

# Urban Adventures in Astronomy, December 2013

## The Details

**Location:** The back of my townhouse in Azusa. The neighbor across the driveway has not one, but TWO bright lights, as if burglars would come using parachutes, hang gliders, or drones. I need to get a large umbrella to shield me from him. I arranged with the other owners to allow me to turn off the driveway lights for some darkness.

**Time:** December 30<sup>th</sup>, 6:00pm to around 10:30pm.

**Weather:** no apparent clouds although there might have been high cirrus. Plenty of haze so the sky was bright; 2<sup>nd</sup> mag stars visible, third mag much harder. Some slight wind. And COLD.

**Equipment:** Orion 10 inch Newtonian on an Orion EQ-G computerized German mount. Orion G3 cooled CCD 752 x 582 camera. This produces an image FOV of 27 arc-minutes wide.

I imaged and skipped some objects, so this is a record of only those where I saved the image, even if the images didn't turn out as keepers in the end. The times are the file time tags.

Because of the layout of my townhouse, the only area of the sky completely open to me is towards the Northwest, but this meant looking towards my backyard neighbor's bright white and uncovered light. This forced me to reconsider the way to use my telescope from my "backyard", but more on that later. So the first several objects are in this area of the sky, with the exception of the first target.

## Selecting Targets

One problem novices have is selecting good targets where you choose to observe. Even within a class of objects like globular clusters or planetary nebulae, there is a wide distribution of sizes, shapes, and brightness. Even color enters into the picture. Color sensitivity varies between individual observers, as was brought to my attention during this past year's Nightfall star party. Don Pensack, among others, saw reddish hues in M-42's companion, M-43, but I didn't see any of this through his telescope. He when admitted that he does have better sensitivity to red wavelengths than most observers. Thus, what is seen by one observer may not be visible to another.

So when one starts making a list of objects to observe, one has to take into account these factors. Images from sky surveys like the STScI are taken at various exposure times and various wavelengths, so what one sees might be very different from what is shown in those image.

Also, your equipment will limit what might be interesting to you. Small objects might appeal to some and not to others. Most planetaries are quite small, less than 2 arc-minutes in width. On the other end of the scale, some open clusters are half a degree wide or wider, and usually pretty thinly spread out.

I decided that open and globular clusters, and some planetary nebulae, would make good targets for my equipment from the back of my townhouse. All are usually bright, or at least have bright stars, have high area brightness, meaning that each square arc-minute is bright enough to image, and are fairly compact or can be. I used the observing list generator at the NGC/IC project website at <http://www.ngcicproject.org/>, then edited

the list to include just those types of objects, further edited the list to include only those larger than about 3 arc-minutes, and then edited it down further by limiting the magnitude to 13<sup>th</sup> and brighter. I then used the STScI image generator at [http://archive.stsci.edu/cgi-bin/dss\\_form](http://archive.stsci.edu/cgi-bin/dss_form) to see what the object would look like in my camera, and whittled the list down from that. In addition, because of the layout of my townhouse and nearby lights, I had to limit myself to objects north of +10° Declination. This still forms a vast list of objects.

And of course, even if you've seen or imaged an object before, you can do better (longer exposures, better tracking or conditions, et al).

Armed with this list, I proceeded to observe.

## Observing Log

**7:01pm:** Neptune was the first target, just because I hadn't seen it this year. It was low and to the Southwest. Looking towards the bright street lights from around the corner of my townhouse, and through a LOT of atmosphere and haze, it was bright thanks to 10-inches of aperture, but small given the f/4.5 focal ratio. Even

a 2x Barlow didn't help much, but I did image Triton.



**7:13pm:** NGC-40 is a planetary in Cepheus. I only selected it due to its relatively large size and brightness, but I was shocked when I processed the image and saw this! RED?! And quite prominently red. I don't think this is due to color processing, since all the other planetaries I imaged that night were the usual bluish green color, and the Crab Nebula even showed

some red. As with a lot of planetaries, the central star is easily imaged; one of the exceptions is the Crab Nebula! Also, this planetary is a strange combination of a ring and a bi-lobed structure. To bring out details on this and other faint objects, I was fortunate enough to be able to increase my exposure times up to 60 sec thanks to better than average tracking that night.

Visually, this one might be tough visually, since it glows mostly in red light, the color the eye is least sensitive to under dark conditions. But if you can see it, and especially color in it, it would be a unique treat!



**7:42pm:** NGC-7354 is another planetary in Cepheus. This one is normal in color at least; almost all planetaries have a greenish appearance due to triply ionized oxygen, also known as O-III, thanks to the strong ultra-violet light emitted by the central star. This image is on the same scale as NGC-40. This is a 60-sec exposure. It is a bi-lobed planetary, but also circular, similar to NGC-40, but there are bright knots in the "ring". Obviously more

image size (magnification) is needed. This is where a good quality 5 or 6 inch Maksutov such as the ones sold by Orion Telescopes would come in handy, but for imagers this would place a premium on accurate tracking, and with such a telescope, the only other objects you can image are the real planets in our own Solar System.

The size is typical for most planetaries, which are 3 arc-minutes or less in size. This places a premium on both aperture and focal length, so a Maksutov or refractor would be excellent if you're interested in these objects. On the other hand, the famous Helix planetary in Aquarius, NGC-7293, is 25 arc-minutes wide.



**7:54pm:** NGC-7662 is the famous Snowball Nebula in Andromeda, yet another green planetary. Planetary nebulae make good targets for urban astronomers because, while they're small, they usually have high area brightness, and their greenish light puts them in the region of greatest sensitivity for human seeing.

*Because this planetary is quite bright, in order to look at the inner details of the object, I reduced the exposure time to only 5-seconds.*

8:35pm: *at this time, I decided that the best way to avoid gulping in the bright uncovered light from my*



*backyard neighbor's house would be for me to point it towards my townhouse. It means I'll operate my equipment like a transit telescope, looking through a narrow window from just a few hours of RA east of the meridian to the meridian, and north to the zenith. I'll be looking through less haze and atmosphere, and avoid any bright lights shining into the front end of my telescope, which winds up as a glow in the more heavily processed images.*

*I went through several open clusters and planetaries that were too sparse, too faint, or too small to keep the images of. Of that group, only this one, NGC-1907 in Auriga, was a keeper. This is an uncropped image, about 26 arc-minutes wide. I used a 45-second exposure to bring out the fainter members of the cluster.*



**8:41pm:** after the let-down of Auriga, I thought a known object would be a nice change-of-pace, so I went to M-1, the Crab nebula, in Taurus. This is a 45 second uncropped image, 26 arc-minutes wide. I still had to contend with light leaking into the image on the lower left corner, but by selecting just that area, I was able to dim the glow from this ambient light without affecting the nebula itself.

I have only seen this planetary a few times visually, and have

never seen the structure that gave the name "crab" to it. The reddish tendrils are visible, along with a pinkish glow due to the blue of synchrotron radiation from electrons mixing with the reddish glow of excited hydrogen atoms. By the way, this is one of the few planetaries that can be definitely tied to a supernova explosion. Most of the rest are from nova. Novae normally leave a central star behind, usually a white dwarf. Supernovae leave behind a neutron star or black hole, neither of which is visible from earth. Even the Crab's star is not really visible. What telescopes see is the pulse from material being wiped around the neutron star a thousand or more miles above the surface of the star.

**8:49pm:** M-36, an open cluster in Auriga, is too sparse to be photogenic in my telescope. Quite a few open clusters were imaged and rejected in this way. I generate my observing list using images from the STSCI site at [http://archive.stsci.edu/cgi-bin/dss\\_form](http://archive.stsci.edu/cgi-bin/dss_form), but these are black and white images at much longer exposure levels than I use, so I use it only as a guide to how large and dense a cluster is. But nothing will tell you what an object will really look like with your equipment, as witness the next one.

**8:59pm:** I remembered that there was another planetary in Taurus I had selected for imaging, so I swung back to Taurus and took a look; NGC-1514, what I call the forgotten planetary in Taurus thanks to its better known cousin above. This image is to the same scale as the Crab nebula image, so you can directly compare the size of the two objects. It's hard to find two objects of the same type having such different appearances! NGC-1514 has a very bright star in the center, so I suspect this is not a white dwarf but a hot bluish white star. My guess is that the very bright central star is exciting the nebula's gas to higher bluish colors. What a beautiful planetary! It's definitely not the usual small green dot that a lot of planetaries are.

9:08pm: IC-2149. The IC designation should be a warning sign to amateurs that the object is too faint to bother with, and IC-2149 is no exception. I barely recorded it with a 30 second exposure at four times the sensitivity of the camera at normal settings. In this case, it is too small to record many pixels, so I moved on.



9:19pm: Gemini was now high enough to move past the top of my townhouse, so I started scanning it for objects. NGC-2158 is the open cluster west of the more famous and larger open cluster M-35. M-35 is too large for my camera, but NGC-2158 isn't, although its members are faint. They also appear to be reddish. If this is accurate, it means this cluster is old. It's a simple progression. All stars in a cluster are born together. The large bluish stars evolve in a few hundreds of thousand

years and disappear. Then the less massive white stars do so in millions of years. Then the yellow stars do so in a few billion years. And then all you have left are reddish stars, which might take tens of billions of years to reach their end. This is a 45 second exposure to capture the fainter stars in the cluster.

It turns out I imaged this object back at the start of November during the Nightfall star party at Borrego Springs.



**9:28pm:** I noticed that there is a planetary, NGC-2022, in the head, or perhaps the neck, of Orion. I was curious, so I dropped down from Gemini and took a look. This is a 60 second image. Talk about small! Normally I would not keep the image, but even with the lack of magnification, there is something not symmetrical about this one. Does anyone know the story about his object?

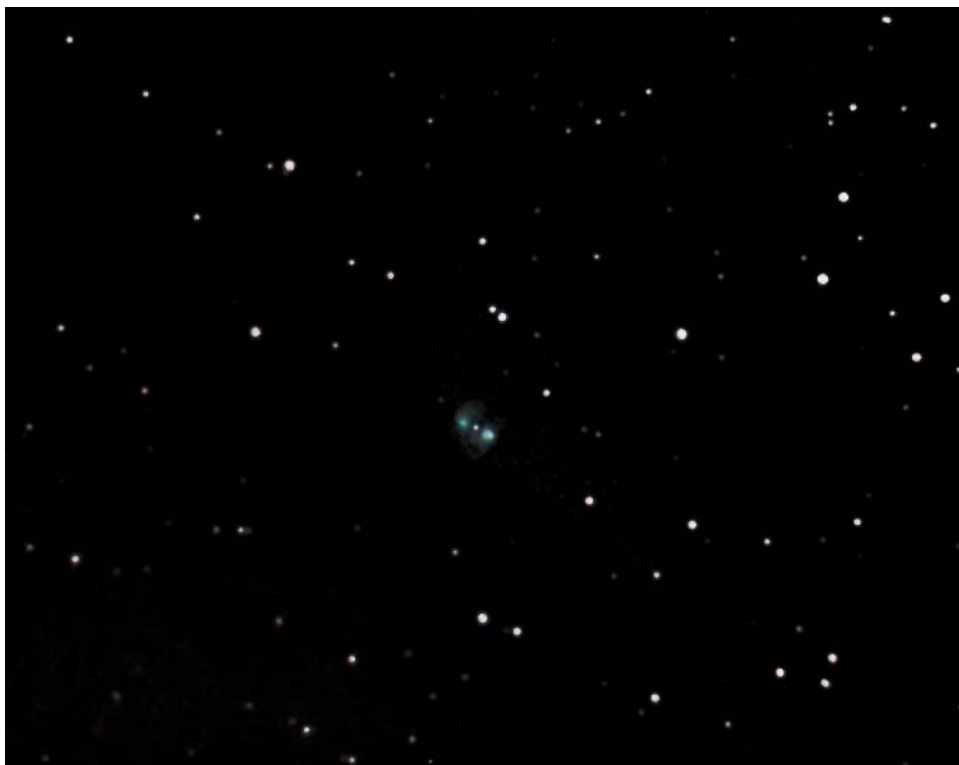
**9:37pm:** Moving right along the upraised arm of Orion from NGC-2022, there are

three fairly dense but faint opens, NGC-2141, NGC-2194, and NGC-2169, but only NGC-2169 was above the roof of my townhouse. NGC-2169 was sparse but bright, but I overexposed the image and it wouldn't process well.



**9:44pm:** I went back to Gemini for more objects, and came across NGC-2266, a dense but faint open cluster. This has faint blue stars and brighter red one, probably young blue giants and evolved red giants, suggesting that this cluster is young. This is a cropped 45 second image with

*the colors saturated a bit to bring out the hues.*



*9:59pm: what I decided would be the last object, as my feet finally got cold and achy, was NGC-2371, yet another planetary, in Gemini. Again, the typical bluish green color due to O-III, but definitely bipolar, like the famous M-27 "Dumbbell" nebula in Vulpecula. This is a 60 second image. The Northeastern lobe is smaller and fainter than the Southwestern one, but this might be due to that end being tilted way from earth.*

*Again, I imaged this object at the start of November during*

*the Nightfall star party. That was a 20 second exposure. The longer exposure showed slightly more detail in the fainter regions of the planetary despite the presence of more ambient light.*





*10:24pm: the last object was Jupiter, taken with my Philips SPC900N CCD web camera and a 2x Barlow to get image size. A stack of the best 130 images were processed through Registax. Jupiter was about 47 arc-seconds wide and occupied about 125 pixels, giving about 2.7 pixels per arc-second. The tiny dot is Europa, measuring about 2 pixels wide. The original image was about 4 arc-minutes wide.*

*And thus the night came to a successful and COLD conclusion. Not a bad way to end the old year.*