THROUGH TIME AND SPACE WITH AN INVISIBLE WHITE RABBIT

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In July, 1998, I refurbished my Celestron 14 Schmidt-Cassegrain telescope, which had been idle for years. On its new Losmandy G-11 mount, the white tube -- repainted to reduce daytime heating -- stood over six feet tall. Most of my friends had never seen the telescope, and perhaps doubted its existence, so I named it for the six foot, three and a half inch tall invisible white rabbit who played the title role in a classic Jimmy Stewart movie. Thus was born Harvey.

I bought my C-14 in 1980, because it was the largest commercially available telescope that fit my budget, garage, and vehicle. I used it eagerly for several years, but after locating nearly all the deep-sky objects in Burnham's _Celestial_Handbook_ visible from my latitude, my enthusiasm waned. I was out of challenges, and long lines at star parties frequently restricted my observing: I often had the biggest telescope there. Everyone wanted a peek.

Things are different now. Better atlases and catalogs abound. Truss-tube Dobson designs ensure abundant mammoth Newtonians to help show off the cosmos. Yet my interests remain the same. I observe the deep sky, and I push on the capabilities of myself and of my equipment.

Fourteen inches (35 cm) of aperture is no longer enormous. Many readers use larger telescopes. Yet Stewart's friend was a pooka, a mischievous magical being in Celtic myth, whose kind were noted for taking humans to strange, far-away places. Perhaps his namesake could do the same.

I logged several difficult objects with Harvey long before I named him. An old _Sky_&_Telescope_ (March, 1971) mentioned two nearby galaxies, Maffei I and Maffei II, that were highly obscured by the Milky Way. Unfortunately, no positions were given, and the images showed neither orientation nor scale. Fortunately, a friend in the astronomy department at U. C. Berkeley provided coordinates, and after precessing and plotting them on my _AAVSO_Variable_Star_Atlas_ -- the best I had -- I could even identify a few stars on the photographs. On February 2-3, 1981, I looked for both with my new C-14, from Fremont Peak State Park, a hilltop site near San Juan Bautista, California. There was no low-lying fog to darken nearby towns, yet the sky was so transparent that evening zodiacal light was easy to see.

I could detect nothing for certain of Maffei II, but after much

scrutiny, I spotted a patch of haze a few arc minutes in diameter right where Maffei I ought to be. About ten faint stars lay on or near it. I tried magnifications of 71x, 122x, and 196x, but the haze showed no tendency to break up into additional stars, as would a faint galactic cluster in the Milky Way. I have since encountered other observing reports which similarly describe Maffei I.

I also precessed and plotted another tough galaxy, Leo II. Its problem was not obscuration, but intrinsically low surface brightness: It is not quite 13th magnitude and 5 arc minutes or more in diameter. Do not confuse it with the much easier Leo I, closely north of Regulus. I looked for Leo II four times in early 1981, inconclusively. The last time, in late April, I put aside my large-scale charts and worked from an approximate position, to be less likely to deceive myself into seeing an object I expected to be there. At 71x and 122x I detected a faint, diffuse smudge, at the limit of averted vision. I sketched its position with respect to nearby stars bright enough to show up on my big atlas.

Yet when I checked, I was dismayed. The pattern of stars was clearly recognizable, but I had drawn the galaxy in the wrong place. It was close, but a miss was a miss. Maybe there was something to this self-deception stuff after all. I at least took cold comfort in having been careful.

Years later, I bought a copy of _Uranometria_2000.0_. One day, as I idly turned its pages, I noticed Leo II plotted. Thinking to try the galaxy again, I opened my AAVSO atlas to the same area, to see which chart had more stars to help identify the field. Yet something was not right. My penciled circle on the older atlas was not in the same place as the printed marking on the new one. Slowly it dawned on me, that my hand-plotted position was off: I had done the precession wrong! I hastily dug out my old drawing, and compared it to _Uranometria_2000.0_. The position I had sketched at the telescope was dead on. So I finally logged Leo II, more than a decade after I had actually seen it. Being careful had paid off, after all.

Harvey's first night out after recommissioning was at a star party where many telescope owners had never seen a Celestron 14. I wanted to show that mine was good for something, and the seeing was unusually fine, so I located M57 and put in a 4 mm Orthoscopic eyepiece. The view of the Ring Nebula was startling: It filled half the field, and showed variations in intensity and hints of subtle mottling. The Ring's central star is often a difficult target, but in these conditions it was easy. It popped in and out of sight as seeing varied, but was visible often enough that most folks in line got a good look, without averted vision, in a short time. At least one other star was also visible amid

the nebulosity.

I tried a 6 mm eyepiece too, but the view through the 4 mm seemed better. 1000x is not often useful in any telescope, so I was well pleased. Even owners of large Dobsons were impressed -- few of those telescopes track smoothly enough to handle so much magnification. I regret not trying more bright targets with fine detail that evening, for Harvey did not encounter such good seeing again that year.

Most amateur astronomers have seen the Crab Nebula, but there is another supernova remnant near it, that is much larger and fainter. My first glimpse of Simeis 147, also known as Sharpless 2-240, was with a six-inch Intes Maksutov. I was anxious to try it with Harvey, for this ancient ghost was closer to not there than any other object I claim to have seen.

For chasing will-o'-the-wisps, good charts are essential. The curving tendrils of this ancient ghost span nearly three degrees, while even with two-inch barrels, no eyepiece provides a C-14 with much more than a 40 arc-minute field. Using a 40 mm Erfle for 98x, and an Orion UltraBlock narrow-band light pollution filter, I star-hopped around the charted position, looking for patches of nebula bright enough to see. I was using _Millennium_Star_Atlas_, whose large scale and limiting stellar magnitude of eleven made it possible to navigate through many empty-looking square degrees without getting hopelessly lost.

Upon close scrutiny, several faint streaks of glowing gas emerged. One ran from roughly 05:44.1 +27 15 to roughly 05:44.5 +27 45 (epoch 2000). Another trended about 15 arc-minutes southeast from the variable star V433 Auriga. Both are shown in the atlas, as is the star. I did not survey the entire nebula, so there were probably more places where it was visible.

I found it handiest to use the light pollution filter like a monocle, rather than attached to eyepiece or star diagonal, so that I could easily move it in and out of the optical path. The relatively short eye relief of the big Erfle helped. Since there was little space between my eye and the eyepiece, there wasn't much room for stray light to sneak in and obscure what I was trying to see. The filter certainly improved the visibility of Simeis 147, but I could see the luminous filaments without it. Harvey's extra aperture provided a noticeably better view than did my six-inch Maksutov.

I do not always find what I look for. Possibly the most difficult object I have yet tried to see is Dwingeloo 1, a faint galaxy some 9 million light years away. I used all the specialized techniques I knew,

including sitting several minutes with my well dark-adapted eyes shut, then fumbling to the eyepiece and putting my still-closed eye to my cupped hands to look through it. By that means, I did detect a faint glow in about the right place, that remained for five or ten seconds after I opened my eye, but the Digitized Sky Survey, on line at http://stdatu.stsci.edu/dss/dss_form.html, showed that I had merely seen a loose patch of background stars -- the real galaxy was several arc minutes away. Perhaps I will have better luck another time, or with more aperture.

Yet I succeeded with another faint, fascinating, and distant object, the gravitationally lensed quasar, "Einstein's Cross". None of my charts showed the galaxy that forms the lens, but CGCG 378-15 -- one of its several catalog labels -- was easy for Harvey: It is only four hundred million light years away. The quasar is a lot farther.

At 98x, the galactic lens obviously became rapidly brighter at the middle, but I could see no positive sign of the cross. I wasn't surprised, for this faint structure is only a few arc seconds wide, and CGCG 378-15 itself provided enough light pollution to hide it. Fortunately, there was a fix -- jam on the magnification. Changing from the 40 mm Erfle to a 12 mm Brandon gave 326x, and diffused the pale smudge of the galaxy enough to render it completely invisible.

So I promptly got lost. Between jiggling the telescope when I changed eyepieces, wind shudder, and confusion about which button moves things which way and where did they put north this evening anyhow, I soon found myself half a degree from the target. I replaced the big Erfle and went back to the finder. It took several more eyepiece switches, and lots of practice star-hops from recognizable stars out to the galaxy, before I could set on it confidently at high magnification. Then I had to swap eyepieces several times more, to verify positions of fainter stars that were confusing me. Finally I had the center of CGCG 378-15 in the center of my 326x field. And there was something there.

The optical quality of the giant gravitational lens is poor. The image of the quasar is four bright lobes distributed symmetrically around a central one, like the corners of a square with the center marked. Many of us have seen star images similarly messed up by poor seeing, or have encountered optical systems that create such views even in steady air. CGCG 378-15 is one of them.

I could not quite see the individual sub-images. Indeed, mostly I could not see anything, for seeing did not permit continuous good use of 326x. Yet when the air steadied, there was a small structure at the heart of the galaxy, a few arc-seconds across, with an irregular shape.

I don't think there is much doubt that it was the combined lobes of Einstein's Cross. It would be fun to look again on a night of fine seeing, perhaps at higher magnification. I suspect Harvey can show more detail.

Most viewers of Einstein's Cross have used telescopes much larger than Harvey. Even then, skilled observers have difficulty seeing separate parts of the cross. So I stress that I did not see any component by itself: In double-star terms, I had an elongation -- actually, several -- not a split. Having a driven telescope certainly helped, for I could patiently sit and wait for steady seeing, taking care to use averted vision just so, rather than shove on a big Dobson as I balanced on a high ladder, while an elusive, nearly invisible object dashed for the far horizon. Notwithstanding, Einstein's Cross was barely there.

Yet what a thing to see. The quasar is eight billion light years away. Those photons left their source before our solar system was formed, probably before most of its heavy atoms had been synthesized, at a time when I myself was still primordial hydrogen from the Big Bang, awaiting nucleosynthesis in long dead suns and redispersal as planetary nebulae or supernova remnants. Now the eyepiece of a telescope led this animate piece of star stuff to gaze back through time in search of its origins, and to wonder about its ultimate destiny.

Perhaps Harvey really is a magical being, after all.

Appendix: Epoch 2000.0 coordinates for objects mentioned. The position of Simeis 147 is for its approximate center.

Name	R. A.	Dec.
Dwingeloo I	02h 56.9m	+58d 55'
Einstein's Cross	22h 40.5m	+03d 22'
Leo I	10h 08.5m	+12d 18'
Leo II	11h 13.5m	+22d 09'
Maffei I	02h 26.3m	+59d 39'
Maffei II	02h 42.0m	+59d 37'
Messier 57	18h 53.6m	+33d 02'
Simeis 147	05h 40m	+28d