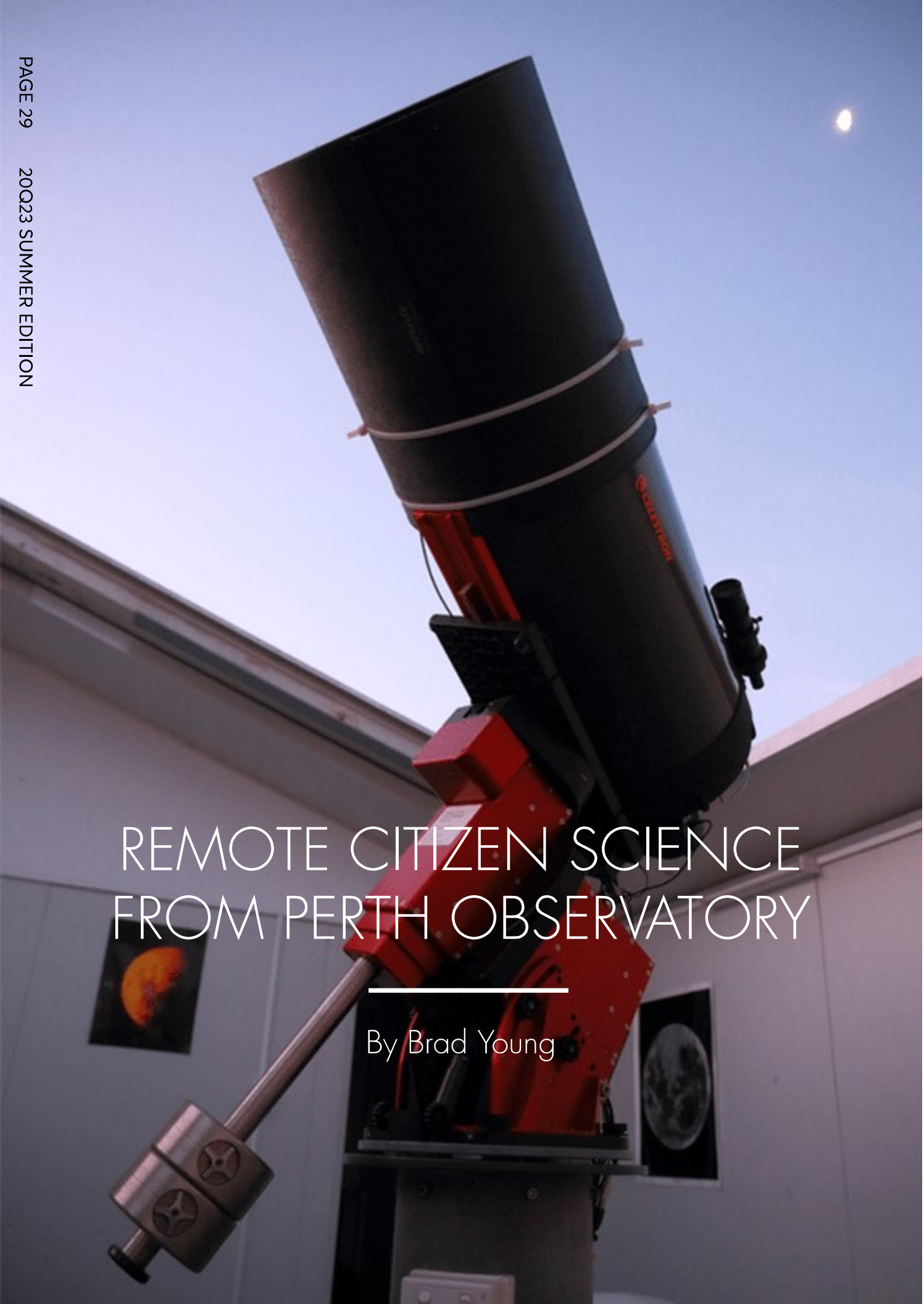


REMOTE CITIZEN SCIENCE FROM PERTH OBSERVATORY

By Brad Young

A few years ago, I began using the online observatory service called Skynet to access the 20 m radio telescope at the National Radio Astronomy Observatory (NRAO), Green Bank, West Virginia, in support of an AL Observing Program. While involved with that project, I was invited to also observe remotely using the Remote Telescope Partnership, Clarion University – Science in Motion, Oil Region Astronomical Society, and Perth Observatory (R-COP) telescope in Perth Western Australia. The optical system at Perth is part of a world class observatory, and for a citizen scientist like me, this provides a powerful tool to observe in the southern hemisphere, which due to geography, is still underrepresented by amateur astronomers.

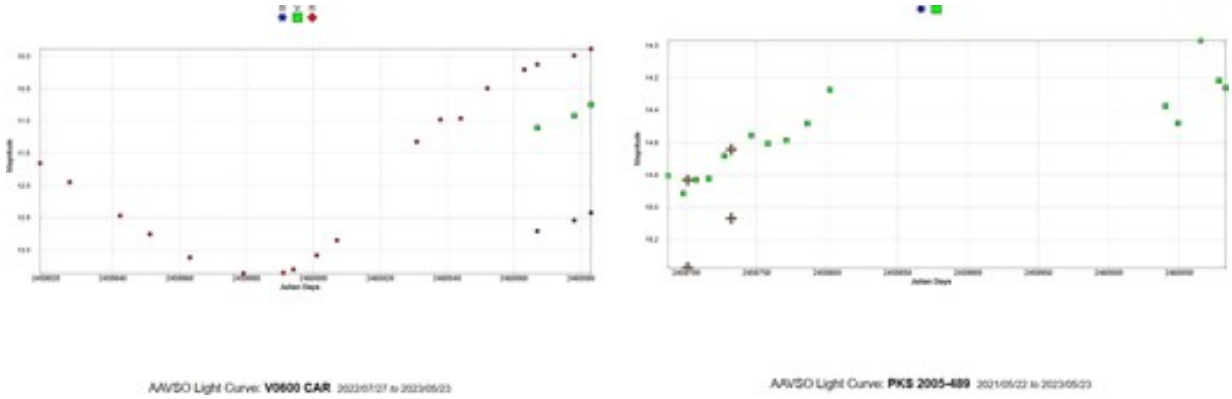
The R-COP telescope is equipped with a Paramount ME telescope mount, a Celestron C14 optical tube, and an SBIG ST-10XME astronomy camera. R-COP Technical Specifications:

APERTURE:	0.4 m
FOCAL LENGTH:	2011 mm
F-RATIO:	5.7
FILTERS:	g', r', i', U, B, V, R, Clear, Ic, SPEC200 grating
CCD SIZE:	1600 x 1200 (7 mega pixels)
FOV:	20.2 x 15.2 arcmins
SITE:	Perth Observatory

A great deal of the work that I do using the R-COP telescope at Perth Observatory is observations of variable stars and minor planets. Using this scope, I have been able to report on many overlooked variable stars in the southern hemisphere. There are also often minor planets that come to opposition in the far southern skies that may be difficult or impossible to see from northern latitudes. With this telescope I can perform astrometry and photometry on these targets and fill the gap.

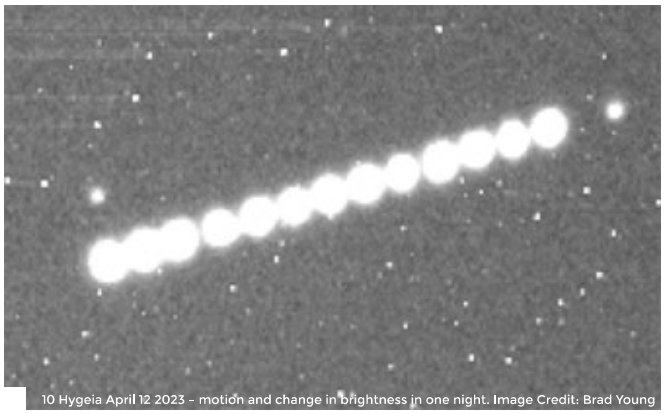
Astrometry is the precise determination of position of an object that moves, for instance a minor planet. Photometry is the measurement of the brightness of an object. Photometry is usually performed because it is variable such as a variable star or differences in brightness due to the rotation of a minor planet.

For variable stars, often the type of variable, and perhaps even its period and luminosity curve are known. However, any changes or evolution that might occur will not be noticed if they are not observed in a regular fashion. There is usually a recommended cadence or time allowed between observations associated with variable stars. It may be as little as an hour for certain types, or several days for long period variables that change very slowly. The variable stars that I track are representative of the many types and categories of variables and have cadences from a few hours to a week or so.



2 light curves generated using recent observations with R-COP. All by me except those denoted with a cross. V0600 Carinae is a Mira type long period variable. PKS 2005-489 is a BL Lacerta object (extragalactic QSO)

Another exciting opportunity occurs when the American Association of Variable Star Observers (AAVSO) sends out a request for observations in support of a science mission. These may involve terrestrial telescopes, or they may be run from orbiting observatories such as Hubble Space Telescope (HST) or Transiting Exoplanet Survey Satellite (TESS). One alert was for continuing observations of PNV J17224490-4137160, a bright nova in Scorpius discovered by Australian amateur Andrew Pearce. The bulletin is disseminated via email and provides pertinent data on the star involved, the cadence, the filters to be used, and the period from beginning to end of the subject project.


10 Hygeia April 12 2023 – motion and change in brightness in one night. Image Credit: Brad Young

No Near-Earth Object (NEO) surveys are run in Perth, but there is much support work to do in both this field and in preparation for the landing, excavation, and exploration of minor planets that is ongoing. I was able to assist the Origins Spectral Interpretation Resource Identification Security - Regolith Explorer (OSIRIS-Rex) project in its visit to extensively map 101955 Bennu and collect samples to return to Earth. Bennu has the highest cumulative rating on the Palermo Technical Impact Hazard Scale of any NEO, at a cumulative 1-in-1,800 chance of impacting Earth between 2178 and 2290 with the greatest risk being on the 24th September 2182.

Other asteroid work has centered on astrometry and photometry of other carbonaceous objects like Bennu, to give researchers more information and perhaps select targets for other missions. I also image minor planets at particularly close approaches, as often these objects may go years between close study. Another way to add to science is to determine through photometry the rotational period of the asteroid about its axis.


Comet 364P PANSTARRS on May 27 2023. Image Credit: Brad Young

Artificial satellites are also a part of my observing program at Perth. Most move much too fast for its narrow, highly magnified field; R-COP is not set up for such work. However, some spacecraft, such as the James Webb Space Telescope (JWST) were visible on the way to final orbit. The booster rockets are not followed with telemetry, and it is useful to see what the initial placement is for the rockets and debris. These items are often confused later with new asteroids and need to be tracked to clear up their identification without wasting observatory or radar time on them. Other spacecraft revisit the Earth occasionally for a gravity boost to conserve fuel needed to reach other planets or asteroids. These can be seen on flybys and can be watched for any unusual orbit changes or evidence of control issues.

I have not yet taken the big step into the search for exoplanets, which depends on very accurate and precise photometry, but it is on the horizon as another use for the R-COP telescope. It is, however, very time and resource intensive, and would tie up this shared system during the exposures.

At some point, when I am sure I can effectively use the scope and not exclude other users too much, I may try this cutting-edge science for amateur citizen scientists.

Both photometry and astrometry also provide useful comet data, although I have only rarely tried this challenging work. Again, due to geography, some comets are much better placed for the southern observer. For transient objects like comets, foul weather in the north can also interfere with gathering as many observations as possible while the object is still nearby or bright.

Citizen science has become an integral part of the human quest for knowledge. Amateurs have always been a crucial part of astronomy, and now with so much to observe, and the tangible rewards available from exploration, it is even more important. Tools like R-COP and the support of the Perth Observatory staff allow me to provide real scientific data, using premier instruments. Instead of having objects fall between the cracks, I can help keep a vigilant eye on our universe. It's important, and, for me, it's rewarding.

Image Credit: Roger Croom