Peterborough Astronomical Association
The Reflector
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It Takes More Than Warm Porridge to Make a Goldilocks Zone

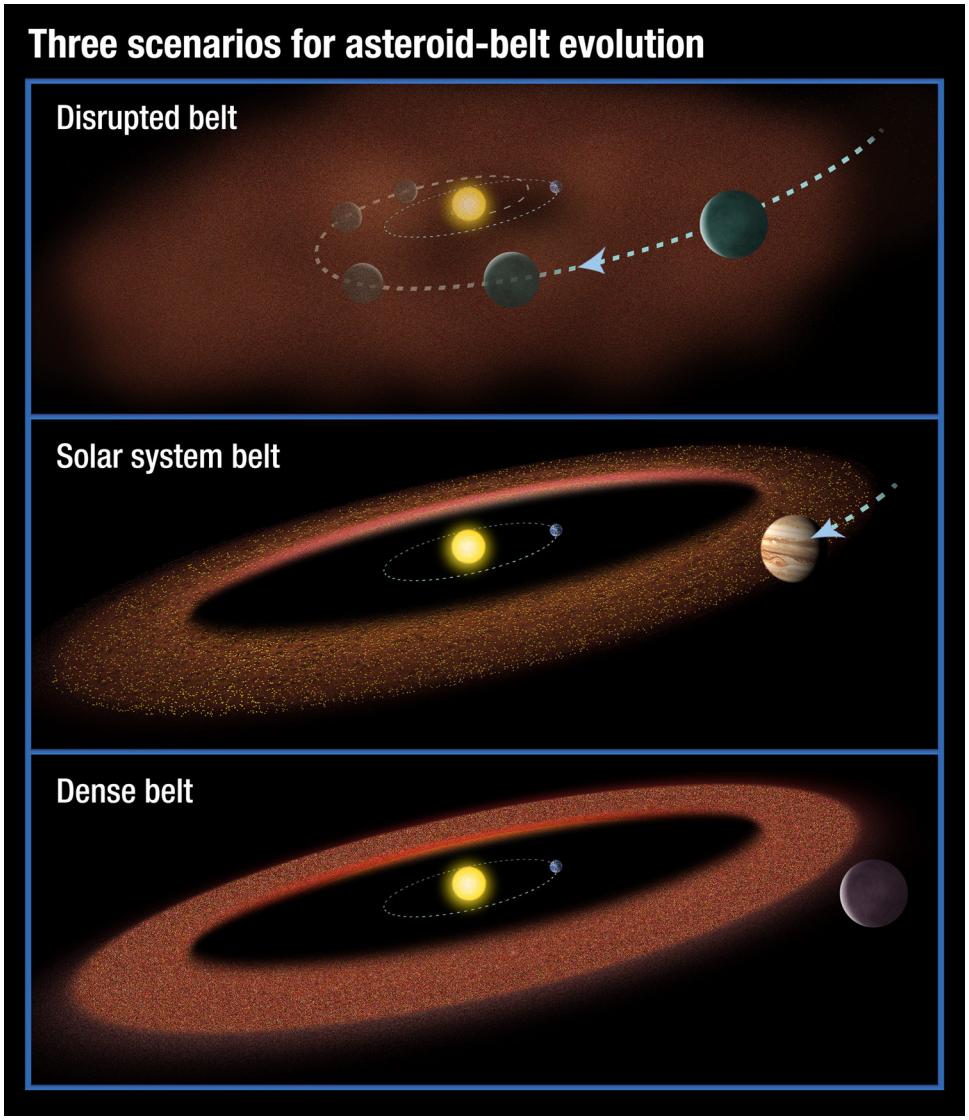
by Diane K. Fisher

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.



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

see "Jupiter" on page 12

President's Message

A "Reflection" on the Year

Once again we arrive at the end of another year. This was a busy year for the PAA.

On the outreach front we began as usual atop Armour Hill at the end of March to observe "Earth Hour." We had a modest turnout from the public. PAA members also helped out at the request of the Clarington Museum and Archives in March. In May we held our annual "Astronomy on the Hill." The weather was an improvement over the previous year but it could have been better, public attendance was a bit of a disappointment. Also in May we were invited to introduce the night sky to a Girl Guide camp held at Emily Provincial Park. This turned out to be a major event with 400 Girl Guides and Leaders taking part. Members also were present at the Warsaw Caves with the "Cawthra Park Secondary School of Mississauga" on May 30th. The largest single event attendance wise was the "Transit of Venus on June 5th" where an estimated 500 people showed up. Our last publicized event was the "Perseid Meteor Shower" on August 12th. Again we had modest turnout with very few meteors and disappointing weather.

The PAA had five judges this year at the annual "Regional Science Fair." This is a record for us and I'm confident we can repeat this in the coming year.

Our members-only observing sessions were a mixed bag again as far as weather went, we did get a few good ones in.

At last count, our membership has grown to 72, a record for the club. Unfortunately, attendance at meetings seems to have declined. I would appreciate some feedback to let us know what we need to do to attract more members to the meetings.

It's time for our "Annual General Meeting & Christmas Social." I hope we have a good turnout. I would like to take this opportunity to wish everyone a Merry Christmas and a safe and Happy New Year.

Rodger Forsyth
PAA President

Letter from the Editor

This Space Could be Yours!

A first for this newsletter is an article from another province. Andre Bordeleau of the now-defunct Montreal Planetarium has translated a film review of *L'oeil de l'astronome* (*Eye of the Astronomer*) from his original French (page 7.) The movie is set during the ten days that Johannes Kepler used one of Galileo's telescopes to verify the latter's discoveries.

Mr. Crossen has some timely Christmas gift ideas and a primer on getting the appropriate binoculars for stargazing, the astronomical kind, not the Hollywood type. Rick Stankiewicz returns from the southern hemipshere with irrefutable proof that stars are fixed and only our (l)attiudes change.

This being the last newsletter of 2012 I want to wish you happy holidays but hopefully you will take some time for stargazing and perhaps penning an article or snapping a photo or two?

Phillip Chee
Editor, The Reflector

Peterborough Astronomical Association

The Reflector is a publication of the Peterborough Astronomical Association (P.A.A.) Founded in 1970, the P.A.A. is your local group for astronomy in Peterborough and the Kawarthas.
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Changes in Latitude, Chances in Attitudes

Tripod mounted Canon 400D, Sigma 10-20 mm len at 10mm; ISO 1,600, f/4.0, 30 sec. exposure. Photo by Rick Stankiewicz.

Rick Stankiewicz

Having been gone a good part of this past month owes to my lack of contributions for this month's *Reflector*. However, I still managed to work in a little astronomy during my trip to Peru and Ecuador. We were normally in light polluted cities at night, like Lima, Cusco, Puno or Quito, but I was still able to find a few familiar friends in the night sky. Jupiter shone bright most nights and I was able several times to find Orion, Taurus, Sirius, the Summer Triangle constellations using Vega, Deneb and Altair. Having said this, things were different near or south of the Equator. Once "upright" constellations at home were now "laying down" in the night sky.

On November 15th while touring the Galapagos Islands on a cruise ship (Galapagos Explorer II), I went to the upper deck where there was the least amount of light pollution and I took the accompanying shot showing Orion laying down and Jupiter to it's upper left. This is about 45 degrees different than I was used to seeing things in southern Ontario. If you think about it though, we are at about 45 degrees latitude in Ontario and the Galapagos Islands are on or just south of the equator. Therefore, 45 degrees difference and I would say my image proves it. It is all about changes in perspective and orientation because we all know the stars do not move, but our latitude might.

Another thing my image shows are that even anchored in port, water does not make a good platform for astrophotography (no surprise.) The movement of the ship at the time was barely noticeable. The image looks out of focus, but see the ship antennae and you will see it is the "fuzzy stars" that were produced by the ships movement during the exposure and not the focus. I think the soft and uniform "squiggles" of starlight make an interesting study of movement and helps accentuate the relative brightness of the objects. Jupiter is by far the brightest light source, but (L to R) Capella, Aldebaran, Betelgeuse and Rigel stand out nicely with their signature colours and magnitudes of brightness.

Study this image and see what other constellations you can see. Never stop changing your attitude as you change latitude because you never know what my become if it!

2012 Was Good to Me Thanks to You

John Crossen

Buckhorn Observatory celebrated its 10th anniversary in 2012, so 2013 sees us off on yet another decade under the stars. During the past year I was delighted to receive an award of merit from the Peterborough Astronomical Association. The last year also brought with it my first column in the *Journal of the Royal Astronomical Society of Canada* and teaching a class in astronomy for the City of Kawartha Lakes. But pictures say it better, so here's a photo review with captions:

A School Group. Attendance at BHO was up, even though the weather was less than exemplary last summer. We enjoyed more school visits and welcomed back more return customers.

Last year's guests included groups from France, Japan, the US and Holland. Not bad for a couple of hicks in the sticks.

Photo of Group with New Telescope. In the early spring of the 2012 a new 16" scope was installed at the observatory. When it comes to telescopes, bigger is better and the views through the new scope were well worth the time, money and effort. It's also smarter than me, thanks to being fully computerized.

Solar Observing. We also enjoyed more visits from schools. Unlike night time astronomy with our regular telescope, we can also view the Sun and sunspots through a special telescope filter that protects the eyes from the Sun's blinding glare as well as harmful UV rays.

See "Buckhorn Observatory" on page 11

PHOTO GALLERY

Fall Feast in the Skies

The fall skies are often some of the best for enjoying the heavens and all they have to offer. This fall was no exception, when we had clear skies. The attached images is a sample to whet your palate for this is what awaits you if you just step outside to sample the celestial fare.

On October 17th I was north of Minden visiting friends when these skies offered themselves to me at about 10:30 p.m. Jupiter is at the extreme left just clearing the maple treetops and Pleiades is the cluster to the right of Jupiter. The Milky Way stretches out overhead. Can you pick out the Andromeda Galaxy (below centre)? There is a true feast for the eyes and the inquiring mind. Eat it up!

Image taken with a modified Canon 50D and Opteka 6.5mm lens, with Vixen Polaris platform, ISO 1600, f/5.6 & 120 second exposure.

Rick Stankiewicz

FILM REVIEW

L'Oeil de l'astronome

André Bordeleau

L'Oeil de l'astronome (The Eye of the Astronomer) is a 2011 French movie about the astronomer Johannes Kepler. It focuses on a very small point in the life of the famed astronomer: the ten night period of the summer of 1610 during which he received one of Galileo's telescopes to verify his discoveries.

And verify them he does. Night after night, Kepler, played brilliantly by Denis Lavant, takes some painstaking measures to confirm the 4 moons as they orbit Jupiter, marking their position and then asking his assistant to observe and mark them as well so their observations can be compared. Kepler also trains the telescope at the Moon to confirm another Galileo discovery: mountains on the Moon.

Kepler also receives a mysterious puzzle from Galileo: a long series of 37 letters making a seemingly nonsensical message. Kepler does attempt to decipher it but eventually gives up. The message is in fact an announcement about an even more astonishing discovery: Galileo had seen "ears" around Saturn. He had discovered its rings.

Kepler's observations take place at the Royal Palace of Rudolph II in Prague, the capital of the Germanic Empire. Kepler is the Royal Astronomer for the emperor. The terrace where he has installed the telescope becomes the focal point of each and every denizen of the palace, each with his own agenda.

While Kepler observes the night sky with the new invention, his guests not only bring forth a plot against the emperor, religious narrow-mindedness and the threat of being considered a witch, but various scientific and historic tidbits as well: Galileo did not invent the telescope and may not have been the first one to point it to the night sky. Kepler's assistant even brings up the fact that Kepler seized 20 years' worth of observations the day after Tycho Brahe had died and that Kepler was suspected of having poisoned Brahe. But, the assistant adds, Kepler didn't have enough acumen to do such a thing. (As a matter of record, scientists recently concluded Brahe was not poisoned but died of a burst bladder).

Sole protestant at the Palace, Kepler, who suffers from dimming sight in one of his eyes, is faced with great pressure from Church officials not to contradict the established dogma. A judge, whose duty it is to find sorcerers and

witches and burn them, actually comes across as an unhinged psychopath. This is a dangerous time to be a scientist. The Earth is still thought to be the center of the Universe, planetary bodies are smooth and orbit the Earth in perfect circles. Contradicting such verities is very dangerous and can lead to death. In that respect, the movie shows well the perils awaiting free thinkers at the time. In this background, testimonies are heard concerning Kepler's mother being accused of witchcraft. While historically true, this didn't happen until 1617.

With all this going on, Kepler begins to work on his theory that planets move around the Sun in elliptical orbits rather than circular ones. He also lays down some basic principles of the laws of optics. He is asked to predict the future using astrology. While he does use astrology, he makes it clear that he values little the belief that the stars' position influence human events.

The movie takes some liberties: Kepler never adopted a mute boy to act as a *de facto* assistant after Kepler had fired his previous one. But this is a rather small point.

Overall, the movie is well-made, for the most part scientifically accurate and is a must-see for all levels of astronomers.

Rating: 4 stars out of 5.

Santa's List for Good Little Astronomers

ASTRO GEAR. There are plenty of gifts for the budding astronomer. Some are as near as your local clothing store and others have on-line shopping and shipping. Photo courtesy of John Crossen.

JOHN CROSSEN

YOU WON'T FIND ANY telescopes on this list because beginning astronomers are better off without them—especially the junk scopes in Big Box Stores. Even if it carries a respected name like Meade or Celestron on it, beware because they also sell some turkey-scopes for the dump-and-run holiday market. Besides, until your budding astronomer knows where to point the telescope, they're stuck with the Moon and even it can get boring—especially on a -10 °C winter night with a stiff wind. But there are plenty of other astro-gifts to choose.

Books, magazines and DVDs are especially helpful to those just getting started. Terence Dickinson's book *Night-Watch* is ideal. The book covers everything from the constellations, planets, star clusters and black holes to astrophotography and how to do it. The star charts are superb and there is a section on how to pronounce the star names. It's available for about $22.00 via Amazon or around $30+ at Chapters, Indigo or Coles.

A subscription of *SkyNews Magazine* should also be a list-topper. It's a Canadian publication that provides star charts and easy-to-read articles on current astronomical events as well as space travel. Graphically it also has lots of big, educational photos.

Amazon, NOVA, PBS and National Geographic also market astronomy DVDs

see "Astronomical Gifts" on page 11

Two-eyed Astronomy with Binoculars

Some binoculars are too small to deliver bright images and some are too big to handhold. The middle binoculars in this picture are in the magical Goldielocks zone—they're just right.

John Crossen

Just as two heads are better than one when solving a problem, two eyes are a better way to explore the universe. For starters binoculars are light in weight so they're highly portable and easy to use. They're also relatively inexpensive at less than $200 in most cases. Plus you can use binoculars for sporting events, bird watching and on nature hikes. So they can also multi-task. With that as the starting line here's what to look for in a pair of good basic binoculars for astronomy.

The two numbers you see on any pair of binoculars tell you the power of magnification the binoculars generate and the distance in millimetres across the primary lenses (known as the aperture.) A pair of 10×50 binoculars will generate ten power of magnification and have a front lens diameter of 50mm and. Generally speaking that is the ideal handheld binocular.

With 50mm of light gathering aperture they pull in more light than your 5mm eye. So objects are nice and bright. And with ten power of magnification, objects appear ten times closer than with the naked eye. Plus there are some other aspects of these binoculars that make them ideal for astronomy.

For starters anything above ten power magnification makes the binocular hard to hold steady. When viewing pin-point stars higher power binoculars can make

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Binoculars

them appear jumpy and that becomes annoying. Also bigger binoculars are heavy and more difficult to hold up for long periods of time. So you wind up with jumpy stars, plus the annoyance of tired arms. So set 10×50 as the upward limit for your binoculars.

If you already have a pair of 8×40 binoculars they will do just fine. The smaller aperture won't capture as much light as a 50mm pair, but that's still a big improvement over your 5mm eyes. Mini binoculars beat the naked eye, but the view isn't very bright.

There are other features to look for. A pair of binoculars that are fully-multi coated means that all the lens surfaces have been coated to provide brighter views.

Having a centre mounting point for a tripod is also handy—especially if you share your views with others. It is also important to have one side independently focusable, because your two eyes may not be quite the same.

How much should you pay? Set your upper limit at around $200 and you'll be in safe territory. Canadian Tire 7×50 bins were my starting point, and they did just fine at under $100 for starters. I then moved up to a pair of Bushnell Legacy 10×50s. They cost about twice that, but the images were much sharper and more satisfying to view.

Avoid yard sale and second hand binoculars because if they have been dropped they may be out of collimation and that's an expensive fix. A sports store and an astronomy shop are your best bet for quality products and sage advice.

The Sky this Month

Mercury is at best morning apparition of the year during first week of December. Greatest elongation W (21°) on the 4th. Venus within 7° W between the 4th and 15th. Waning crescent Moon passes S on the 12th.

Venus in eastern morning sky. Waning crescent Moon passes 1.6° S on the 11th.

Mars low in western evening sky and passes from Sagittarius to Capricornus moving eastward in the SW. Sets in early evening.

Jupiter near opposition near Hyades on the 3rd with brightness of magnitude –2.8. Moon occults on the 25/26th.

Saturn well placed in dawn sky. Moves from Virgo into Libra early in the month.

Geminid meteors peak on the 13th at 7 pm.

Moon Phases

Last Quarter	**2:29 AM**	**December 6**
New Moon	**3:42 AM**	**December 13**
First Quarter	**12:19 AM**	**December 20**
Full Moon	**5:21 AM**	**December 28**

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Buckhorn Observatory

Thanks for a great 2012 and we look forward to seeing you all again in 2013.

A Classroom Shot. Plans for 2013 include more teaching, adding an H-alpha solar scope and making BHO wheelchair accessible. We almost accomplished the latter in 2012, but ran into some focusing issues with the new telescope and video camera. Soon to be solved!

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Astronomical Gifts

that are quite impressive. Dig around on the websites of the above-mentioned companies and you'll find plenty to choose from. Brian Cox's *Magnificent Universe* and *Magnificent Solar System* are two of my favourites.

There are other bits of gear that come in handy. A planisphere is a big help in finding the constellations no matter what the time of year or night. Just rotate the dial so that the correct date and time of night are lined up, hold the planisphere over your head facing north and you're constellation hunting with your faithful guide.

A red-beamed flashlight is also handy. Red light doesn't affect your eyes when they are dark adapted to night vision, but you can still read your star charts.

Some of the items mentioned above are best found at astronomy stores. Locally my favourite is Focus Scientific. Their website is www.focusscientific.com. You can shop on-line and they have a toll-free number (613-723-1350) if you need to ask questions. There are numerous other stores across Canada which you can find just by searching *canadian astronomy stores* on Google.

That's just a brief list of the gear that you can buy for a beginning astro-buff. Also on your list should be warm mitts, gloves, socks and hats. Comfort is essential to the enjoyment of any hobby–especially one that takes place on a cold winter's night.

In my next article I'll talk about the astronomer's best friend, binoculars. They needn't be expensive, but they are the next step from eye-ball astronomy to a telescope. So hang tight until then.

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Jupiter

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.

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 father 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.

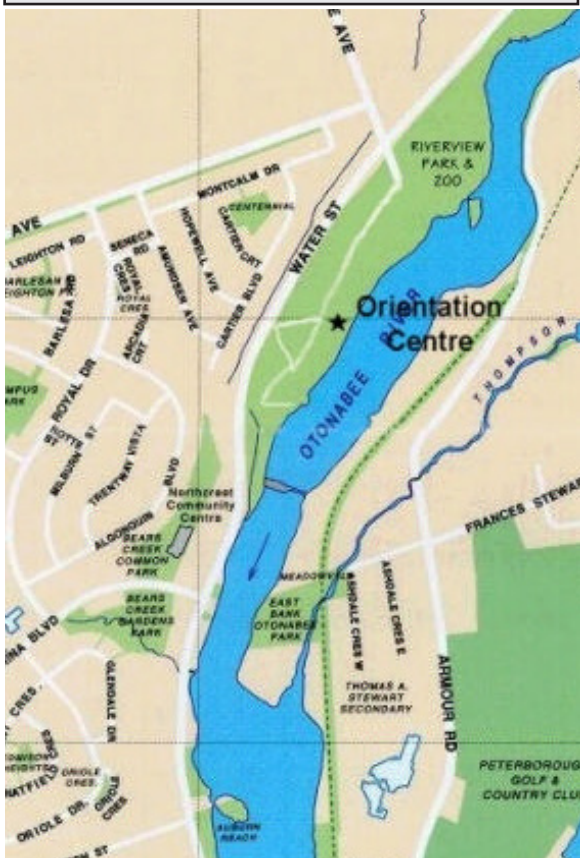
This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Articles

Submissions for *The Reflector* must be received by the date listed below. E-mail submissions are preferred (Microsoft Word, OpenDoc, ASCII and most common graphic formats are acceptable). If your article contains photso or graphics, please provide a separate file for each. Typed or handwritten submissions are acceptable provided they are legible (and not too long.) Copyrighted materials will not be published without written permission from the copyright holder. Submissions may be edited for grammar, brevity, or clarity. Submissions will be published at the editor's sole discretion. Depending on the volume of submissions, some articles may be published at a later date. Please submit any articles, thoughts, or ideas to:

phillip.chee@gmail.com

Next submission deadline:
December 23, 2012



Meetings

The Peterborough Astronomical Association meets every first Friday of most months at the **Peterborough Zoo Orientation Centre** (Next to the PUC Water Treatment Plant) at 8 p.m. P.A.A. executive business will be conducted starting at 7:30 p.m. Members and the public are welcome to attend the earlier time.