRST QUARTER MOON ON DECEMBER 19 AT 22:20**

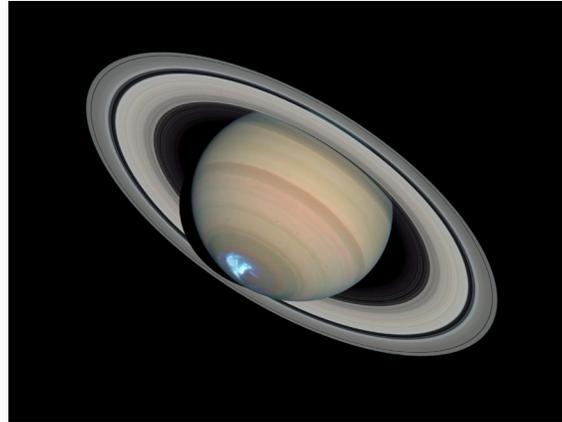
● **FULL MOON ON DECEMBER 28 AT 03:21**

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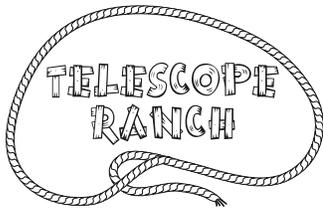


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Upcoming Meetings

December 21
Holiday PotLuck

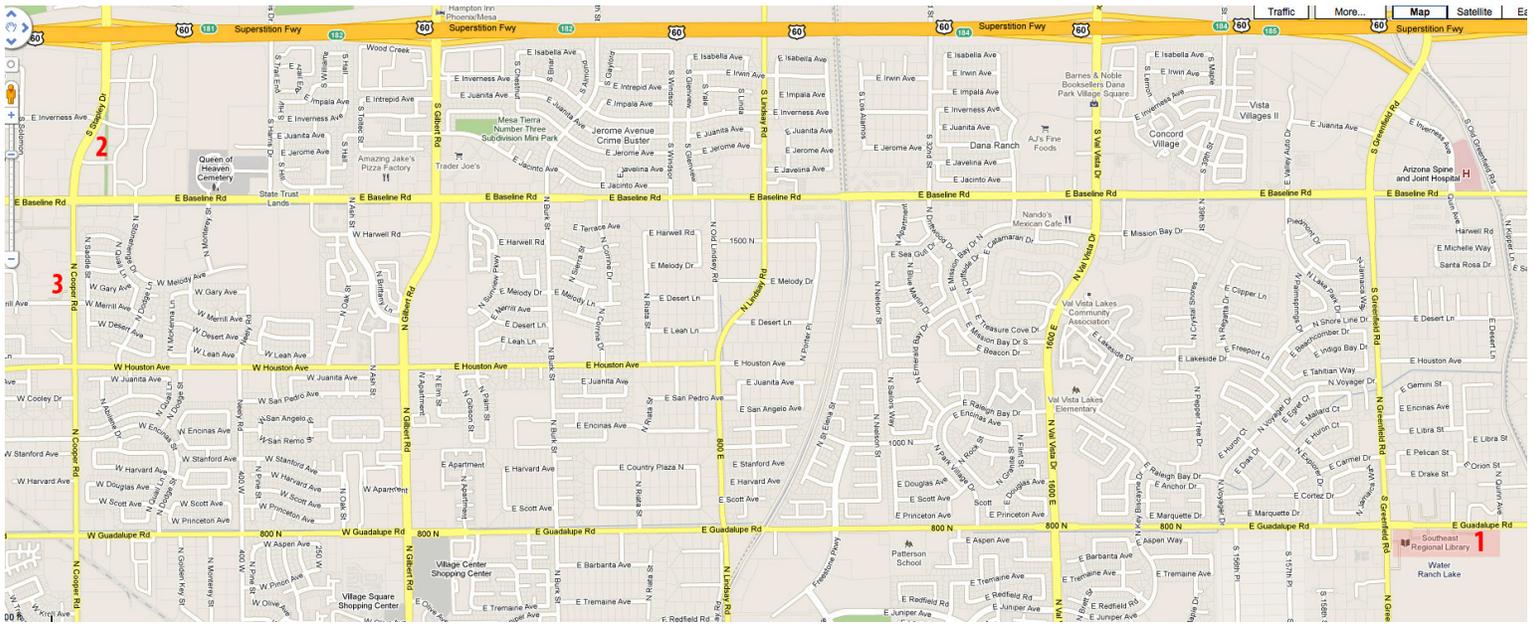
January 18
February 15
March 15
April 19
May 17

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.

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



DECEMBER 2012

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

December 5 - Edu Prize Gilbert Star Party

Party

December 7 - Salt River Tribal Library Star Party

December 14 - Public Star Party & SkyWatch

December 8 - Local Star Party at Boyce

December 15 - Deep Sky Observing Night

Thompson

December 20 - St. Mary - Basha Catholic School

December 8 - Sheraton Wild Horse Pass Star

Star Party

Party

December 21 - Holiday PotLuck at SE Library

December 13 - Akimel A-AI Middle School Star

December 29 - Az Cultural Academy Star Party

JANUARY 2013

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

January 5 - Local Star Party at Boyce Thompson

January 18 - Special Meeting at SE Library

January 10 - Centennial Middle School Star Party

January 22 - Payne Junior High Star Party

January 11 - Public Star Party & SkyWatch at

January 23 - Kyrene Middle School Star Party

Riparian Preserve

January 29 - Concordia Charter School Star Party

January 12 - Deep Sky Observing Night

January 31 - Basha Elementary Star Party

January 17 - Charlotte Patterson Elementary Star

Party

East Valley Astronomy Club -- 2013 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"/> \$30.00 Individual January through March | <input type="checkbox"/> \$22.50 Individual April through June |
| <input type="checkbox"/> \$35.00 Family January through March | <input type="checkbox"/> \$26.25 Family April through June |
| <input type="checkbox"/> \$15.00 Individual July through September | <input type="checkbox"/> \$37.50 Individual October through December |
| <input type="checkbox"/> \$17.50 Family July through September | <input type="checkbox"/> \$43.75 Family 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.evaconline.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

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**

It Takes More Than Warm Porridge to Make a Goldilocks Zone

by Diane K. Fisher



The “Goldilocks Zone” describes the region of a solar system that is just the right distance from the star to make a cozy, comfy home for a life-supporting planet. It is a region that keeps the planet warm enough to have a liquid ocean, but not so warm that the ocean boils off into space.

Obviously, Earth orbits the Sun in our solar system’s “Goldilocks Zone.”

But there are other conditions besides temperature that make our part of the solar system comfortable for life. Using infrared data from the Spitzer Space Telescope, along with theoretical models and archival observations, Rebecca Martin, a NASA Sagan Fellow from the University of Colorado in Boulder, and astronomer Mario Livio of the Space Telescope Science Institute in Baltimore, Maryland, have published a new study suggesting that our solar system and our place in it is special in at least one other way.

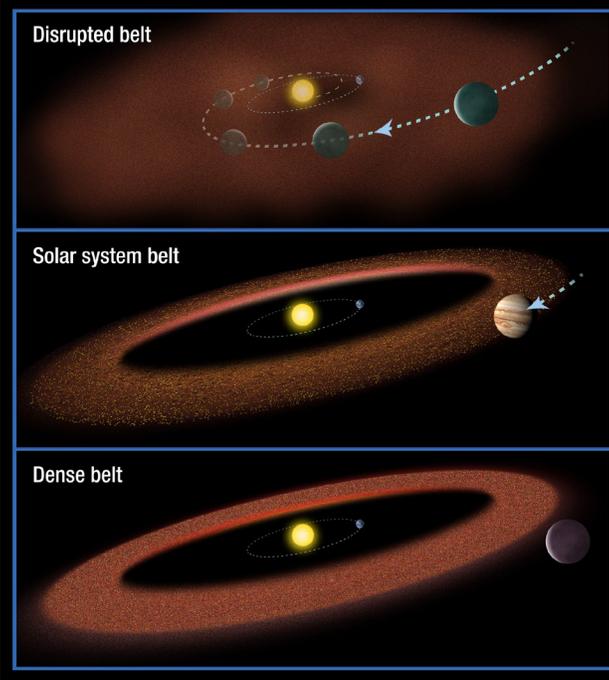
This fortunate “just right” condition involves Jupiter and its effect on the asteroid belt.

Many other solar systems discovered in the past decade have giant gas planets in very tight orbits around their stars. Only 19 out of 520 solar systems studied have Jupiter-like planets in orbits beyond what is known as the “snow line”—the distance from the star at which it is cool enough for water (and ammonia and methane) to condense into ice. Scientists believe our Jupiter formed a bit farther away from the Sun than it is now. Although the giant planet has moved a little closer to the Sun, it is still beyond the snow line.

So why do we care where Jupiter hangs out? Well, the gravity of Jupiter, with its mass of 318 Earths, has a profound effect on everything in its region, including the asteroid belt. The asteroid belt is a region between Mars and Jupiter where millions of mostly rocky objects (some water-bearing) orbit. They range in size from dwarf planet Ceres at more

than 600 miles in diameter to grains of dust. In the early solar system, asteroids (along with comets) could have been partly responsible for delivering water to fill the ocean of a young Earth. They could have also brought organic molecules to Earth, from which life eventually evolved.

Three scenarios for asteroid-belt evolution



Our solar system is represented by the middle scenario, where the gas giant planet has migrated inward, but still remains beyond the asteroid belt.

Jupiter’s gravity keeps the asteroids pretty much in their place in the asteroid belt, and doesn’t let them accrete to form another planet. If Jupiter had moved inward through the asteroid belt toward the Sun, it would have scattered the asteroids in all directions before Earth had time to form. And no asteroid belt means no impacts on Earth, no water delivery, and maybe no life-starting molecules either. Asteroids may have also delivered such useful metals as gold, platinum, and iron to Earth’s crust.

But, if Jupiter had not migrated inward at all since it formed far away from the Sun, the asteroid belt would be totally undisturbed and would be a lot more dense with asteroids than it is now. In that case, Earth would have been blasted with a lot more asteroid

impacts, and life may have never had a chance to take root.

The infrared data from the Spitzer Space Telescope contributes in unexpected ways in revealing and supporting new ideas and theories about our universe. Read more about this study and other Spitzer contributions at spitzer.caltech.edu. Kids can learn about infrared light and enjoy solving Spitzer image puzzles at spaceplace.nasa.gov/spitzer-slyder.

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

DECEMBER 2012

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.

This month is a good one for seeing two asteroids. (1)Ceres [the first discovered] and (4)Vesta [the brightest] reach opposition. See Sky & Telescope, December 2012, p. 45 & 50; and Astronomy, December 2012, p. 43 for details.

On Saturday, December 1, about 6:20 AM (nautical dawn, many stars still visible), you can see Mercury at its best for the year 2012. Look 7 degrees above the east-southeast horizon for the magnitude -0.5 planet. With a telescope you can see that Mercury is at "last quarter" phase. Brilliant Venus (magnitude -4) is to the upper right, dimmer Saturn (magnitude +0.7) is further to the upper right. On December 4 Venus is close to Zubenelgenubi (Alpha Librae, magnitude 2.7).

On Monday, December 3, 2:10 AM, a transit of Europa in front of Jupiter begins. This is particularly interesting because the satellite and the shadow are right next to each other. The transit ends at 4:31 AM.

On Wednesday, December 5, you can watch an entire transit of Ganymede in front of Jupiter. Here is the schedule:

7:24 PM Ganymede moves in front of Jupiter.

7:37 PM Ganymede's shadow falls on Jupiter.

9:15 PM Ganymede moves from in front of Jupiter.

9:42 PM Ganymede's shadow leaves Jupiter.

While all this is happening in the southern part of Jupiter, Callisto is passing north of the planet.

Io similarly transits from 3:43 AM to 5:59 AM (Thursday).

On the night of Thursday, December 6, the last quarter Moon rises at 1:00 AM (Friday).

On Sunday, December 9, about 3:15 AM, the Moon and Spica rise next to each other.

From Tuesday, December 11 to Friday, December 14, before midnight, you can see the asteroid (4179) Toutatis. It is close (0.046 Astronomical Units [1/20 the distance to the Sun]), fast moving (20 arc-seconds per time-minute) but dim (magnitude 11, use a big telescope). See Sky & Telescope magazine, December 2012, p. 53 for charts. Note that the times on these charts are given in Universal Time, not Mountain Standard Time (MST = UT - 7 hours).

On the night of Wednesday 12, you can watch a transit of Ganymede in front of Jupiter. Here is the schedule:

10:38 PM Ganymede moves in front of Jupiter.

11:35 PM Ganymede's shadow falls on Jupiter.

12:32 AM Ganymede moves from in front of Jupiter.

1:43 AM Ganymede's shadow leaves Jupiter.

On the night of Thursday, December 13, it is new Moon so you have all night to hunt for faint fuzzies. It is also the peak of the Geminid meteor shower. (No moon + good shower - cold temperature = maybe you will see some.)

The meteor show is best after midnight.

On the night of Wednesday, December 19, the Moon is at first quarter phase and sets at 12:35 AM (Thursday). Check it out at 10:19 PM and see how close to half illuminated it is.

On Tuesday, December 25, after sunset (5:25 PM), you can see the Moon near Jupiter in the East.

On Thursday, December 27, at 5:11 PM (15 minutes before sunset) the full Moon rises, spoiling any chance of hunting for faint fuzzies.

Looking for that perfect weekend activity?

Why not resolve to getting involved?

Contact Dave Coshow to join the staff at GRCO

Email: grco@evaconline.org

Revisiting M31

Continued from page 3

ity as so far detected. It also has more BH candidates as indicated from the X-ray data, many of which are in the surrounding galactic clusters as well as near the galactic center. In GC G1, (aka Mayall II) which is one of the largest and brightest GC in our Local group, (about 15,000,000 solar masses) there is much evidence of an intermediate sized BH of about 20,000 solar masses. This is thought to be the remnant of a dwarf galaxy cannibalized by M31 in the past. M31 is thought to have between 400-500 GCs in total.

Some new information

Just recently in 2011 it appears that M31 may also contain a newly discovered magnetar. When it was first discovered in 2008 by the XMM-Newton telescope it was thought to be a BH X-ray binary but subsequent analysis has made the magnetar explanation more feasible. The x-ray spectra and the lack of any optical counterpart support this conclusion. There are less than a dozen verified magnetars known to date.

In 1995 the HST imaged a double nucleus in M31 and at the time it was thought, (as did I) that this represented a double BH center from past merger activity. Seeing a double nucleus in a galaxy is often attributed to such past merger activity. However thru subsequent analysis over the years the double nucleus image in M31 was recently discovered to be only a single BH with a very dense blue cluster of UV bright stars close by. These new young stars are about 200 million years old and form a tight cluster around the central BH.

This is in general contrast to the older stars further out in the nuclear region. They orbit in a relatively flat disk at a high speed in the range of 1000 km/sec.

They seem to have been formed in a brief period of starburst activity. Exactly how these stars can be formed in the close tidal proximity of a SMBH remains unknown, (it is also seen in some other galaxies) and there are several theories

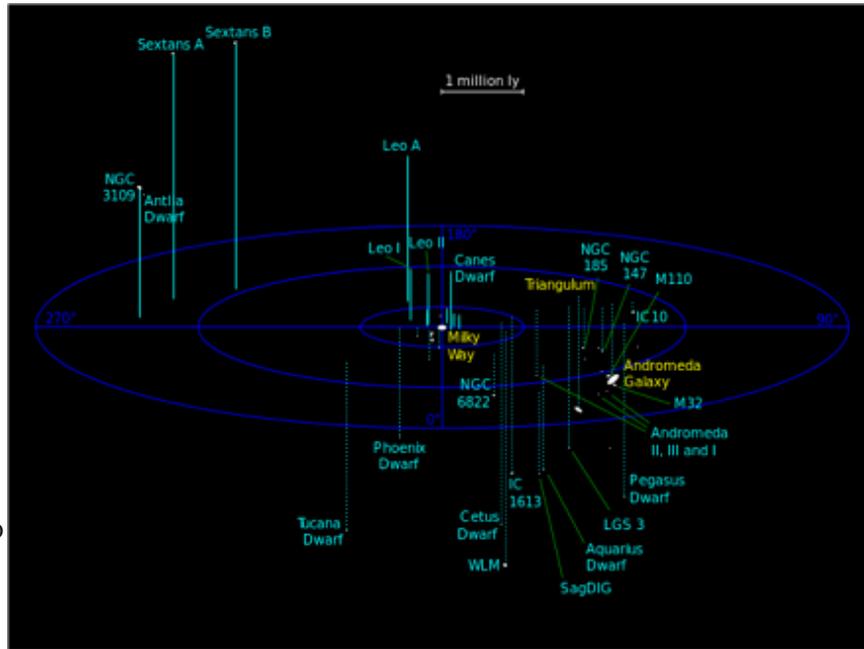
describing this behavior. This one large extended thick disk that looks like a dual nucleus with both a SMBH, close stars, and other debris, is called a Tremaine Disk.

We know that SMBHs besides being destructive can also be creative. It turns out that the Milky Way like M31 also has this central SMBH surrounded by relatively new, young stars. Perhaps it is more common in the Universe than previously thought. It may be possible in the future to measure the velocities of the individual stars surrounding the SMBH of M31, (which has been done in the MW) and thus obtain more information about the SMBH and better determining its exact position. Now M31 is thought to have only a single SMBH at its center with a mass roughly 140

million solar masses. Currently the SMBH in the center of M31 is fairly quiet.

In another line of thought relating to the SMBH in M31 there have been recent studies of HVS, (high velocity stars) that seem to be moving fast enough, (500 km/sec or faster) which would exceed the local escape velocity and be able to leave the galaxy. Out of over 370,000 stars in the SDSS thirteen were classified as HVS and 4 of these may have come from M31. It is now thought that there may be many solar mass stars, (small stars) ejected from M31 via gravitational interaction, (slingshot effect) with the SMBH. Several of these stars have been detected, however it is unknown exactly what the mechanism is that caused them to have such a high velocity and the ejection rate of HVS from a galaxy is a great unknown.

Recently advances have been made in studying the GCs surrounding M31 with the HST in order to better understand the formation and evolution of the halo of the galaxy and the galaxy as a whole. These advances basically bring the study of M31 to the status of our understanding of the Milky Way as we had in the 1970's and 80's so that we still have a long ways to go. Studying the GCs around M31 has



The Local Group showing the MW, M31, and M32



HST image of the "double" nucleus in M31

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THE DEEP SKY OBJECT OF THE MONTH



Take a long, careful look at the stars in Stock 2. Let your imagination run wild for a moment. See any pattern among them? Careful scrutiny will show that the stars seem to fall into four distinctive threads curving away from the center. John Davis from Amherst, Massachusetts, mentioned more than 20 years ago that the brighter stars almost look like a headless stick figure flexing his muscles, christening it the "Muscleman Cluster." His legs stretch out in two straight lines to the east, while his flexing arms curve to the west, above his long, albeit headless neck. Others remark that the pattern is more reminiscent of a pirouetting ballerina, again sans head. Muscleman or ballerina notwithstanding, the next time you are drinking in the beauty of the Double Cluster, be sure to swing northward and spot Stock 2 in the same field of view.

Stock 2 (Muscleman Cluster) Open Cluster in Cassiopeia

RA: 02h 15m 44.74s Dec: +59° 05' 10.4" Size: 60.0' Magnitude: 4.40

Revisiting M31

Continued from page 13 also allowed us to more accurately determine its distance with a variety of methods by analysis of certain stars such as RR Lyrae variables, white dwarfs, and red giants.

Recent analysis of over 130 GC x-ray sources surrounding M31 for a period of over 12 years has revealed at least 3 additional new BH candidates bringing the total number of suspected BHs in GCs around M31 to 9. Interestingly in general, the x-ray sources in M31 seem to be more luminous than the ones seen in our own galaxy. There remain hundreds of x-ray sources within and around M31 still awaiting more observation and analysis. Some of these intermediate sized BHs in the GCs around M31 are thought to be in the tens of thousands of solar mass range.

We also know that most likely the Milky Way and M31 will merge in the long term future. Current estimates, (2012) are that this event will take place in approximately 5.86 billion years, (give or take a billion years or so). M31 appears to be on a direct collision course with us advancing towards the MW with a velocity of at least 100kms.

It is also expected that M33 will also merge with the Milky Way and/or M31. This could take place either before the MW-M31 merger or shortly afterwards according to the latest mathematical models. There is also a small chance that M33 could be ejected completely from the local group by gravitational interactions. The M31-MW merger will most likely result in the formation

of an elliptical galaxy with the solar system, (our sun) having an 85% probability of orbiting at a further distance away from the new galaxy center. There is also some probability, (20%)

of our sun being contained within M33 over the next 10 billion years. Supposedly the collision of M31 and the MW, (and with M33 joining the party as well) is fairly well certain according to the models. However the exact nature of the merger is still not known, that is will it be a "direct" hit, a "glancing blow" or something else.

Summary

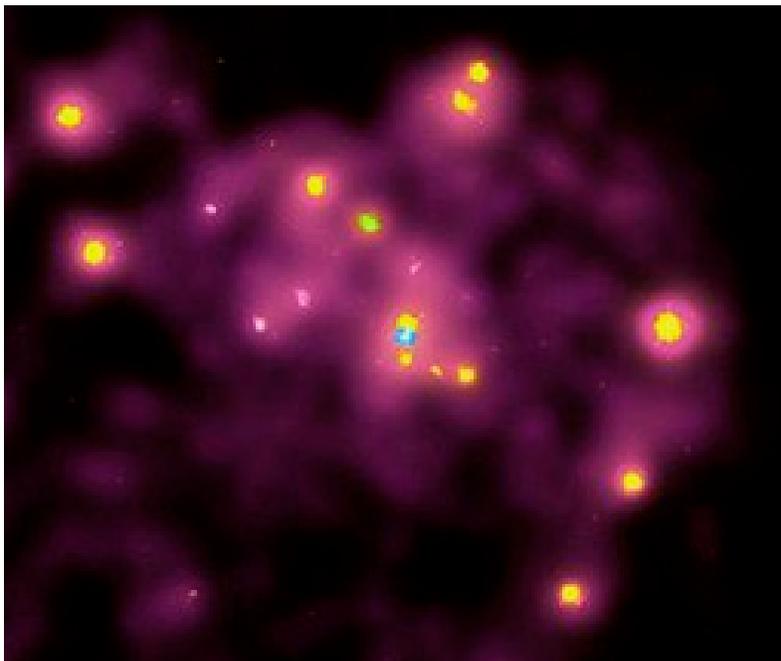
Since the Andromeda galaxy is so similar to our own in size, mass, and shape we have been given a unique opportunity to study our own evolution by studying it. There are many similarities

as well as differences in these two galaxies as we have seen. For example, the average star formation rate in the disk of M31 is about 1 solar mass per year which is a bit less than that of the MW at about 3-5 solar masses per year. It does however seem to have had

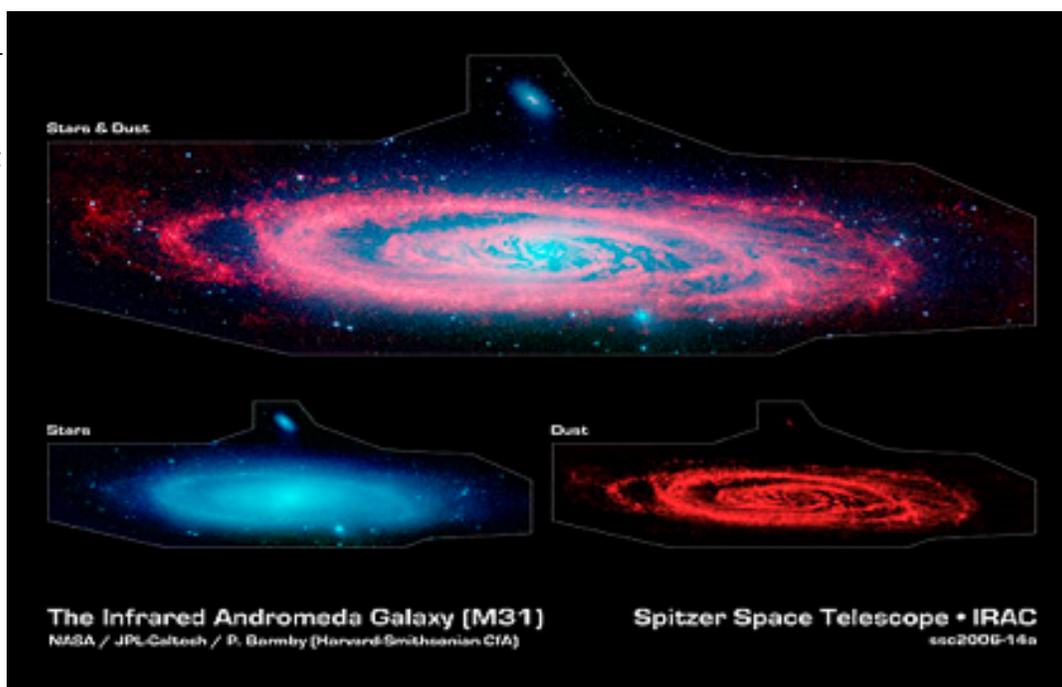
more bursts of star formation than our MW galaxy and has several well know dust rings around it that are potential excellent stellar nurseries.

We are learning about GCs, SMBHs, and DM by studying M31. There are many new questions we now have and many more discoveries regarding M31 that remain. It is nice to

know that it is much more than just a beautiful picture.



Nucleus of M31 showing the SMBH as the blue dot in the center



Images of M31 showing dust, stars, and some of the extended disk

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