

---

## COMET DISCOVERY

---

In February 2012 I discovered a comet, now designated [Comet C/2012 C2 \(BRUENJES\)](#). This is the story of its discovery. Biographical information about me is available [here](#).

---

Friday, February 10th 2012 just felt like the perfect night for a comet to be discovered by an amateur astronomer. I felt really compelled to observe, as the sky conditions were perfect, the cold weather probably scared off other amateurs, and most professional observatories had been shut down by the full moon for several days. That leaves the sky wide open for new discoveries. There was only an hour or two before the moon would rise and ruin chances of finding anything, but an hour is all it takes for me to search about 270 square degrees of sky to limiting magnitude 16. [Click here for some details about my observatory and equipment.](#)

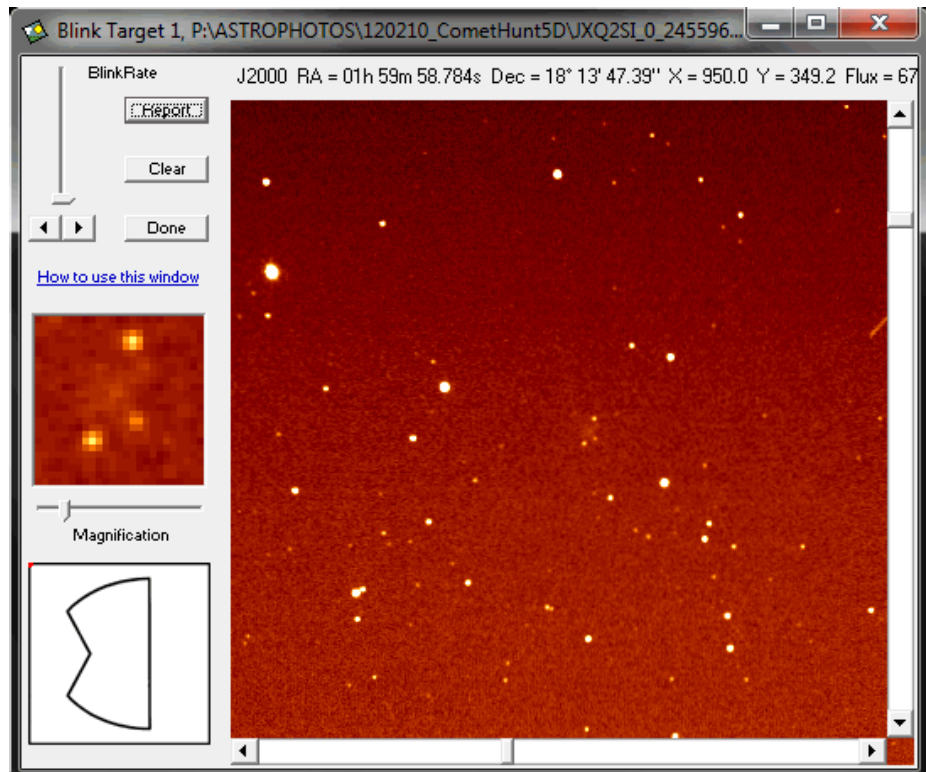


[Moonglow Technologies All Sky Cam](#) image of my observatory at the moment of discovery.

I got the system up and running like a well oiled machine, so I sat down for a rare chance to watch TV. When checking in on the system around the time it should have been completing the first hour set of search images, I was really frustrated to find that the Canon 5D DSLR camera had locked up. It does this about once an hour, so I have a solid state relay controlling its power in order to automatically power cycle it to clear lockups. But for whatever reason that didn't work tonight and the first set of images was an unusable incomplete set. I was frustrated because the perfect conditions had been squandered away.

At this point I really wanted to give up and shut down the observatory as the moon was about to rise. However I reminded myself that you can't find if you don't look and so I restarted the system. I let it run for two hours, when it was clear that the Moon was severely impacting sensitivity and it was time to give up.

At around 11pm I started reducing the images by blinking them in DC3's Visual Pinpoint tool. It's a quick and easy way to search through a lot of frames. It automatically detects movement, but I like to do a cursory visual search just in case Pinpoint missed something wierd or faint. Something immediately caught my attention in a set that was taken as the moon was rising. There was a faint fuzzy object in two of the frames, and possibly in the third frame. It was moving in a straight line and clearly wasn't an asteroid. It was so faint in the third image (because of interfering moonlight) that Pinpoint didn't pick it up. There are so few comets visible at any given time, when you see something like this it really grabs your attention.



999 times out of 1000, someone else has already found it, so I plugged its coordinates in to the Minor Planet Center's checker webpage form to see if it was anything currently known. The results came back blank, with nothing known at that location. Gulp. A manual search of known comets in the vicinity also came up empty. Maybe it was an already-known asteroid that has now gotten close enough to the sun to begin showing cometary activity? A check of known objects in the region had a lot of results in the area, but all were moving eastward while my fuzzy was moving westward. Rocks don't make U-turns. This was really getting exciting. I had Jen, my better half, an accomplished astro imager, take a look at the images and before I could point out the faint smudge she exclaimed "That's a comet!".

Still, this wasn't a slam dunk. The image was so faint, it could be explained away as any number of causes. It looked somewhat like the residual bulk image phenomenon that plagues Kodak CCDs, so I loaded up the raw frames to check if the fuzzy remained at the

same location and the apparent motion was just a result of the scope moving around. Nope, the fuzzy was at different X/Y locations so that's not RBI, and the scope positioning was randomly distributed, not in the perfect straight line like this fuzzy is following. Plus this Canon DSLR does not suffer from RBI.

In Pinpoint I use monochromatic, 2x2 binned frames for expediency, but the raw images from the Canon are full color. In the raw color images I immediately saw that the fuzzy was greenish in color. With this equipment setup, comets usually render as green due to cyanogen and carbon emission, so that's very encouraging.



*Raw color discovery image. Streak at right is a satellite.*

A check of the Distant Artificial Satellites webpage confirmed that it was not a far off man-made satellite that was venting. One thing I couldn't rule out was an internal reflection within the telescope. Bright Jupiter was only 6 degrees away, so its light was definitely entering the telescope and bouncing around. It didn't look like an internal reflection, as those usually have much brighter curvaceous, figure-8, or swirl forms, so I was really starting to believe this was a comet. It had set by the time I reached this point, so I would have to wait for another night to obtain confirming images.

I needed to get an idea of where the moving fuzzy might be located the next night. The Minor Planet Center has a tool to make predictions of where a possible object will be, based off a few observations. I plugged in my measures, and got back a nonsense eastward moving orbit with the note: "This object is moving quite rapidly. You should probably report it ... immediately." Nope, not yet, I need confirmation on a second night before I report this. I don't want to send expensive professional telescopes on a wild goose chase.

I had to manually extrapolate where the object would be the next night. A few minutes in Excel provided a target. I would point the scope there, wait for darkness, and if something fuzzy moved in the immediate vicinity, the crowd goes wild. Predicting the location of an object and then finding it dead on would be the ultimate confirmation that



this is something worthy of reporting, and would very probably be a new comet.



*The full discovery frame, vignetted in the corners by the Hyperstar.*

The next 18 hours were spent double checking images, catalogs, equipment, and reporting procedures. As soon as Jupiter was visible I sync'd the telescope and then slewed to the expected location of the potential comet. Through the bright twilight I could see enough stars to confirm I was pointed at the right target area.

Slowly the twilight faded and I began to stretch and process the images in hopes of spotting something fuzzy. The first few frames showed only bright blue from the receding twilight. Then in a later frame I saw an object barely out of the noise that was not on star charts. Waiting a little longer, in the next frame that object was definitely there and it had a greenish fuzzy tinge! Oh. Wow. It was dead nuts at where it was supposed to be. Wow. This thing is for real! It's at about this time that it begins to sink in that a lifelong quest has just been fulfilled. I just crossed another thing off the bucket list!

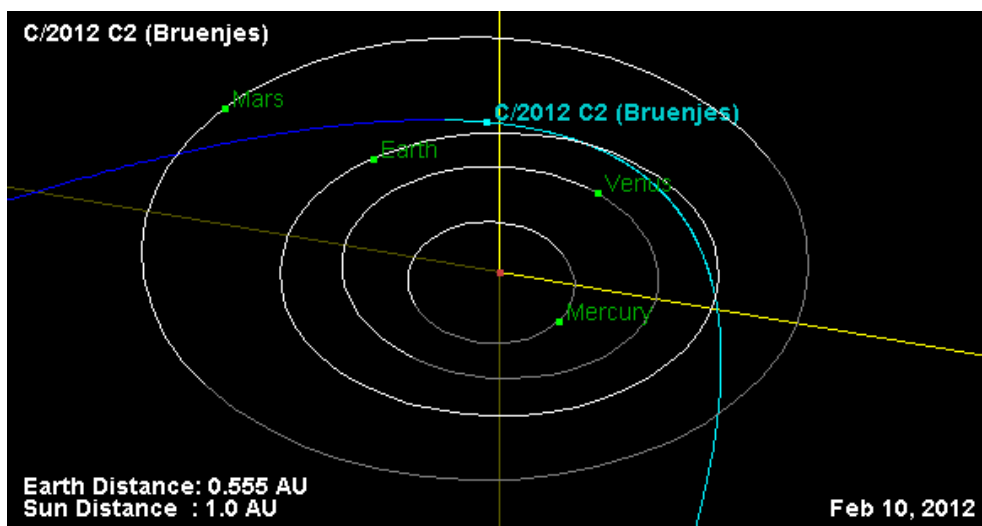
I spent the next hour gathering a series of exposures so that the report to the Minor Planet Center would have multiple measures to ensure other observatories could follow up the object easily. My hope was that the observations would be enough to quickly place the object onto the NEO Confirmation Page, so that observers around the world could immediately get to work confirming or denying it.



*Ten 60s exposures stacked while tracking the comet on Feb 11th. No discernible tail.*

It didn't take long; perhaps five minutes after submitting the report, it was up on the NEOCP. Now my job was to sit back and wait for confirmation and the discovery announcement. This could just be a new apparition of an older, lost comet, or it could be something new. As the adrenaline began to wear off and I fell asleep, I started to think about who I was going to tell first...

Fred Bruenjes  
Warrensburg, Missouri, USA  
February 12, 2012



Orbit diagram courtesy [NASA/JPL](#)



---

*I received the 2012 Edgar Wilson Award from the Smithsonian.*

You can go back to my [main astronomy page](#) for lots more good images!

---

Comments? Questions? Click [here](#) to send email to me, Fred Bruenjes.

All text and images are © 1995-2012 Manfred Bruenjes - All Rights Reserved. Image inlining is strictly prohibited. [Email](#) for permission before using an image or text.