



Observations

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CHESTER COUNTY ASTRONOMICAL SOCIETY

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Two-Time Winner of the Astronomical League's Mabel Sterns Award ☼ 2006 & 2009

March 2015

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If Only It Were This Convenient!



Thought the socks were fun? See page 2 for Don Knabb's latest astronomy-related find.

Membership Renewals Due

03/2015	Angelini End LaFrance Sterrett
04/2015	Armored Imburgia Miller Richter
05/2015	Cunningham Fletcher O'Hara

Important March 2015 Dates

- 5th** • Full Moon, 1:06 p.m.
- 8th** • Daylight Savings Time begins.
- 13th** • Last Quarter Moon, 1:48 p.m.
- 20th** • New Moon, 5:36 a.m.
- 20th** • Spring Equinox, 6:45 p.m.
- 27th** • First Quarter Moon, 3:43 a.m.



CCAS Upcoming Nights Out

CCAS has several "nights out" scheduled over the next few months. Members are encouraged to help out during these events any way they can. See below for more information.

- ☼ **Saturday, March 21, 2015.** Star Party at Bucktoe Creek Preserve, Kennett Square, PA. The event is scheduled for 8:00 PM to 9:30 PM. CCAS members participate for free. Preserve members & the general public pay a small fee; non-members must register at bucktoecreekpreserve.org
- ☼ **Saturday, April 18, 2015.** CCAS special observing session at Nottingham County Park.
- ☼ **Saturday, May 9, 2015.** CCAS special observing session at Hoopes Park, West Chester, PA.

Winter/Spring 2015 Society Events

March 2015

4th • PA Outdoor Lighting Council monthly meeting, 1438 Shaner Drive, Pottstown, PA 19465, starting at 7:30 p.m. For more information and directions, visit the [PA Outdoor Lighting Council](#) website.

6th • West Chester University Planetarium Live Show: "Venus—The Evening Star," in the Schmucker Science Building. The show starts at 7 p.m. and runs approximately one hour in length.

8th • Daylight Savings Time starts at 2:00 AM.

10th • CCAS monthly meeting in Room 112, Merion Science Center, WCU. Meet & Greet over coffee and refreshments from 7:10 to 7:30 p.m. The meeting starts at 7:30 p.m. Theme: Member's Night..

20th • Spring Equinox, 6:45 PM.

26th-27th • The von Kármán Lecture Series: [Adventures From the Field - \(Down and Dirty Stories of Pursuing JPL Science from the Ground up to Space\)](#), at the Jet Propulsion Laboratory, Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

20th • Open call for articles and photographs for the April 2015 edition of [Observations](#).

20th • CCAS Monthly Observing Session, Myrick Conservancy Center, BVA. The observing session starts at sunset.

21st • Bucktoe Creek Preserve Star Party, Kennett Square, PA.

26th • Deadline for newsletter submissions for the April 2015 edition of [Observations](#).

April 2015

1st • PA Outdoor Lighting Council monthly meeting, 1438 Shaner Drive, Pottstown, PA 19465, starting at 7:30 p.m. For more information and directions, visit the [PA Outdoor Lighting Council](#) website.

3rd • West Chester University Planetarium Live Show: "Walking on the Moon," in the Schmucker Science Building. The show starts at 7 p.m. and runs approximately one hour in length.

14th • CCAS monthly meeting in Room 112, Merion Science Center, WCU. Meet & Greet over coffee and refreshments from 7:10 to 7:30 p.m. The meeting starts at 7:30 p.m. Speaker: Paul Halpern presenting his new book about Einstein and cosmology.

18th • CCAS special observing session at Nottingham County Park.

20th • Open call for articles and photographs for the May 2015 edition of [Observations](#).

23rd-24th • The von Kármán Lecture Series: [Robots to the Rescue! JPL's RoboSimian and Surrogate Robots are here to Help](#), at the Jet Propulsion Laboratory, Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

26th • Deadline for newsletter submissions for the May 2015 edition of [Observations](#).

Minutes from February 2015 Meeting

by Ann Miller, CCAS Secretary

- Roger Taylor, CCAS president, welcomed 19 members and guests to the February 10, 2015 meeting.
- Don Knabb, our observing chair introduced skymap.com as an app and source of monthly sky charts. We then viewed Stellarium for our monthly night sky tour.
- Dave Hockenberry, program chair reminded members that March is Member's Night. All members are encouraged to share their astronomy interests, observations, equipment, etc., at this member's meeting. April's speaker will be Dr. Paul Halpern who is releasing a new book, "Einstein's Dice and Schrodinger's Cat: How Two Great Minds Battled Quantum Randomness to Create a Unified Theory," on the day of our meeting. May's meeting will be our own John Conrad presenting "Near Earth Objects".
- Our evening speaker was Dennis O'Leary, NASA Solar System Ambassador, who presented "Exploring the Dwarf Planets of our Solar System." In addition to an overview of dwarf planets in our solar system, Dennis discussed the Dawn and New Horizons missions. Both missions will be approaching their intended destinations this year. We are looking forward to their new findings.

March 2015 CCAS Meeting Agenda

by Dave Hockenberry, CCAS Program Chair

Our next meeting will be held on March 10, 2015, starting at 7:30 p.m. The meeting will be held in Room 112, Merion Science Center (former Boucher Building), West Chester University. Theme: Member's Night. Bring your questions, observations, and/or research to share.

Please note that inclement weather or changes in speakers' schedules may affect the program. In the event there is a change, CCAS members will be notified via e-mail with as much advance notice as possible.

We are looking for presenters for future meetings in our 2015 season. If you are interested in presenting, or know someone who would like to participate, please contact me at programs@ccas.us.

Fun New Nightlights Available

by Don Knabb, CCAS Treasurer & Observing Program Chair



Fun New Nightlights

If you want to add some fun to your house late at night, a new series of night lights is being sold at Lowes and Home Depot.

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Telescope Review: Questar 3.5" Standard Matsukov-Cassegrain

by Dave Hockenberry

Any amateur astronomer born before 1970 will immediately recognize the Questar name, as it has a long and somewhat legendary reputation. This small company has been producing telescopes for the consumer market since 1950 in New Hope, Pennsylvania.

When it was first sold the Questar immediately set a high standard for small telescope optics, and it wasn't long before it garnered considerable notoriety. Werner Von Braun owned one. Johnny Carson and Arthur C. Clarke owned one. Questar was the first telescope in space aboard multiple Mercury, Gemini and Apollo missions. NASA used a 12 inch Questar mounted on an anti-aircraft gun turret to monitor rocket launches at Cape Canaveral. Questar's seductive advertisements in *Scientific American* and *Sky and Telescope* also set a new standard for consumer telescope marketing.

While other manufacturers like Cave, Celestron, Unitron, and Tasco were pushing bigger instruments with larger aperture, Questar was emphasizing smaller, finely handcrafted optics. Look at Unitron and Cave products of that era and you'll see gadgetry galore, sticking out in every direction. Questar stood apart, looking more like a Faberge egg mounted on a small dual fork base akin to a precision Swiss watch.

And like a Faberge egg or a fine Swiss watch, the Questar came with a high price tag for all that hand crafted, precision machined, neatly coiffed execution.

By the mid 1960's the Questar found itself occupying a narrow market niche that was clearly upscale, luxury "carriage trade" while the clever marketing created considerable demand that persists to this day. Unfortunately, few could afford it.

Flash forward a few decades. I found myself at NEAF last April. Standing in front of the Questar booth, I was staring at the Questar 3.5" Standard. It looks virtually identical to the Questar model that left New Hope in the early 50's. There is a reason for this – the telescope and optics ARE virtually identical to the product they made in the 50's.

Four months later, I was driving up to New Hope to pick one up. I had been perusing the Web chat rooms. The overwhelming opinion was that the Questar design was too old, the optics too slow, the price was too high, the view too obstructed, and that any high end small APO refractor could beat it. Were they right? Was I a willing victim of smooth marketing?

In short, the answer from this reviewer is decidedly "No." Having used this telescope for four months now, I have no regrets about this purchase. In fact, for visual use the Questar 3.5 has quickly become my most used instrument. But the argument in favor of the Questar is only partly about optics.

First, the numbers. The visual focal length is 1330 mm, with a focal ratio of 14.6. The optics as mentioned are a modified Greg-

ory Maksutov-Cassegrain design, with a central obstruction of about 32% on an aperture of 3.5 inches. Questar's optics are made by J.R. Cumberland in Marlowe Heights, MD. The barrel is about 9 inches long, and with the "control box" in the back included measures a little less than 11 inches. In short, this is a small Catadioptric telescope with a big focal ratio. The corrector lens up front is thick, as is usual for a "Mak-Cass" design.

Most of the Questar Standards ever built are still in use, according to Jim Reichert at Questar as evidenced by returns for factory service and cleaning. This little unit is made to last a lifetime, truly an heirloom instrument.

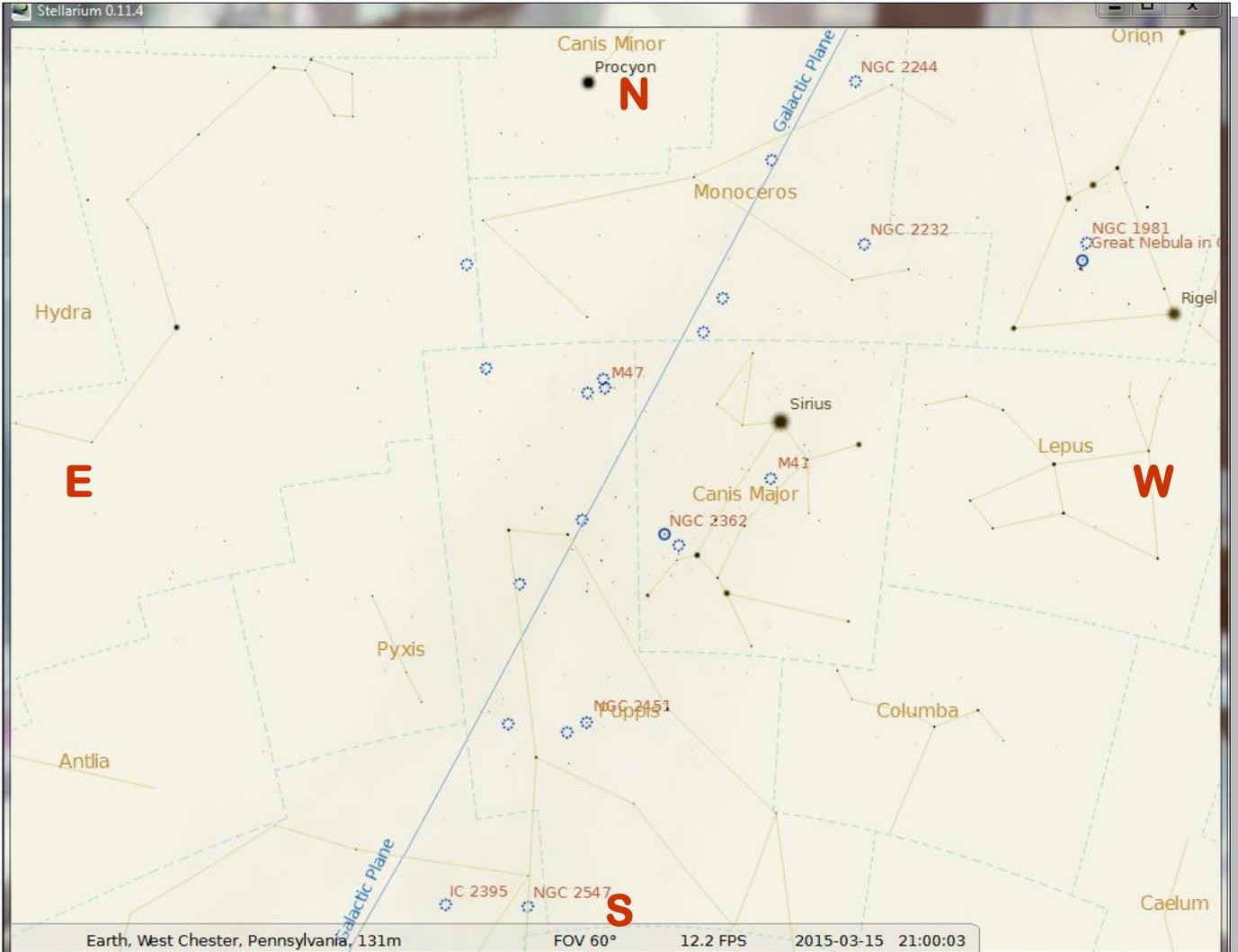
The back of this telescope has what Questar calls a "control box." This is what made the Questar unique when first introduced. The Meade EXT is a direct copy of this design. The control box houses a diagonal mirror, a Barlow, and a unique finder mechanism consisting of a simple mirror positioned *below* the OTA (Optical Tube Assembly) accessed through an opening at the bottom of the control box. At this opening is a flip-in/out small solar filter for use with the finder. The middle of the back of the control box also has a "Photo-Axial" port. With the controls in "finder" mode this bypasses the internal diagonal and allows the light coming through the telescope out the back port for photography, an external star diagonal, or erector prism. The lever at the top controls the internal, high-

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The Sky Over Chester County

March 15, 2015 at 9:00 p.m. ET

Note: This screen capture is taken from Stellarium, the free planetarium software available for download at www.stellarium.org.



Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
3/01/2015	6:07 a.m. EST	6:34 a.m. EST	5:52 p.m. EST	6:19 p.m. EST	11h 17m 55s
3/15/2015	6:46 a.m. EDT	7:13 a.m. EDT	7:07 p.m. EDT	7:34 p.m. EDT	11h 54m 39s
3/31/2015	6:20 a.m. EDT	6:47 a.m. EDT	7:24 p.m. EDT	7:51 p.m. EDT	12h 36m 54s

Moon Phases

Full Moon	3/05/2015	1:06 p.m. EST	Last Quarter	3/13/2015	1:48 p.m. EDT
New Moon	3/20/2015	5:36 a.m. EDT	First Quarter	3/27/2015	3:43 a.m. EDT

March 2015 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

2	The Moon is near Jupiter
5	Full Moon, the Worm Moon
8	Daylight Saving time begins
8	The Zodiacal Light is visible during the next two weeks
13	Last Quarter Moon
20	New Moon
20	Spring Equinox, 6:45 p.m.
22	The crescent Moon is near Venus
24	The Moon crosses The Hyades in Taurus the Bull
27	First Quarter Moon
28	Lunar Straight Wall visible

The best sights this month: March is a great month for naked eye observing of planets with Venus and Jupiter visible in the evening sky and Saturn visible after midnight. And for a special treat, use binoculars to catch Jupiter and M44, the Beehive Cluster in close proximity.

Mercury: Mercury is not in good viewing position during February.

Venus: Our sister planet is shining at magnitude -4.0 throughout March and is brilliant in the west after sunset.

Mars: Dim Mars falls further into the sunset during March and sets about an hour and a half after the Sun, so you'll need a view with a low western horizon if you want to catch the red planet before it drops out of view into the glow of the sunset in a few weeks.

Jupiter: During March you can see why Jupiter is called the king of the planets! As soon as Venus drops below the horizon it's time for Jupiter to rule the sky! Jupiter is fairly high in the southern sky around 10 or 11 p.m. so it is in great position for telescopic study. Look for bands of color and possi-

bly the Great Red Spot, a storm that has been raging for centuries, on the planet's surface.

Saturn: Saturn rises around midnight during March and is highest in the sky just before morning twilight. I'll wait until this summer when Saturn will be in position for evening viewing.

Uranus and Neptune: If you have a low western horizon you will find Uranus close to Venus and not far from Mars in early March. In fact, on March 4th Venus and Uranus are closer than any other two planets during all of 2015. Neptune passed behind the Sun in late February so it cannot be seen during March.

The Moon: The Moon is full on March 5th. According to Native Americans this is the Full Worm Moon. As the temperature begins to warm and the ground begins to thaw, earthworm casts (poops) appear. The more northern tribes knew this Moon as the Full Crow Moon, when the cawing of crows signaled the end of winter; or the Full Crust Moon, because the snow cover becomes crusted from thawing by day and freezing at night.

Constellations: In mid-March around 9:00 pm the winter constellations are in the western half of the sky heading toward their summer sleep before too many weeks have passed. Catch the Pleiades, Taurus and Orion before we lose them to the spring constellations that are rising in the east. In the spring constellation group Leo the Lion is heading toward center stage. The Big Dipper in Ursa Major is high overhead. Follow the arc of the Dipper handle to bright Arcturus in Bootes.

Messier/deep sky: There are many wonderful deep sky sights in the cold March skies. The star clusters in Auriga are heading toward the western horizon but are still well positioned for viewing through the minimum amount of atmosphere early in the evening. Later in the night look overhead to find the galaxies M81 and M82 in Ursa Major. And use your binoculars to look for M35 in Gemini, an open star cluster containing several hundred stars in an area the size of the full Moon.

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Looking Up: Conjunctions

by Don Knabb, CCAS Treasurer & Observing Chair



Image Credit: Don Knabb. Details: Canon 7D, zoom lens at 300mm, 0.3 seconds, ISO 1600, f 5.6, tripod mounted

Each month I write an article in Observations about something in the sky. Most of my articles are titled “*Through the Eyepiece*”, but occasionally I write an article titled “*Looking Up*”, like this month’s article.

The distinction between the two kinds of articles is that *Through the Eyepiece* articles require equipment such as binoculars or a telescope, but *Looking Up* articles are about things we can view with just our eyes.

This month I’ll write about conjunctions. We were fortunate to have a beautiful conjunction in February when the crescent Moon, Venus and Mars were

close in the night sky. Above is a photograph I took on February 20th.

It was quite cold when I was taking this photo, somewhere in the single digits. The day had started at -11 and although it warmed up a bit, the temperature dipped again at sunset. I mounted the camera on a tripod and took about 20 shots at various settings until my hands simply would not work anymore.

Conjunctions occur when two celestial bodies have the same right ascension or the same ecliptic longitude as seen from the Earth. Two planets appear near one another in the sky

around the time of a conjunction. In the case of two objects that always appear close to the ecliptic – such as two planets, or the Moon and a planet, or the Sun and a planet – this implies an apparent close approach between the objects as seen on the sky.

I tend to use the term more broadly than the strict definition above, I simply call any close approach of two celestial objects a conjunction.

A conjunction is caused by perspective only: there is no close physical approach in space between the two objects involved.

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Conjunctions (Cont'd)



Image Credit: Don Knabb. Details: Canon 7D, zoom lens at 28mm, automatic exposure, hand held

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Conjunctions between two bright objects close to the ecliptic, such as two bright planets, can be easily seen with the naked eye and are great fun to observe and to share with others.

Here is a picture from earlier in the evening when the glow of the Sun had not yet faded from the sky. In this picture we can only see the Moon and Venus, it was too bright and too wide a field of view to see faint Mars.

You can take pictures of conjunctions with almost any camera, even a cell phone camera. You'll just need to find a way to

hold your phone against something steady to avoid blurring from a long exposure.

Each month I list conjunctions or close approaches in the table of events in Observations. There will be several conjunctions between Venus and Jupiter throughout 2015, and if you time it with a crescent Moon nearby you can get a great scene.

So give it a try and send you photos to John Hepler for publishing in Observations!

Observing (cont'd)

(Continued from page 5)

Comets: Comet Lovejoy continues to rise higher into the sky throughout March, passing through the constellation Cassiopeia the Queen. Use a telescope to find this fading comet during mid-month when the Moon is absent from the sky. A star chart is in the March issue of Astronomy magazine.

Meteor showers: There are no major meteor showers during March.

Questar (Cont'd)

(Continued from page 3)

quality 1.7 X flip in/out Barlow lens. The right lever allows the user to flip in/out of the finder view or telescope view. All this may seem confusing at first, but in practice is quite handy once you get used to the controls. The focuser knob is below on the right.

The finder on the Questar is a feature that you either love or hate. It does seem weird at first, as most of us instinctively want to look through a separate finder scope. In the Questar, the flip of a lever makes it so that your eyepiece is looking at a small mirror mounted below the scope pointing forward. The supplied Brandon eyepieces yield a FOV of about 14 degrees for a 32 mm, and 12 degrees FOV for a 24mm eyepiece, respectively.

So in finder mode, you are looking at a large swath of sky. Once the object or region of interest is centered in the finder view, a flip of the right switch has you looking parfocal through the telescope without ever moving your eye from the eyepiece. Flip the left switch, and you engage the internal Barlow for a magnified view through the same eyepiece. In practice this means that a single eyepiece yields three different magnifications, without ever having your eye look away. It takes some getting used to, but I found it to be one of my favorite features of the Questar. No squatting down to peer behind a separate finder scope!

The barrel of the telescope has a Moon map silk screened on the top. The Moon map is inverted to the same orientation as seen



Close-up of Questar Controls

through the eyepiece, so a quick glance up and you can find the name of the larger surface features you are looking at. The dew shield has a star map silk screened on it. Accurate RA and month scales are included along with star magnitudes. By rotating the dew shield to the current

month, with the OTA facing South, the star map gives you an accurate view of what is overhead. So you can leave your star map and Moon map at home.

Leaving the OTA, we next come to the small fork mount. On the left fork is an accurate Declination setting circle, permanently fixed at the factory. On the right fork is the Dec knob. An optional detachable Dec drive is available. The base has an adjustable Right Ascension setting circle, and a clock drive. There is also an RA knob for manual control.

The clock drive can be run at either sidereal or lunar rate, and is powered by a single 9 volt battery contained in the Power-Guide 2 hand control! This same hand control and 9 volt battery can also power the optional Dec drive, and a single battery lasts anywhere from 30 to 50 hours

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No need for star & moon maps with the silkscreened maps on the dew shield

Questar (Cont'd)

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of use. Both RA and Dec motions have friction clutches permanently engaged. You either turn the RA and Dec knobs or just grab the scope and push the OTA while the drive is running to your desired position, and the drive continues uninterrupted. I found the RA and Dec knobs to be incredibly smooth in use, so much so that at low power I can track the moon manually without the RA drive engaged and not miss it. When engaged, the clock drive is almost silent. I have to strain my ear to hear it at all.

A note about the Power Guide 2 hand control – *it is not a GoTo unit*. Questar does not make one. The hand control only sets the tracking rate at sidereal or Lunar, and allows adjustment of the RA (or optional Dec drive) only. Questar has stuck to this design for over 60 years, and they have no plans to make a GoTo in the future. This means that to operate a Questar mount you are either going to star hop with a star map, or you are going to use the setting circles to locate objects.

In an age of computerized, GPS controlled robotic telescopes, this may seem an anachronism. In some respects, it is. And yet it is astoundingly simple to use and incredibly efficient. Using setting circles requires that the base be roughly polar

aligned, and that the RA circle is adjusted to current sidereal time. In practice, this can be accurately accomplished in less than 5 minutes so long as Polaris and another star of known RA coordinate is available. After that, all the operator needs to do is dial in the desired object's RA and Dec with the manual knobs, and presto – the object is in the FOV. No computer or GPS or encoders needed!

The Questar base can be used in different ways. One can simply sit the unit on a table top for terrestrial observing. Indeed, the birding crowd *loves* the Questar. The standard 1/4-20 hole on the

bottom of the base allows the unit to be mounted on any photographic tripod for portable field use. But the base unit has two other holes drilled into the sides, and the Questar comes standard with three detachable legs to that it can be polar aligned on a table top. The legs fit into the one square cubic foot carrying case, so theoretically all one needs is a reasonably level surface and it can be used for celestial observing anywhere. I found this to be possible, but not really desirable. On a table top the legs slide on a surface easily, messing up the polar alignment. So care must be taken if you want to observe

this way. Far better in my experience is to polar align the unit on a sturdy tripod, or better yet the Tri Stand or Astro Pier made specifically for the Questar.

The Tri Stand is made for observing in a seated position, and the Astro Pier is taller, more suitable for observing in a standing position. Both are engineering and construction "overkill," and are far sturdier than need be for a small 3.5" telescope. That being said, they are extremely convenient. The Tri Stand has legs that flip up with a flick of a lever, and a built in handle that makes the whole thing very easy to transport and move around. It is rock stable,



The Questar Tri Stand Works Well for Seated Observing

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Questar (Cont'd)

(Continued from page 9)

so even in stiff winds the telescope gives steady views unperturbed. The head of the Tri Stand has a circular platform to which the Questar base mounts, and the azimuth and altitude adjustments always keep the telescope's center of gravity in the same place, no matter what the latitude. The locking mechanisms and mount movements are smooth and precise. The whole assembly of the Questar 3.5" on the Tri Stand has an undeniable cachet.

But how is the Questar 3.5 under the night sky? After all, observing is what we are all about no matter how many features are packed into this unit. I have taken the "Q" to one of our CCAS demonstration events, and have had many occasions to use it at home and elsewhere. Let me share my thoughts.

First and foremost, this ensemble of the Questar and the Tri Stand is the most convenient portable rig I have ever used. Period. Questar 3.5 fits into a carrying case that is one square foot. I have seen Coach handbags that are much bigger. This telescope can be taken aboard an airplane as carry-on luggage, and only weighs a few pounds. The Tri Stand, with the head attached and the legs folded upwards, can be easily carried with one hand.

When I went to a CCAS event last Fall, I made 2 trips to the trunk of my car. First out was a small folding table, eyepiece box, and a ladder-type adjustable observing chair. Second trip was the Questar and the TriStand. In about 10 minutes the whole rig was assembled, polar aligned,

tracking, and showing the public the sky, *on a 9-volt battery*. With Stellarium freeware, all I needed to do was look up an object, dial in the RA and Dec using the knobs, and the target was in the FOV every time. No GoTo needed. All that was required was that (A) I polar align the Tri Stand by putting Polaris in the center of a low power eyepiece, and then (B) turn on the PowerGuide and set the sidereal clock drive with another bright star. It's that easy! After that, all you do is look up RA and Dec coordinates and dial them in.

Over the years I have had many telescopes and mounts, most of them GoTo. I experienced countless frustrations and equipment challenges with these on the observing field. Sometimes it was alignment problems. Sometimes it was software problems. In Summer months it was waiting for Polaris to polar align a GEM, knowing that there would be very little demonstration time left for the public once I got everything working. Sometimes it was power issues, either losing battery charge or dragging along a 100 foot extension cord to power the mount – if AC power was available. Sometimes the mount would get "bumped" accidentally and I would have to polar/ GoTo align all over again. I have been through it all. The Questar on the Tri Stand is the simplest, most efficient system I have ever used for showing the public the sky.

Now, on to the view through the eyepiece. Here there are some pluses and some minuses. I'd like to be clear about what the Questar can – and can't – do.

The optics in the Questar are superb, meeting or even exceeding the Dawes limit theoretically obtainable for the size of the aperture. The Zygo report that came with my Questar tested at better than 1/10th wavelength. This is the entire telescope, not just the mirror! BUT – this is a small aperture, long focal length telescope with a thick hunk of glass up front and 32% obstruction. Doing it Questar's way means the images you see are in a dark background, with high contrast and dimmer appearing than a corresponding APO refractor. The FOV is small by definition.

So what does this mean? It means that the Questar excels at viewing solar system objects. It does "okay" with brighter nebula like the Swan, Ring, Dumbell and Orion. It is simply superb at splitting double stars. And the high contrast, especially with the Brandon eyepiece, allows you to get good views under very challenging conditions – like unsteady air, thin clouds, and lunar/planetary views when the object is close to the horizon. Get more than 20 degrees above the horizon, and the views of the Sun, Moon, and planets are jaw-dropping, especially for such a small telescope.

The Questar's hallmark is contrast, and with either the supplied Brandon eyepieces or with a TeleVue 19mm Panoptic (favored by many Questar owners) the details of lunar craters and mountains, the cloud bands of Jupiter, and the rings of Saturn just "pop" into razor sharp view. Moon and planetary edges

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Questar (Cont'd)

(Continued from page 10)

are clearly demarcated against a black backdrop, crisp and flat more than $\frac{3}{4}$ out of the FOV. No “soft” edges here. But what about deep space? Well, let me say at the outset that galaxies, globular clusters and faint nebula are NOT the forte of the Questar Standard. But let’s get real here. They are not the forte of ANY 3.5 inch aperture telescope, Questar or otherwise. No matter how exacting the Questar optics are, a faint smudge looks like a faint smudge. If you want to see details in galaxies, get yourself 14 inches or more of aperture and some dark skies. If you want to resolve globular clusters, you’ll want AT LEAST 8 inches of aperture. If you want to see the entire Cirrus nebula complex with an O3 filter, get yourself the best short focal length high quality APO you can afford. If you want to fit the large open clusters in a big FOV, get yourself any 60 mm refractor and have a ball. The Questar Standard is not designed for this, and it won’t do it.

Questar naysayers – and they are legion – would at this point argue that a very high quality small APO refractor, like the Takahashi or the AstroPhysics Traveller are much more versatile telescopes and give better views. They can do wide field well, handle ridiculous amounts of magnification, and provide brighter images and better color definition. I have looked through these telescopes, and indeed the views are astounding. But let’s not kid ourselves – Takahashi or AstroPhysics tele-

scopes don’t come cheap, either. In the case of a Tak or an AP, be prepared to sit on a waiting list for a few years before you can take delivery. And then, you still aren’t finished spending money because the Tak and the AP don’t come equipped with much. You still need a finder, a mount, and eyepieces. And, after spending top dollar for a premium APO, are you really going to put it on a cheap mount? Probably not! The Questar Standard comes with 2 Brandon eyepieces, carrying case, table top tripod legs, solar filter, RA clock drive, PowerGuide 2 hand control and built in Barlow, star diagonal, finder, setting circles, and Moon/star map included.

Our naysayers might yield the cost point. So why not get a lesser quality APO, say a Stellarview 80 mm or a TeleVue Pronto? You’ll have a more versatile scope, and will save a lot of money. I have owned a Stellarvue 80mm, and used it as a guide scope and stand alone on an iOptron Cube Pro mount. The Stellarvue does wide field views, as expected. But the planetary, lunar, double star and brighter nebula views were grossly inferior to the Questar. Moreover, I had to deal with a squirrely Cube mount that would often give me problems with alignment, GoTo, and tracking not to mention much more work to set up and use. I also own a TeleVue NP 101 APO. It is a superb refractor. It gives me fantastic wide field views, and can handle a considerable amount of magnification. BUT – for much above 140 x power, it really wants to be on a heavy duty, stable mount

that can track. To set up the mount, balance the scope, polar align, GoTo align, and start viewing takes about 30-45 minutes, when all goes well. I love both telescopes – but for higher magnification views the convenience and portability factors both easily go to the Questar.

Lastly, if you think about it, what are we showing the public most of the time at CCAS demonstration events? They are the Sun, the Moon, any planet available, occasional pretty double stars like Albireo or Epsilon Lyrae, brighter globs and open clusters, and occasionally some of the brighter nebulae. The Questar does a superb job on many of these, and is ridiculously simple and reliable to set up and use. I can guarantee that as long as CCAS is giving demonstrations, my telescope of choice will be the Questar. It comes “loaded” with features, is a joy to use, gives fantastic views, and is a pleasure to look through – and at! It can unequivocally be called the best example of the small Maksutov-Cassegrain telescope, built to last a lifetime.

Combined with the Tri Stand it sets up effortlessly and tracks accurately with minimal effort. It is a classic design that has withstood the test of time for over 60 years. I hope that this review has given the reader some insight as to why this little telescope persists in a world of constant upgrades, model changes, and planned obsolescence.

The Heavyweight Champion of the Cosmos

by Dr. Ethan Siegel

As crazy as it once seemed, we once assumed that the Earth was the largest thing in all the universe. 2,500 years ago, the Greek philosopher Anaxagoras was ridiculed for suggesting that the Sun might be even larger than the Peloponnesus peninsula, about 16% of modern-day Greece. Today, we know that planets are dwarfed by stars, which themselves are bound together by the billions or even trillions into galaxies.

But gravitationally bound structures extend far beyond galaxies, which themselves can bind together into massive clusters across the cosmos. While dark energy may be driving most gal-



axy clusters apart from one another, preventing our local group from falling into the Virgo Cluster, for example, on occasion, huge galaxy clusters can merge, forming the largest gravitationally bound structures in the universe.

Take the "El Gordo" galaxy cluster, catalogued as ACT-CL

J0102-4915. It's the largest known galaxy cluster in the distant universe. A galaxy like the Milky Way might contain a few hundred billion stars and up to just over a trillion (10^{12}) solar masses worth of matter, the El Gordo cluster has an estimated mass of 3×10^{15} solar masses, or 3,000 times as much as our own galaxy! The way we've figured this out is fascinating. By seeing how the shapes of background galaxies are distorted into more elliptical-than-average shapes along a particular set of axes, we can reconstruct how much mass is present in the cluster: a phenomenon known as weak gravitational lensing.

(Continued on page 13)



Image credit: NASA, ESA, J. Jee (UC Davis), J. Hughes (Rutgers U.), F. Menanteau (Rutgers U. and UIUC), C. Sifon (Leiden Observatory), R. Mandelbaum (Carnegie Mellon U.), L. Barrientos (Universidad Catolica de Chile), and K. Ng (UC Davis). X-rays are shown in pink from Chandra; the overall matter density is shown in blue, from lensing derived from the Hubble space telescope. 10 billion light-years distant, El Gordo is the most massive galaxy cluster ever found.

Space Place (Cont'd)

(Continued from page 12)

That reconstruction is shown in blue, but doesn't match up with where the X-rays are, which are shown in pink! This is because, when galaxy clusters collide, the neutral gas inside heats up to emit X-rays, but the individual galaxies (mostly) and dark matter (completely) pass through one another, resulting in a displacement of the cluster's mass from its center. This has been observed before in objects like the Bullet Cluster, but El Gordo is much younger and farther away. At 10 billion light-years distant, the light reaching us now was emitted more than 7 billion years ago, when the universe was less than half its present age.

It's a good thing, too, because about 6 billion years ago, the universe began accelerating, meaning that El Gordo just might be the largest cosmic heavyweight of all. There's still more universe left to explore, but for right now, this is the heavyweight champion of the distant universe!

Learn more about "El Gordo" here: <http://www.nasa.gov/press/2014/april/nasa-hubble-team-finds-monster-el-gordo-galaxy-cluster-bigger-than-thought/>

El Gordo is certainly huge, but what about really tiny galaxies? Kids can learn about satellite galaxies at NASA's Space Place <http://spaceplace.nasa.gov/satellite-galaxies/>.

Night Lights (Cont'd)

(Continued from page 2)

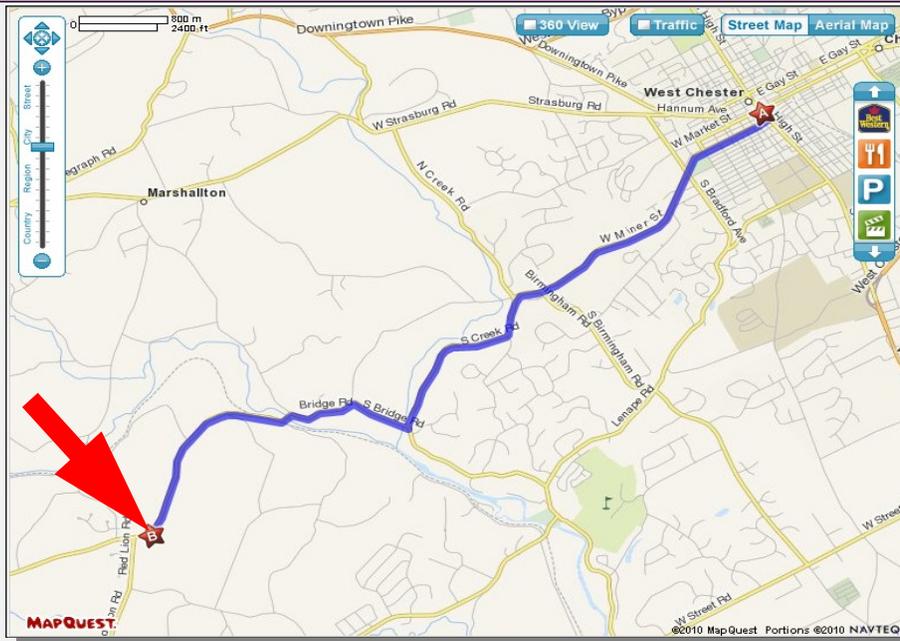
I happened to see these sitting on the shelf during a recent trip in search of hardware for the never ending list of home projects.

They are called "projectables" because they project an image onto the wall or ceiling when the room becomes dark. There are several scenes that are sold, animals, tropical fish and the topic of this article, an artistic image of the solar system.

The planets are not to relative size, but this light is just for fun, not education. I must admit that it has made those nocturnal trips to the litter box a bit more fun.

(Continued on page 14)

CCAS Directions



Brandywine Valley Association

1760 Unionville Wawaset Rd
West Chester, PA 19382
(610) 793-1090

<http://brandywinewatershed.org/>

BVA was founded in 1945 and is committed to promoting and protecting the natural resources of the Brandywine Valley through educational programs and demonstrations for all ages.

Brandywine Valley Association

The monthly observing sessions (held February through November) are held at the Myrick Conservation Center of the Brandywine Valley Association.

To get to the Myrick Conservation Center from West Chester, go south on High Street in West Chester past the Courthouse. At the next traffic light, turn right on Miner Street, which is also PA Rt. 842. Follow Rt. 842 for about 6 miles. To get to the observing site at the BVA property, turn left off Route 842 into the parking lot by the office: look for the signs to the office along Route 842. From that parking lot, go left through the gate and drive up the farm lane about 800 feet to the top of the hill. The observing area is on the right.

If you arrive after dark, *please turn off your headlights and just use parking lights* as you come up the hill (so you don't ruin other observers' night vision).

CCAS Directions

West Chester University Campus

The monthly meetings (September through May) are held in Room 112 in Merion Science Center (formerly the Boucher Building), attached to the Schmucker Science Center. The Schmucker Science Center is located at the corner of S. Church St & W. Rosedale Ave. Parking is generally available across Rosedale in the Sykes Student Union parking lot (Lot K).



Night Lights (Cont'd)

(Continued from page 13)

The image is in focus even if your wall or ceiling is near or far from the night light and the light only comes on when the room is dark. It is also an LED light, so the energy use is very minor. I took a picture of the image on our ceiling (see cover page). It's not a great picture, but you get the idea. I found that an image of the Moon is also available, I'll need to look for one of those.

So if you want to brighten up your night, this is a fun way to do it!

CCAS Membership Information and Society Financials

Treasurer's Report by Don Knabb

Feb. 2015 Financial Summary	
Beginning Balance	\$2,195
Deposits	\$105
Disbursements	\$0
Ending Balance	\$2,300

New Member Welcome!

Welcome new CCAS member Pete Kellerman from Downingtown. We're glad you decided to join us under the stars! Clear skies to you!

Membership Renewals

You can renew your CCAS membership by writing a check payable to "Chester County Astronomical Society" and sending it to our Treasurer:

Don Knabb
988 Meadowview Lane
West Chester PA 19382

The current dues amounts are listed in the *CCAS Information Directory*. Consult the table of contents for the directory's page number in this month's edition of the newsletter.

Join the Fight for Dark Skies!

You can help fight light pollution, conserve energy, and save the night sky for everyone to use and enjoy. Join the nonprofit International Dark-Sky Association (IDA) today. Individual memberships start at \$30.00 for one year. Send to:

International Dark-Sky Association
3225 North First Avenue
Tucson, AZ 85719

Phone: 520-293-3198
 Fax: 520-293-3192
 E-mail: ida@darksky.org

For more information, including links to helpful information sheets, visit the IDA web site at:

<http://www.darksky.org>

Note that our CCAS Webmaster John Hepler has a link to the IDA home page set up on our Society's home page at <http://www.ccas.us>.

Dark-Sky Website for PA

The Pennsylvania Outdoor Lighting Council has lots of good information on safe, efficient outdoor security lights at their web site:

<http://www.POLCouncil.org>

Find out about Lyme Disease!

Anyone who spends much time outdoors, whether you're stargazing, or gardening, or whatever, needs to know about Lyme Disease and how to prevent it. You can learn about it at:

<http://www.LymePA.org>

Take the time to learn about this health threat and how to protect yourself and your family. It is truly "time well spent"!

CCAS Event Information Phone Number

We've set up a special phone number you can dial to find out if our monthly observing session and other scheduled events will be held or postponed. Call **610-436-0829** after 5 PM ET to hear a recording to find out the latest news.

Good Outdoor Lighting Websites

One of the biggest problems we face in trying to reduce light pollution from poorly designed light fixtures is easy access to good ones. When you convince someone, a neighbor or even yourself, to replace bad fixtures, where do you go for good lighting fixtures? Check out these sites and pass this information on to others. Help reclaim the stars! And save energy at the same time!



Light pollution from poor quality outdoor lighting wastes billions of dollars and vast quantities of valuable natural resources annually. It also robs us of our heritage of star-filled skies. Starry Night Lights is committed to fighting light pollution. The company offers the widest selection of ordinance compliant, night sky friendly and neighbor friendly outdoor lighting for your home or business. Starry Night Lights is located in Park City, Utah.

Phone: 877-604-7377
 Fax: 877-313-2889

<http://www.starrynightlights.com>



Green Earth Lighting is a dedicated lifetime corporate member of the International Dark-Sky Association. GEL's products are designed to reduce or eliminate the negative effects outdoor lighting can have while still providing the light you need at night.

Green Earth Lighting LLC
 620 Onion Creek Ranch Rd
 Driftwood, Texas 78619

Phone: 512-944-7354

<http://www.greeneearthlighting.com>

Local Astronomy-Related Stores

Listing retail sites in this newsletter does not imply endorsement of any kind by our organization. This information is provided as a service to our members and the public only.



Skies Unlimited is a retailer of telescopes, binoculars, eyepieces and telescope accessories from Meade, Celestron, Televue, Orion, Stellarvue, Takahashi, Vixen, Losmandy and more.

Skies Unlimited
Suburbia Shopping Center
52 Glocker Way
Pottstown, PA 19465

Phone: 610-327-3500 or 888-947-2673
 Fax: 610-327-3553

<http://www.skiesunlimited.net>



Located in Manayunk, Spectrum Scientifics educates and entertains customers with an array of telescopes, microscopes, binoculars, science toys, magnets, labware, scales, science instruments, chemistry sets, and much more.

4403 Main Street
Philadelphia, PA 19127

Phone: 215-667-8309
 Fax: 215-965-1524

Hours:
 Tuesday thru Saturday: 10AM to 6PM
 Sunday and Monday: 11AM to 5PM

<http://www.spectrum-scientifics.com>

CCAS Information Directory

CCAS Lending Telescopes

Contact Don Knabb to make arrangements to borrow one of the Society's lending telescopes. CCAS members can borrow a lending telescope for a month at a time; longer if no one else wants to borrow it after you. Don's phone number is 610-436-5702.

CCAS Lending Library

Contact our Librarian, Barb Knabb, to make arrangements to borrow one of the books in the CCAS lending library. Copies of the catalog are available at CCAS meetings, and on the CCAS website. Barb's phone number is 610-436-5702.

Contributing to *Observations*

Contributions of articles relating to astronomy and space exploration are always welcome. If you have a computer, and an Internet connection, you can attach the file to an e-mail message and send it to: newsletter@ccas.us

Or mail the contribution, typed or handwritten, to:

John Hepler
313 S. Queen St.
Chestertown, MD 21620

CCAS Newsletters via E-mail

You can receive the monthly newsletter (in full color!) via e-mail. All you need is a PC or Mac with an Internet e-mail connection. To get more information about how this works, send an e-mail request to John Hepler, the newsletter editor, at: newsletter@ccas.us.

CCAS Website

John Hepler is the Society's Webmaster. You can check out our Website at: <http://www.ccas.us>

John welcomes any additions to the site by Society members. The contributions can be of any astronomy subject or object, or can be related to space exploration. The only requirement is that it is your own work; no copyrighted material! Give your contributions to John Hepler at (443) 282-0619 or e-mail to webmaster@ccas.us

CCAS Purpose

The Chester County Astronomical Society was formed in September 1993, with the cooperation of West Chester University, as a non-profit organization dedicated to the education and enjoyment of astronomy for the general public. The Society holds meetings (with speakers) and observing sessions once a month. Anyone who is interested in astronomy or would like to learn about astronomy is welcome to attend meetings and become a member of the Society. The Society also provides telescopes and expertise for "nights out" for school, scout, and other civic groups.

CCAS Executive Committee

For further information on membership or society activities you may call:

President:	Roger Taylor 610-430-7768
Vice President:	Liz Smith 610-842-1719
ALCor, Observing, and Treasurer:	Don Knabb 610-436-5702
Secretary:	Ann Miller 610-558-4248
Librarian:	Barb Knabb 610-436-5702
Program:	Dave Hockenberry 610-558-4248
Education:	Kathy Buczynski 610-436-0821
Webmaster and Newsletter:	John Hepler 443-282-0619
Public Relations:	Deb Goldader 610-304-5303



CCAS Membership Information

The present membership rates are as follows:

REGULAR MEMBER	\$25/year
SENIOR MEMBER	\$10/year
STUDENT MEMBER	\$ 5/year
JUNIOR MEMBER	\$ 5/year
FAMILY MEMBER	\$35/year

Membership Renewals

Check the Membership Renewals on the front of each issue of *Observations* to see if it is time to renew. If you need to renew, you can mail your check, made out to "Chester County Astronomical Society," to:

Don Knabb
988 Meadowview Lane
West Chester PA 19382-2178
Phone: 610-436-5702
e-mail: treasurer@ccas.us

Sky & Telescope Magazine Group Rates

Subscriptions to this excellent periodical are available through the CCAS at a reduced price of **\$32.95**, much less than the newsstand price of \$66.00, and also cheaper than individual subscriptions (\$42.95)! Buying a subscription this way also gets you a 10% discount on other Sky Publishing merchandise.

To **start** a new subscription, make **sure** you make out the check to the **Chester County Astronomical Society**, note that it's for *Sky & Telescope*, and mail it to Don Knabb.

To **renew** your "club subscription" contact Sky Publishing directly. Their phone number and address are in the magazine and on their renewal reminders. If you have **any** questions call Don first at 610-436-5702.

Astronomy Magazine Group Rates

Subscriptions to this excellent periodical are available through the CCAS at a reduced price of **\$34.00** which is much less than the individual subscription price of \$42.95 (or \$60.00 for two years). If you want to participate in this special Society discount offer, **contact our Treasurer Don Knabb**.