

CITIZEN SCIENCE USING REMOTE TELESCOPES

By Brad Young

Amateur astronomers have a huge role to play when it comes to citizen science. However, we don't all have the high-end equipment to involve ourselves in the best opportunities. Remote telescopes offer a solution that may work for you. The Astronomical League considers remote telescopes "go-to telescopes where the observer is not responsible for maintenance and operation of the telescope." However, the observer is responsible for the selection, definition, and timing of the observation, and the exposure times, cadence, filters, and processing used to create the final images. They are also responsible for measurements such as astrometry (position), photometry (brightness), and other useful data. Several AL Observing Clubs accept remote telescope observations for both the main program and the citizen science continuation of the program.

VARIABLE STARS

Variable stars provide several ways to perform citizen science. Measuring variability has taught us the inner workings of stars, set stellar and galactic distances, and helped explain how stars form and die. Some of the best-known targets can be seen naked eye or with a small telescope; you may wish at some point to find dimmer and more challenging targets such as young stellar objects and novae, or do spectroscopy. All these can be done using remote telescopes, and the findings reported to the American Association of Variable Star Observers (AAVSO).

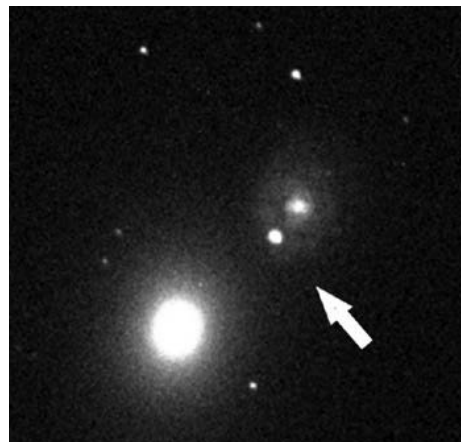
SUPPORTING HUBBLE MISSIONS

One exciting offshoot of this is to provide ground support for Hubble Space Telescope missions. The science being done by HST may be adjusted based on this ground support, with changes made or even rescheduling HST observations based on findings by amateurs. In some cases, a star may be best observed

when brightest, or it may have to be delayed if a flare up occurs. Often, the request is for multiband (B, V, R, I) imagery and even spectroscopy. In all cases, the requests are time sensitive.

The AAVSO publishes alert bulletins on upcoming missions that need observations of certain variable stars to support an upcoming or ongoing Hubble mission. The bulletins provide details on the star, the timing, the filters requested, and some background on what the observation is about.

EXTRAGALACTIC SUPERNOVAE



SN 2022rms, image by the author.

Another exciting type of object is extragalactic supernovae (EGSN). One famous one this year (SN 2022rms) occurred in NGC 4647, a galaxy visible next to M60. Not only was the supernova brighter than its host galaxy, but its location made it easy to observe.

ACTIVE GALACTIC NUCLEI

There is also a group of variables known as active galactic nuclei which are not the same as EGSNs but indicate variability in the nucleus itself. This group includes objects such as quasars, blazars, BL Lacertae objects, and more. These usually have AAVSO identifiers and can be easily reported, although many of them are faint and require larger scopes or long exposures.

ASTEROIDS

With asteroids, several opportunities are open to amateurs using remote imaging. The Minor Planet Center (MPC) provides orbital data for all known asteroids and comets to use for preparing observations. Association of Lunar and Planetary Observers (ALPO) publishes the *Minor Planet Bulletin* four times a year, a journal of various findings, especially determinations of rotational periods for asteroids. You can either use their template to write an article for their journal, or if you prefer, you can use data you've gathered and the methodology and determine rotational periods yourself. Also useful in the *Minor Planet Bulletin* is the annual list of "Minor Planets at Unusually Favorable Apparitions," which appears in every January–March issue.

Another way that remote telescopes are used in minor planet studies is the Astronomical League's Target NEO program (formerly Target Asteroids program, co-sponsored by NASA and University of Arizona). This effort is centered on determining characteristics of asteroids that are near-Earth objects, and others that may be worth visiting, landing on, or even returning samples from such as the recent success at Bennu. They accept reports in MPC format so you won't have to do any extra work to provide the data; however, in this case you will need to provide a FITS (image) file in addition to the report.

SATELLITES

Satellite tracking is another observing situation where remote telescopes are often useful. Many satellites are geosynchronous and will never appear in your sky, as their orbits are designed to stay over single spots on the Earth's surface. These can be imaged or tracked by radio remotely with equipment at the proper location.

Another reason for tracking satellites is that some may be confused with near-Earth objects because they are in solar or highly elliptical orbits. These are often rocket bodies

or other debris from early launches. Project Pluto (projectpluto.com/sat_eph.htm) is an effort to determine and follow some of these very high orbit objects so that they are not using up valuable survey effort and can be discounted as a threat to the Earth.

Remote telescopes have also been useful, at least in my case, in identifying objects that are listed in the ISON (International Scientific Optical Network) catalog but are not listed in the U.S. Space Command catalog (Space-Track). This goes beyond just classified satellites, although those do appear in that list. I'm more interested in the ones that are not matched with a classified payload but are indeed tracked by one system and not matched to another. I recently published my final version of this study, which I performed over a period of nearly three years.

COMETS

Comets are notorious for being on the other side of the world from where you are when they're at their best. This is another way that remote imaging may be useful to you, as you may be able to find a telescope that has a better view of the comet you can't see well or at all from your home site. As a bonus, you can always report data on the comet to the COBS (Comet Observation Database) and add to our knowledge of comets through citizen science.

ACKNOWLEDGEMENT AND THANKS

Most citizen science work I've done over the last six years has been using a telescope at the Perth Observatory in Western Australia. They have been highly supportive of all my efforts and continue to help me and their other research partners throughout the world to add to our knowledge of the universe. ★

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REFERENCES

www.astroleague.org/content/terms-common-usage-al-observing
www.wis-tns.org/object/2022jli/classification-cert
minorplanetcenter.net/iau/mpc.html
aavso.org
alpo-astronomy.org
www.astroleague.org/node/4017
www.nasa.gov/osiris-rex
iasc.cosmosearch.org
www.projectpluto.com/sat_eph.htm
www.space-track.org
hafsnt.com/index.php/recent-articles
cobs.si

It's All About the Moon!

AN INTERVIEW WITH A NEW CLUB MEMBER INTERESTED IN LUNAR PHOTOGRAPHY

The Moonstruck Astronomy Club, a member of the Astronomical League, is active at On Top of the World, a 55+ community in Ocala, Florida. The club holds monthly meetings for the 72 men and women who are members of the club to discuss topics in astronomy and to feature presentations by guest speakers and club members about telescopes, observing, and the heavens. When the weather allows, the club hosts evening observation sessions for its members, some of whom bring their own telescopes to share views with others. The club also maintains a small "telescope lending library" from which members may "check out" a scope for weeks or months to use on their own.

This article is an interview conducted by Moonstruck Astronomy Club reporter Jim Shuman with new club member Dean Rehphol about his initiation into lunar photography.

Jim: How did your interest in the Moon begin, Dean?

Dean: While visiting our eight-year-old grandson in Minnesota, my wife and I gave him a used 90 mm Bushnell refracting telescope. And on Tuesday August 31, 2021, for the first time in my life, I viewed our Moon through a telescope. I was moonstruck! The hair on my arms and neck came to attention! My first thought was, "I've never seen such a magnificent thing in the Universe!" I knew I wanted to see more of it!

Jim: How did you land on a Dobsonian?

Dean: After seeing the Moon for the first time through a telescope, I immediately spent hours and weeks watching YouTube videos such as "Viewing Our Moon," "Best Beginner Telescopes," and "How to Photograph the Moon." I also searched the Internet to find dealers, prices, and availability of various telescopes I felt could best serve my needs and budget. I decided that an 8-inch Dobsonian reflector would be a great place to start for a novice. But to my disappointment, I soon found out that ALL the 8-inch Dobsonians were out of stock everywhere, and no one had any idea when they would be restocked.



Dean Rehphol with the 8-inch Dobsonian

It was sad because that was the model I had decided I needed.

Jim: So, what did you do?

Dean: Shortly after that, I realized for the first time that the 55+ community where we had lived for nine years (On Top of the World in Ocala, Florida) has an astronomy club with a website (moonstruckastronomyclub.org). We flew home from Minnesota on October 12, 2021, just in time for me to attend the next club meeting on October 14. I was so excited to be there; I didn't attend as a "visitor" but just paid my yearly membership fee as I came in the door and joined up as a member immediately!

During that meeting the club officers mentioned that they had six "loaner" telescopes and one was an 8-inch Sky-Watcher Dobsonian reflector! My hand shot up into the air. "I'll take that one!" (Talk about an answer to prayer! I didn't even know that they had a telescope lending library!) The next morning, one of the club officers dropped the telescope off at my house, gave me a quick overview, and answered my many questions. Later, I built a wood and foam cradle that supports the tube section of the scope for transport in my Kia Soul or on my golf cart.