BRIGHTNESS AND COLOR MEASUREMENTS FOR TOTAL LUNAR ECLIPSE OF NOVEMBER 8, 2022

By Carl Hergenrother

Observing Location: Tucson, Arizona (more specifically all observations were taken from my backyard in the Tanque Verde area on the northeast edge of the Tucson, Arizona metro area.)

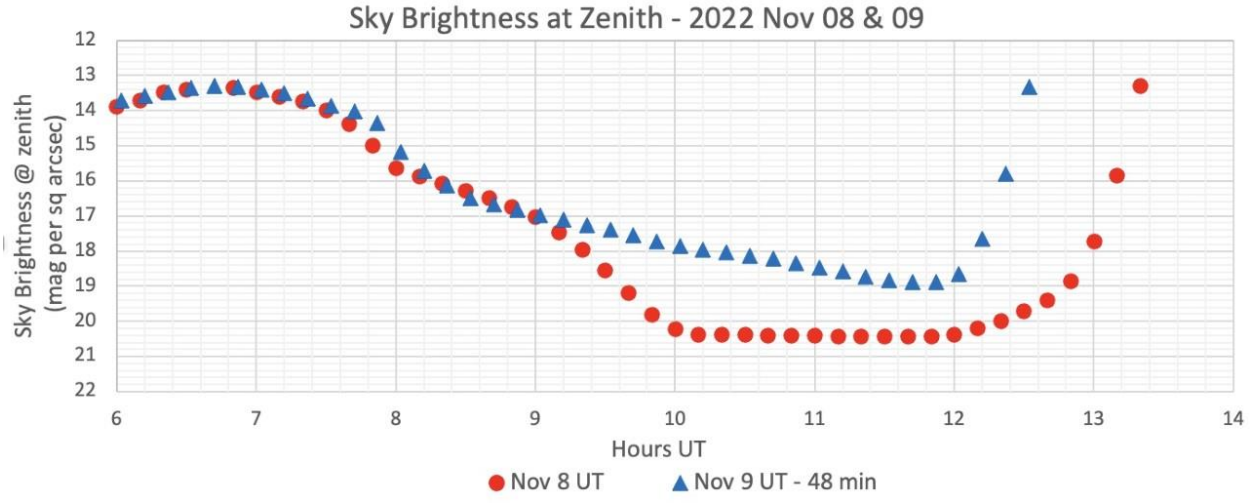
Exposure Timing Details: Blue filter observations used a number of different exposure times between 0.002 and 30 sec. Green filter observations used between 0.002 and 15 seconds and Red between 0.002 and 6 seconds.
Sky conditions were clear throughout the eclipse. Images were obtained roughly every 10 minutes between 07:40 and 11:20 UT.

Equipment: Astro-Tech AT72EDII 72mm refractor with 0.85x focal reducer. To cut down on the brightness of the Moon, I used a 1" aperture mask. The effective aperture was 25 mm and focal ratio was f/15. Sky brightness measurements were made with a Unihedron SQM-LU sky brightness monitor pointed near zenith.

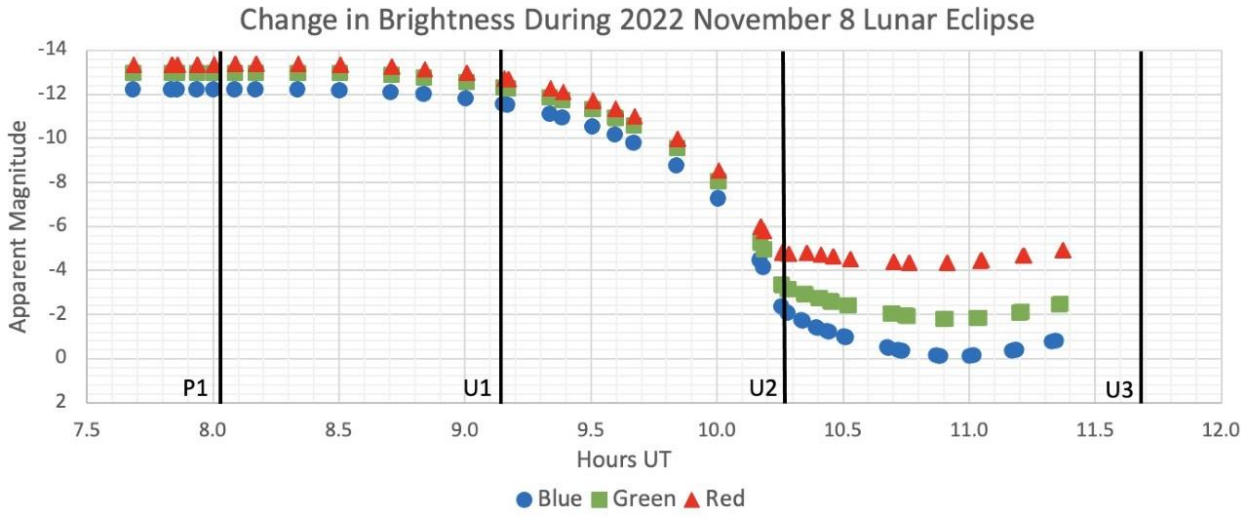
General Weather Conditions: Clear with no clouds.

Comments:
At the time of mid-eclipse (11:00 UT), I measured a Danjon value of 2.25. I really went back and forth between a value of 2.25 and 2.5.

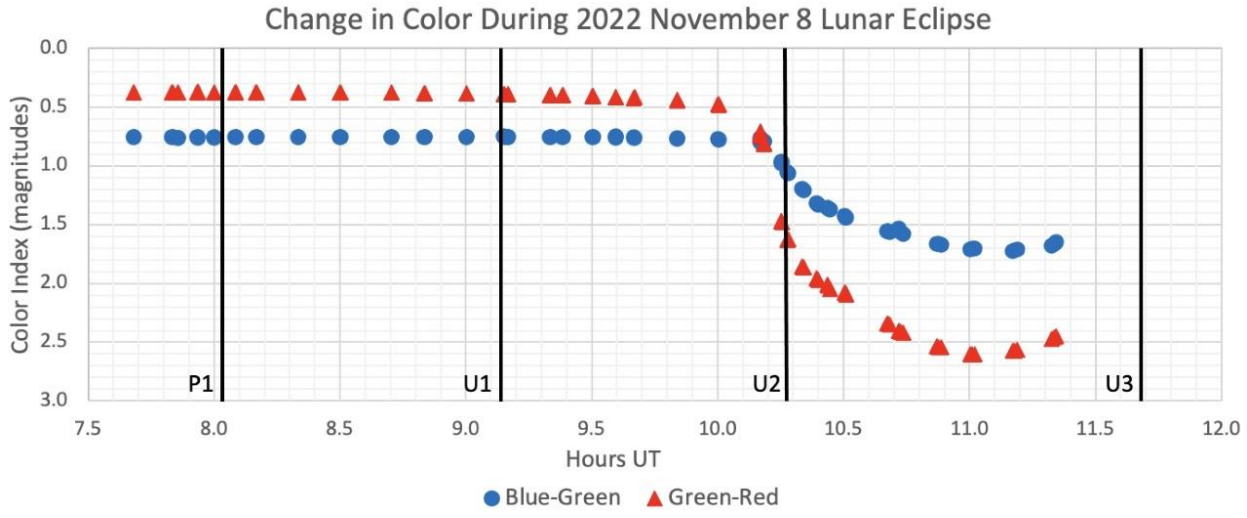
The Sky Brightness at Zenith plot compares the sky brightness for the night of the eclipse and the next night (2022 Nov 09). I would have also included the previous night but the weather was partly cloudy. The Nov 09 data was shifted earlier by 48 minutes to better match the location of the moon in the sky on the night of the eclipse. The rapid sky brightening between 12 and 13 hours on both nights was due to the start of dawn.



I used Orion color filters from their 1.25" LRGB Astrophotography Filter Set. The minimum brightness measured for each filter was -0.1 in Blue, -1.8 in Green, and -4.2 in Red. As can be somewhat gleamed from the "Change in Brightness" plot, the eclipse seemed to reach a minimum brightness in Red around 10:45 UT, 10:54 UT in Green, and 10:57 UT in Blue, all before the mid-eclipse time of 11:00 UT. The photometry was corrected for airmass (by directly comparing with stars in the field with the Moon) so the Moon's decreasing elevation shouldn't have been the cause.



The "Change in Color" plot shows how the Moon continued to get redder between the start of totality and mid-eclipse. The reddest point according to the Green-Red index was reached right around the time of mid-eclipse.



The filters I used do not match the Johnson/Cousins BVR filters usually used for photometric work. The Green filter lets in more red light than the Johnson V so the minimum brightness of -

1.8 in Green may be too bright by a few tenths of a magnitude. An uncertainty of a few tenths of a magnitude is also true for the other filters. In the future I plan to acquire photometric filters so should have better results for the next deep eclipse.

Still my value of -1.8 in Green/V isn't too far off the value predicted by Di Giovanni (2018, JBAA 128, 1, pp. 10-17). His equation

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m = 0.263L^2 - 2.72L + 3.55
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predicts a V magnitude of -1.6 for a Danjon number (L) of 2.5 or -1.2 for L = 2.25. A photometric V filter should have resulted in a fainter V mag closer to the values predicted by Di Giovanni.

The spreadsheet which contains all of my observations and reductions is included for the Eclipse Section's archives.