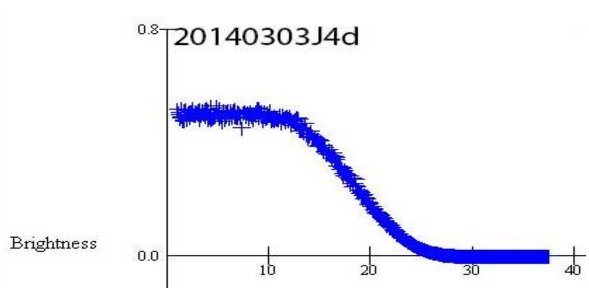
Photonic Cleaning Technologies Presents: Chris Stockdale

I became interested in astronomy during the lead-up to the Moon landings in the 60's. My interest intensified during 1985 – 1986 with the arrival of Halley's Comet and I purchased what I regarded as my first decent telescope, a C8, in 1985.

In 1992 I built my first observatory, manually operated with a massive push-to mount that held my C8 and a C11 telescopes. I became interested in performing photometry on variable stars, including the outburst of U-Sco. I followed the decay of light from a rapidly fading Gamma Ray Burst and undertook precise timing of the ingress and egress times of the four Galilean satellites entering or leaving Jupiter's shadow. It was the timing of these later events that began my push for better precision in my observations.

The Jupiter satellite observations were used to refine their orbital elements that were then used to calculate their precise location in space. NASA needed to be able to calculate the precise location of the Galilean satellites of Jupiter so that their robotic spacecraft could undertake closer fly-bys of the satellites and to be certain that their expensive space probes did not end up in little pieces on the surface of one of these bodies. Collectively, observations by the group that I was part of reduced the error from hundreds of kilometres to less than ten kilometres. Images were analysed and the results sent through for combining with other observations. Eventually, this program came to a close. Its legacy is a set of precise timings that can be used in the future to validate any updates to the orbital elements.

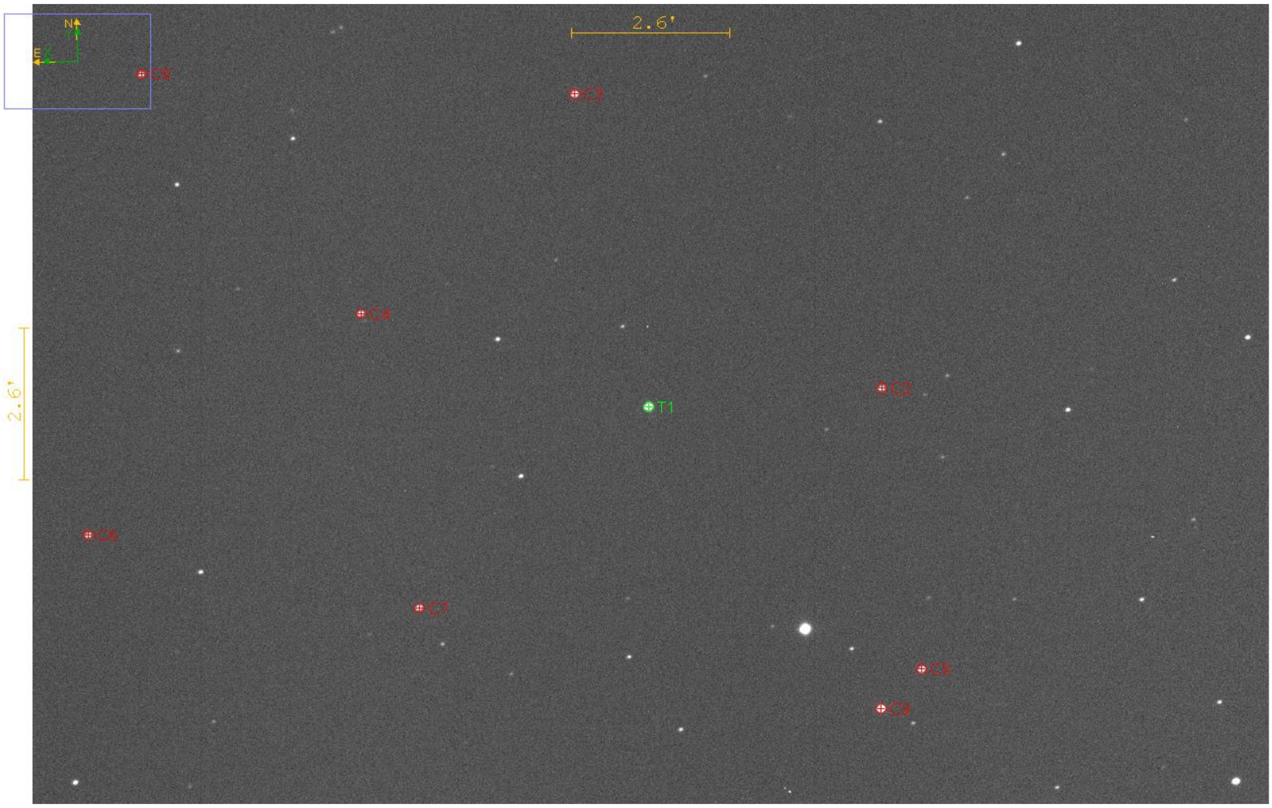
The figure below shows a typical light curve of Callisto entering Jupiter's shadow. It's brightness diminishes over approximately 20 minutes.

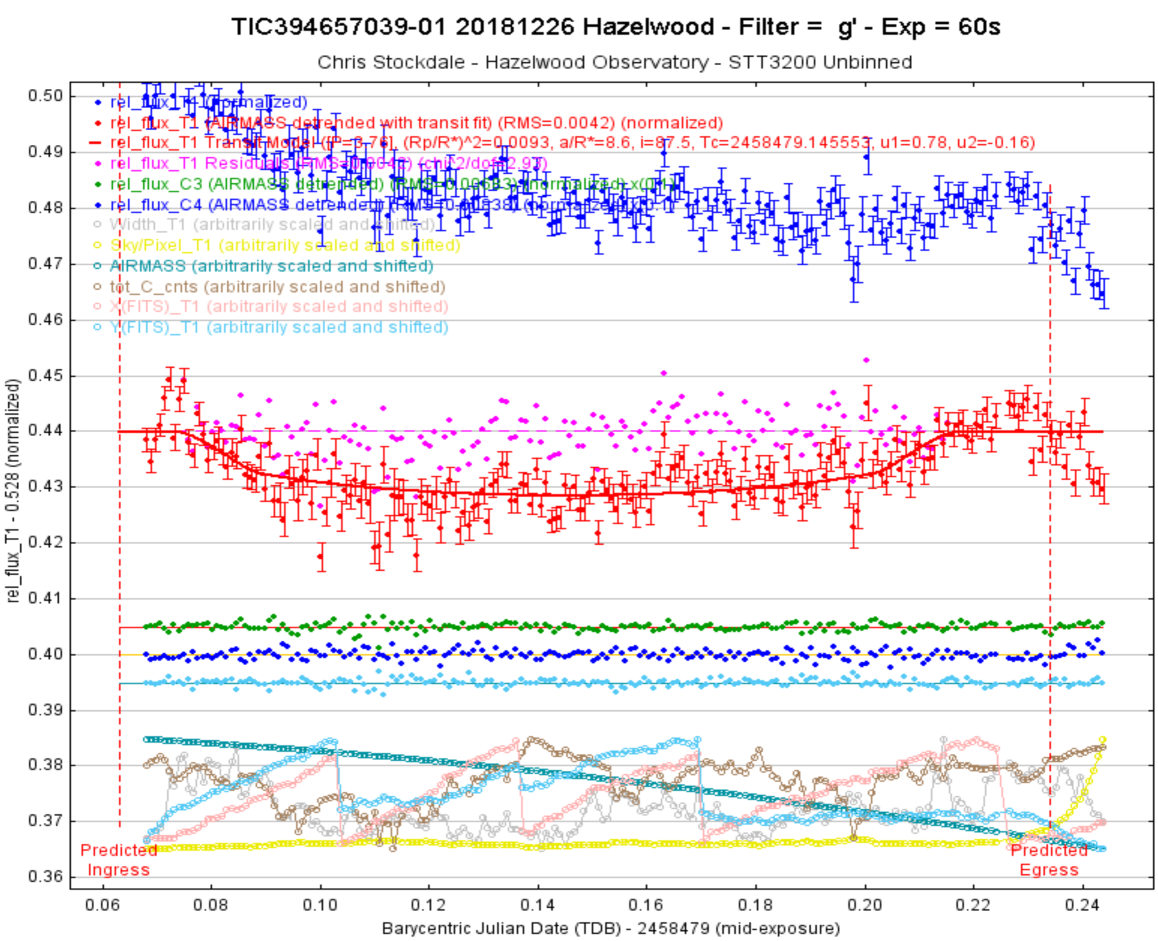


In 2013 I replaced my manual observatory, mount and telescope. The dome is fully motorized with an Astrophysics AP1200 Planewave CDK12.5 telescope and SBIG STT3200 CCD camera, adaptive optics and various photometric filters. The observatory is now fully automated and the telescope pointing and tracking is exceptional.

Around about the same time as I was getting this all operational, an exciting opportunity arose to observe and report on the tiny dips in light that are associated with a transiting exoplanet, that is a planet that is orbiting another star and passes between us and its host star. In 2014 I joined the KELT team that were using very small wide-field telescopes to patrol the southern and northern skies for the tell-tail signs of these tiny dips. My role, along with a number of others, was to undertake follow-up observations to verify that the dip did actually occur in the suspect star and to confirm the depth of the dip across multiple photometric passbands. In 2018 I joined the group of astronomers undertaking follow-up observations for verification of planet candidates for the NASA TESS satellite mission. Because of the extremely wide field and limited pixels, any given pixel may have the light of several candidate stars shining on it. Imaging from the ground can tease out which of these stars was responsible for the TESS observed light dip.

With reference to the image on the top of the next page, the light from the target star (T1) is compared with that of the comparison stars (C2, C3 etc.) and a light curve is produced. The light curve shows a dip of 1% (or 10 parts per thousand). After a series of confirmations by my and others' radial velocity and spectroscopic measurements, calculations have determined that the dip was caused by a planet that is 18 times the diameter of the earth, passing in front of a magnitude 11 star every 3¾ days. See chart on bottom of next page.


2.6'
2.6'
C5
C3
C4
C2
T1
C6
C7
C8
C9


TIC394657039-01 20181226 Hazelwood - Filter = g' - Exp = 60s
Chris Stockdale - Hazelwood Observatory - STT3200 Unbinned
rel_flux_T1 (normalized)
rel_flux_T1 (AIRMASS detrended with transit fit) (RMS=0.0042) (normalized)
rel_flux_T1 Transit Model (P=3.76), (Rp/R*)^2=0.0093, a/R*=8.6, i=87.5, Tc=2458479.145553, u1=0.78, u2=-0.16)
rel_flux_T1 Residuals
rel_flux_C3 (AIRMASS detrended)
rel_flux_C4 (AIRMASS detrended)
Width_T1 (arbitrarily scaled and shifted)
Sky/Pixel_T1 (arbitrarily scaled and shifted)
AIRMASS (arbitrarily scaled and shifted)
tot_C_cnts (arbitrarily scaled and shifted)
X(FITS)_T1 (arbitrarily scaled and shifted)
Y(FITS)_T1 (arbitrarily scaled and shifted)
rel_flux_T1 - 0.528 (normalized)
Predicted Ingress
Predicted Egress
Barycentric Julian Date (TDB) - 2458479 (mid-exposure)

Whilst I enjoy undertaking scientific observations, I also like Astrophotography. This photo of the total eclipse of the Moon in May 2021 was taken with a DSLR on a Takahashi TSA120.

The photo below is of NGC5139, otherwise known as Omega Centauri. It was taken with an SBIG STT3200 on a Planewave CDK12.5.

Despite the technology and quality of equipment, one issue that I still had was that the main mirror would fog up after a cold winter's night of observations. The fogging actually occurred after the observatory was closed down while the air was warming up and the mirror still cold. Whilst the dehumidifier would eventually dry the air sufficiently, over time a film was being left behind on the mirror. I did not clean the mirror regularly because of the significant effort required to demount the telescope and to recalibrate everything afterwards. Additionally, there was a significant risk of dropping or damaging something expensive or doing myself an injury in the process.

I came across First Contact Polymer from Photonic Cleaning Technologies in 2016 and ordered a batch of what I call "Red Goop". My first clean was brilliantly successful and since then I have been cleaning the mirror at least annually and have cleaned the objectives on my portable refractors as required. Having clean optics and a safe cleaning process that minimises the risk of inadvertently damaging the optics, the equipment, or myself during the process of cleaning has been of significant importance to me.

Are you a First Contact Polymer user and astro imager? Contact us at sales@photoniccleaning.com for the chance to be our featured guest in an upcoming issue courtesy of Photonic Cleaning Technologies! Not familiar with our products; see our ad on the next page or visit us at http://www.photoniccleaning.com