For those of us active in visual astronomy and/or astrophotography, one of the biggest downsides of the hobby is that after a few years one has seen/photographed essentially all of the interesting things in the night sky.

So, the question becomes... Should I find something within astronomy that keeps me interested, or is it time to find another hobby to spend my time on?

I would recommend going with the first option. Within that option, I can identify a few specific directions one can pursue:

1. Buy better equipment and/or take much longer exposures.
2. Travel to the southern hemisphere where there’s a huge number of cool astro things that we can’t see from up here in the north. Or, ...
3. Simply revisit things you’ve already seen/imaged and hope to find that something has changed.

The first two answers are the most commonly pursued directions. In this talk, I will elaborate on the third direction.
Equipment

- Finder scope
- Takahashi FSQ-106
- 10" Ritchey-Chretien
- No camera here
- Imaging camera
- Filter wheel
- Another imaging camera
- 200mm telephoto lens
- Off-axis guide camera
Roll it outside.
Ready To Go...
Things Nearby
MiniMoon and SuperMoon

**MINIMOON**
Distance = 399,686 km
22:09 EST, Feb 3, 2015

**SUPERMOON**
Distance = 353,615 km
23:30 EDT, Aug 9, 2014
Supernovae
The Whirlpool Galaxy

May 9, 2005
Supernova Remnants – The Crab Nebula
There are two interesting things to observe in the animation:

1. The Crab Nebula’s size varies. It’s bigger in the 2019 image.

2. The bright star in the upper right part of the image seems to be moving.

Let’s focus on the varying size of the nebula. It’s expanding because this nebula is the remnant of a supernova explosion that took place in the year 1054 (almost one thousand years ago).

After a careful analysis, it appears that the nebula in 2019 is 1.288% larger than it was back in 2006.

Here’s an animation in which the 2006 picture has been enlarged by a factor of 1.288% (the stars appear to move but the nebula doesn’t vary)...
There were 4533 days between the two exposures. In years, that’s \( \frac{4533}{365.25} = 12.41 \).

If we denote the expansion factor by \( x \) and we assume a constant linear rate of expansion, then the formula for computing the date at which the supernova explosion took place is

\[
\text{date} = 2007 - \frac{12.41}{x}
\]

Plugging in the value \( x = 0.01288 \), we get an estimate of the date for the supernova:

\[
x = 0.01288 \implies \text{date} = 1043
\]

I recomputed the estimate by subsampling the measurements 34 different ways. Here’s the histogram showing the range of dates obtained:
Histogram of Dates

Histogram of Crab Nebula's Supernova Date

Supernova Data (Year AD)
Future Supernovae? – Betelgeuse
Betelgeuse

Angstroms/Pixel: 14.3

Betelgeuse
Mar 15, 2020

Angstroms

4000 4200 4400 4600 4800 5000 5200 5400 5600 5800 6000 6200 6400 6600 6800 7000 7200 7400 7600 7800 8000 8200 8400 8600 8800 9000
Proper Motion – Barnard’s Star
Barnard’s Star Overlay
Parallax is $0.5478$ arcsecs. $\implies$ Distance is $5.97 \pm 0.18$ ly. 
Proper motion is $10.5$ arcsecs/yr.

Wikipedia: $5.96$ ly
10.4 arcsecs/yr
M27 – The Dumbbell Nebula
I uploaded the image from 2016 into https://astrometry.net to look up the exact coordinates of this picture.

I then used Cartes du Ciel (aka SkyCharts) to determine the precise RA and DEC of the variable object.

I uploaded the RA and DEC into the Simbad website and found that it is a Mira variable star.

It's V571 Vul in the Variable Star catalog and is also listed as a variable star in the Gaia DR2 catalog (number 1827257659609857072).

It was discovered to be a variable star only about 30 years ago...
Dumbbell Nebula

It was discovered by Leos Ondra in the spring of 1991 while looking at the covers of two astronomy magazines...
M13 – The Great Globular Cluster
Date: 20:18-22:22 EDT, Sept. 4, 2018
Telescope: 10” Ritchey-Chretien at f/9
Mount: Takahashi NJP equatorial mount
Camera: Starlight Xpress Trius SX-694
Filters: L (6 min), R (8 min), G (6 min), and B (6 min)
Exposures: 20 seconds, unguided
Seeing: Best Frame: FWHM = 0.98 arcsec
          Stacked Image: FWHM = 1.18 arcsec
Processing: log stretch, unsharp mask
M13 – The Great Globular Cluster
HR Diagram Based On My Image
HR Diagram Using Gaia Data

Hertzsprung-Russell Diagram for M13 using Gaia Data
M13’s Variable Stars
M15 – Another Great Globular Cluster
M15 – Another Great Globular Cluster
M15’s Variable Stars
M15’s Variable Stars
M15’s Variable Stars
Questions?