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# mnassa

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In this issue:

**Cover caption**

Comet NEOWISE is a long period comet with a near-parabolic orbit discovered on 27 March, 2020, by astronomers during the NEOWISE mission of the Wide-field Infrared Survey Explorer space telescope

mnassa

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## Editor's Note

Recently one of our contributors to MNASSA used material for an abstract about Nova Lupi 2018 from an Internet Blog site, https://skyhuntblog.wordpress.com/ without acknowledging the source. I, as MNASSA Editor, therefore assumed that the material was the contributors work. This was an oversight, and the original author accused MNASSA of Plagiarism. This is a serious offence.

The Editor, in consultation with senior members of Council and the contributor of the material published, established what had happened and found that there was no misrepresentation intended and that it was a lapse by the contributor. The Editor drafted an explanation and apology to the original author, who gracefully accepted it and it was agreed to let the matter rest; so the matter was professionally and amicably resolved.

However, this is an opportune time to remind all contributors to MNASSA and Editors of ASSA Newsletters, to act professionally and acknowledge all other sources in their work, and the President and senior council members are asking Chairs of all ASSA Centres to ensure that their content is properly acknowledged; this applies particularly to Internet images and material from SGAS.

Case Rijsdijk
MNASSA Editor.

# C/2020 F3 (Neowise)

*Kos Coronaios*

Comet NEOWISE is a long period comet with a near-parabolic orbit discovered on 27 March, 2020, by astronomers during the NEOWISE mission of the Wide-field Infrared Survey Explorer space telescope.

At that time, it was an 18th-magnitude object, located 2 AU (300 million km; 190 million mi) away from the Sun and 1.7 AU (250 million km) away from Earth.

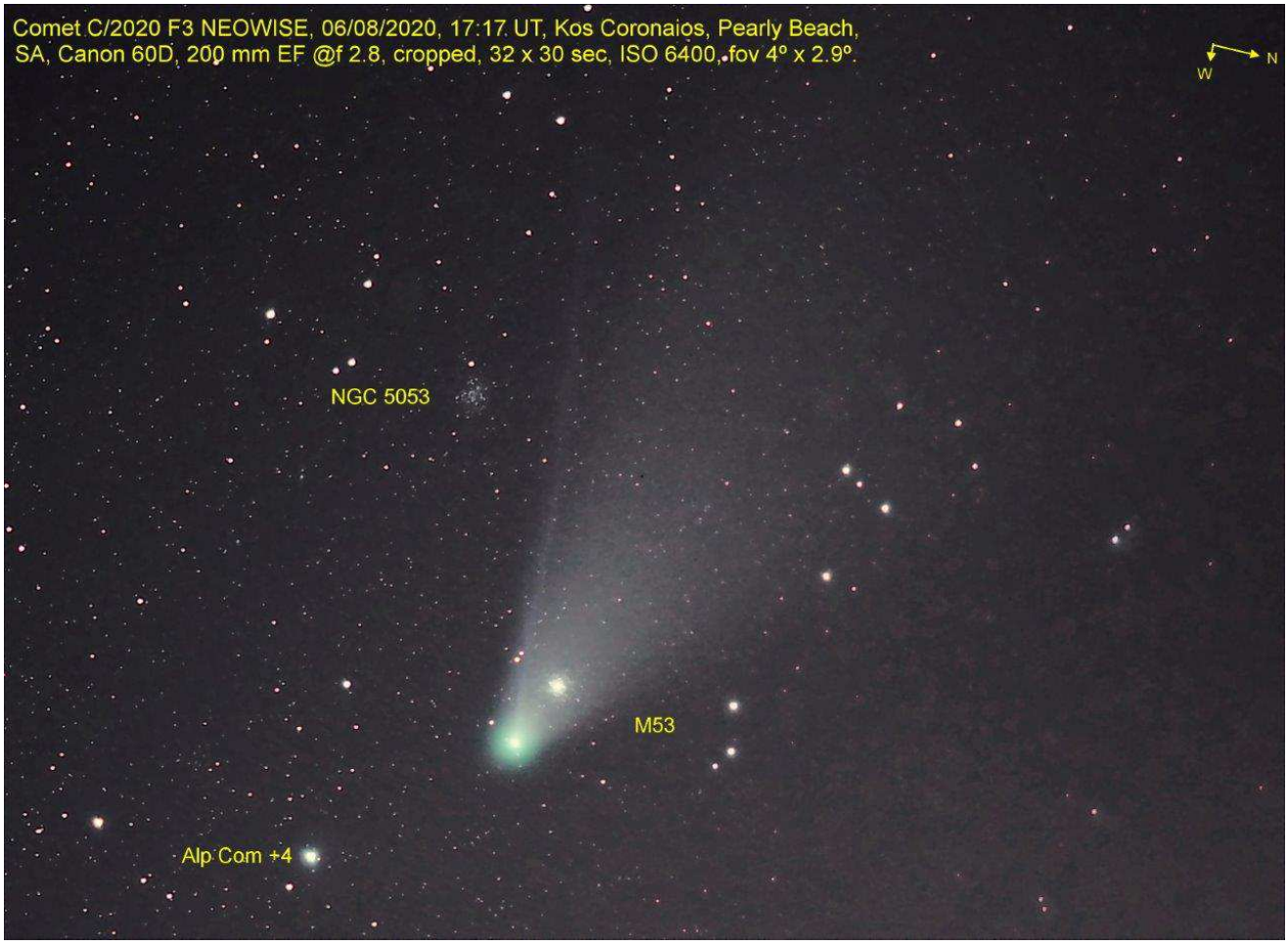



*Fig 1. Neowise 2020 August 6*

NEOWISE is known for being the brightest comet in the northern hemisphere since Comet Hale–Bopp in 1997. It was widely photographed by professional and amateur observers and was even spotted by people living near city centres and areas with light pollution. While it was too close to the Sun to be observed at perihelion (03 July 2020), it emerged from perihelion around magnitude 0.5 to 1, making it bright enough to be visible to the naked eye. Under dark skies, it could be seen with the naked eye and remained visible to the naked eye throughout July 2020. By July 30,

the comet was about magnitude 5, but binoculars were required near urban areas to locate the comet.
For observers in the southern hemisphere, the comet was visible from around 26 July a couple of degrees above the northern horizon after sunset. At around magnitude +5 it was never going to be visible with the naked eye due to its proximity to the horizon shortly after sunset, but it was a reasonably easy target for binoculars as well as small telescopes by the first week in August. Currently at around magnitude +7 it is in the constellation of Virgo, moving into Libra by the end of September 2020.

## HST Image of Neowise

The NASA/ESA Hubble Space Telescope has captured the closest images yet of the sky's latest visitor to make the headlines, comet C/2020 F3 NEOWISE, after it passed by the Sun. This image features the colour image of the comet taken by Hubble on 8 August 2020 within the frame of a ground-based image of the comet that was taken from the Northern Hemisphere on 18 July 2020.

Hubble's image of the comet shows a portion of the comet's coma, the fuzzy glow, which measures about 18 000 kilometres across in this image. Comet NEOWISE won't pass through the inner solar system for another nearly 7 000 years.

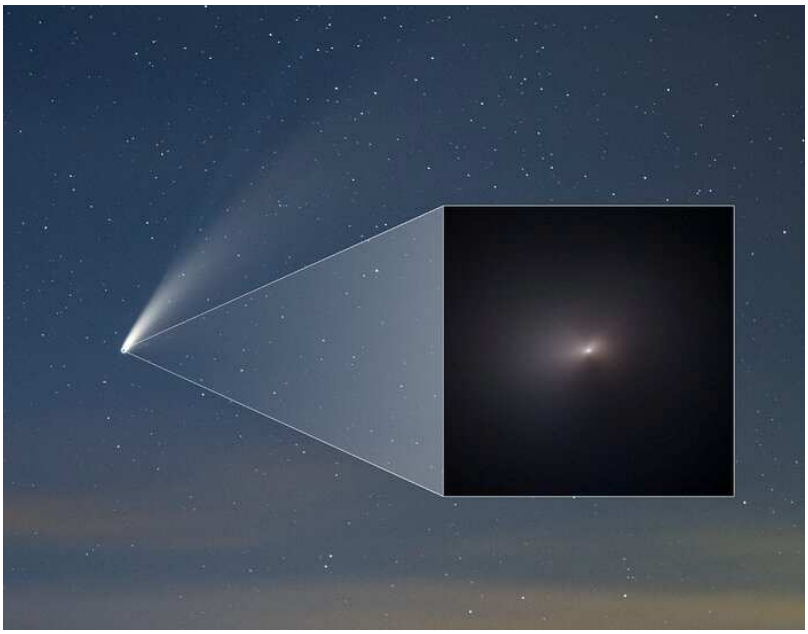


*Fig 1. Hubble image of Neowise (NASA, ESA, Q. Zhang (California Institute of Technology), A. Pagan (STScI), and Z. Levay)*

# "Clyde's Spot" Update

*Clyde Foster*

## Observations

Following the initial "methane bright" outbreak as it was seen in the detection image, it faded( in methane brightness) over the following days. It has continued to be monitored by both the amateur imaging community and professional observations(see below-IRTF) becoming a complex dark feature which has shown significant dynamic activity. Small light and dark spots and ovals have been observed over the last two months. It is not clear at this stage whether any long term, large scale developments will arise from the outbreak. For any amateurs that are able to capture reasonable resolution images, it is easily detected. If it maintains its current form, it will however become more difficult to observe as Jupiter moves further away from opposition.

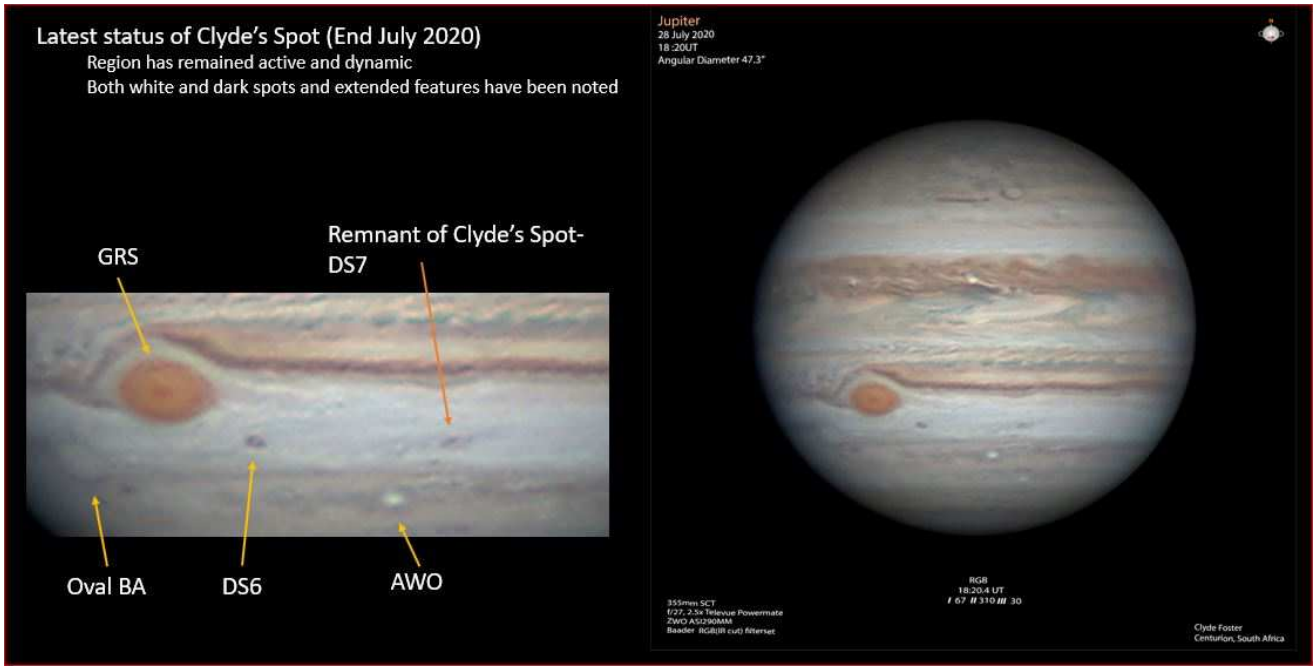



*Fig 1. Image captured at the end of July, 2 months after detection*.

## NASA IRTF

The author was privileged to be invited by Dr Glenn Orton (NASA JPL and Juno mission) to sit in on various Zoom observing sessions of Jupiter using the NASA IRTF facility on Mauna Kea, Hawaii. Very exciting to observe Clyde's Spot at deep Infra-Red wavelengths, where, a month after detection, its initial form as an upwardly erupting plume was replaced by a hole in the upper Jovian atmosphere.

**Research**

Detailed research into the two previously observed STB outbreaks, headed by Ricardo Hueso, was undertaken by the Planetary Science group at the University of the Basque, Bilbao Spain. The same group has already undertaken initial research into the Clyde's Spot outbreak, and an abstract has been submitted for presentation at the DPS 2020 (AAS) virtual conference in October. The author of this article has been included as a co-author in the abstract. It is anticipated that a peer-reviewed article (s) will be published in due course.

## News note – SAAO 200

From Tuesday 20 October to Friday 23 October the SAAO will celebrate 200 years of the existence of the Cape Town Observatory with a series of events.

1. Unveiling of the National Heritage Site

The celebrations will kick off with the virtual unveiling of the National Heritage site, to be held on the morning of the 20 October 2020, 200 years to the day since the establishment of the Royal Observatory, Cape of Good Hope. Attendees are invited to join this exciting event online before the official symposium begins.

2. The Virtual Symposium will include themes in:

- African ethnoastronomy and indigenous knowledge
- History of Astronomy in Africa
- Contributions to global astronomy
- Developments in African Research Astronomy in recent decades
- Astronomy and Society

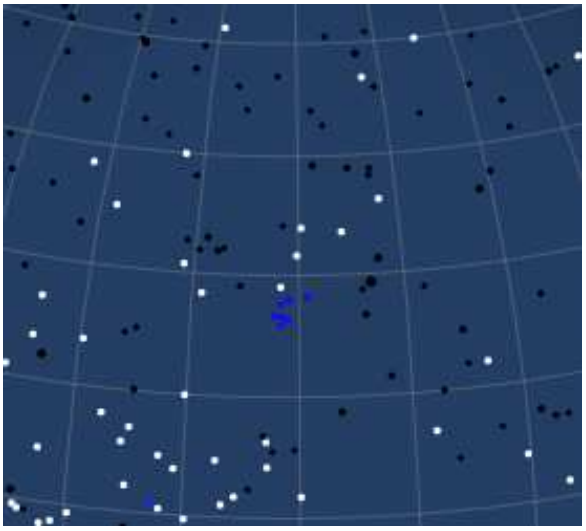
Some 33 local and international speakers will participate.

3. Astronomy Festival

SAAO will also be hosting a Virtual Astrofest 2020, with many exciting online engagements that aim to further enhance and support science promotion, communication and engagement activities.

Details of these events and registration for the free virtual symposium can be found at https://saao200.saao.ac.za

## Chi Cygnids Meteor Shower 2020



P. Jenniskens, SETI Institute and NASA Ames Research Center, reports that the CAMS low-light video surveillance networks in Australia, South Africa, Namibia and Chile recorded an outburst of slow meteors from a compact radiant between the constellations Delphinus and Aquila on 2020 August 20/21 (cf. website http://cams.seti.org/FDL/ for date of Aug. 21).

*Fig 1. Plot of the detections; the shower meteors are the blue dots*

The CAMS South Africa low light surveillance cameras operated by Philip Mey (at Hartebeesthoek Radio Astronomy Observatory, station HA) and Tim Cooper (at Bredell Observatory, station BR) as part of the global CAMS network recently participated in the confirmation of a possible outburst of chi Cygnid meteors. Several possible chi Cygnids were detected by CAMS Australia, South Africa, Namibia and Chile, and shown as blue dots in Figure 1 (cf. website http://cams.seti.org/FDL/ for date of Aug. 21). White dots in the figure are non-shower meteors, black dots are stars.

The slow-moving meteors emanated from a compact radiant between the constellations of Delphinus and Aquila, during the night of August 20/21 (Jenniskens P., Hanke T., Heathcote S., Jehin E., Towner M., Cooper T. (2020). CBET 4837. IAU Central Bureau for Astronomical Telegrams. D. W. E. Green, ed). The apparent radiant of the shower members was from R.A. = 304.7 $\pm$ 1.0° (20h18.8m), Decl. = +8.5 $\pm$ 1.0°, speed 17.0 km/s and were active between solar longitudes 147.6° to 148.4° (2020 Aug 20 12 to Aug 21 7 UTC). The mean orbital elements of the shower members were derived as a = 2.95 AU, q = 0.830 AU, e = 0.716, i = 12.7°, $\omega$ = 235.3°, $\Omega$ = 148.0° (J2000.0), and longitude of perihelion of the median orbit PI = 23.5°. The orbit is typical of a Jupiter Family Comet, but the parent remains unknown. The radiant of the meteors was identified by the CAMS software as chi Cygnids (IAU shower code CCY, #757), which were first detected in 2015 (Jenniskens P. (2015). "New Chi Cygnids meteor shower". CBET 4144. IAU Central Bureau for Astronomical Telegrams. D. W. E. Green, ed.). However the orbital elements of the 2015 meteors had a higher inclination (i = 18.6°) and appeared later, on September 14/15. The global CAMS network, including our cameras in South Africa, continues to observe this and other meteor activity, measuring the orbits of around one thousand meteors every night. It will be interesting to see if activity from the chi Cygnids appears again later into September as was the case in 2015.

# Bright fireballs observed by CAMS@SA, Events 354 and 360

*Tim Cooper[1] and Philip Mey[2]*

## Background

The authors operate two arrays with eight low-light video cameras each as part of the global Cameras for All-Sky Meteor Surveillance (CAMS) network. The camera arrays are separated by 66.8 km and are oriented so that their fields of view overlap at an altitude of 95 km above the earth's surface, coincident with the region where most visual meteors occur. Meteors captured simultaneously from both sites are triangulated to determine orbital elements and radiant position, and nightly plots are prepared to show shower radiants active each night. The aim of CAMS is to validate the meteor streams in the IAU Working List of Meteor Showers. The cameras used are Watec 902H, sensitivity is 0.0001 Lux, and with the configuration used the detection limit is around magnitude 4.5 for meteors. Depending on the time of year and shower activity our cameras capture and determine radiant positions for up to two hundred meteors per night. From time to time very bright meteors are detected, and since they are processed the same way, CAMS can be used to derive the trajectory and orbital elements for bright meteors or fireballs ($m_v \geq -4$). Such was the case for two very bright meteors detected on the evenings of July 13 and 27, 2020. Neither meteor was observed visually but Event 360 was also captured with an all sky camera operated by Cory Schmitz.

## Fireball SAFC #354

The appearance time for the fireball was 21h49m38.3s UTC on July 13, 2020. The entire path was captured on camera 6000 at Bredell, as well as on both cameras 6021 and 6028 at Hartebeesthoek. The capture frames are shown in Figure 1.

The fireball commenced ablation at latitude 26.5603°S, longitude 27.6474°E, altitude 100.32 km, terminated at 26.4536°S, 27.7337°E, altitude 54.65 km and entered the atmosphere with velocity $V_{inf}$ = 19.92 km/s. The path above Earth's surface is shown in Figure 2, moving in an approximately northerly direction about 20 km south east of the town of Westonaria.

[1] Coordinator, CAMS South Africa, Bredell Observatory, Station BR

[2] South African Radio Astronomy Observatory Hartebeesthoek Site, Station HA

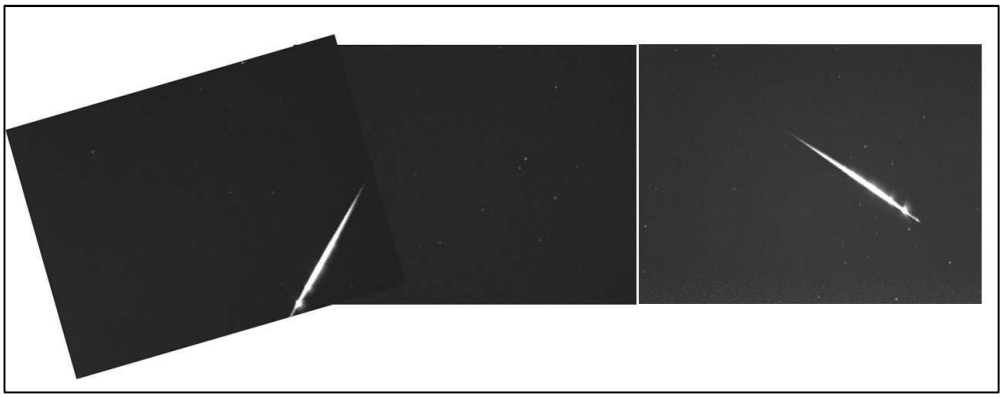


Fig 1. *Video captures of Event 354 from station HA cameras 6021 and 6028 on left and from station BR camera 6000 on right.*

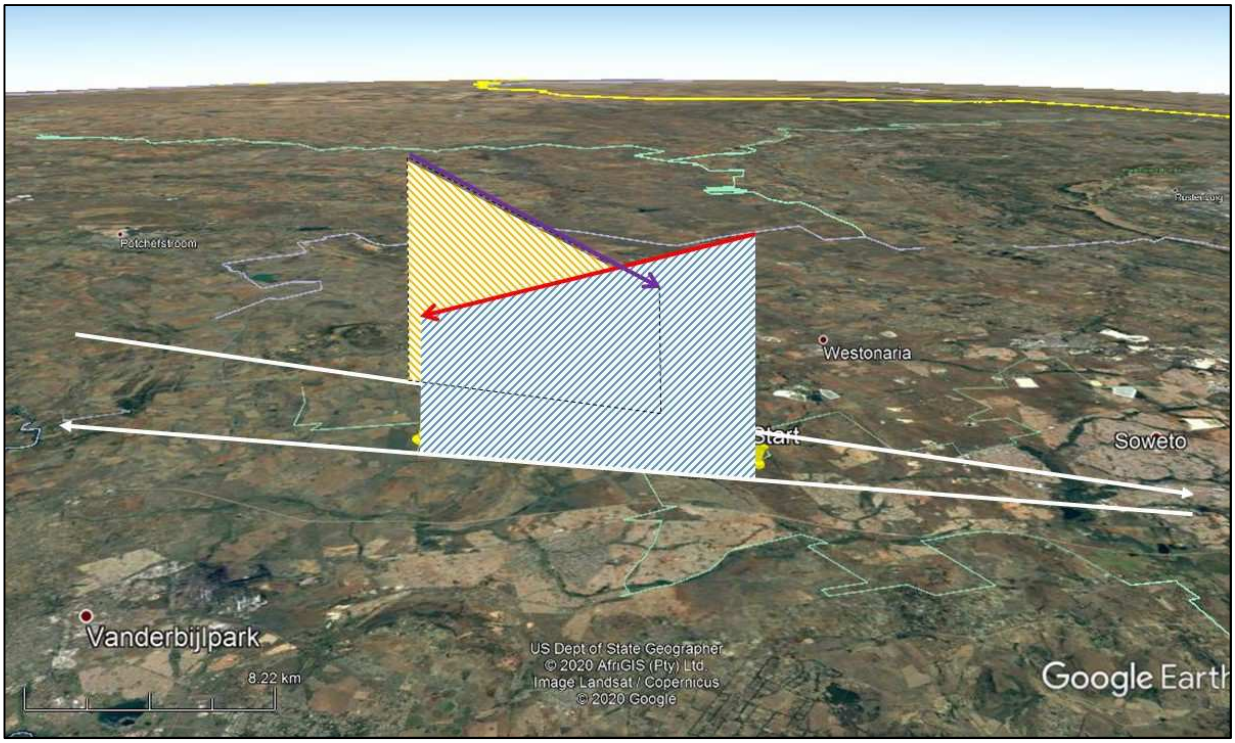



Fig 2. *Ground tracks for fireball #354 (purple arrow with yellow shading) and #360 (red arrow with blue shading). North is to the right and west at top of diagram. Heading of Event 354 is south to north. Heading of Event 360 is north to south. Vertical and horizontal axes are not to the same scale, vertical scale is compressed by 13.4x.*

The apparent radiant was from RA = 273.55° (18h22m12.0s), Dec. = –40.38°, which is located just off the tail of Scorpius, and is indicated by an arrow in Figure 3, which shows all meteors captured by the global CAMS network for the night of July 13/14.

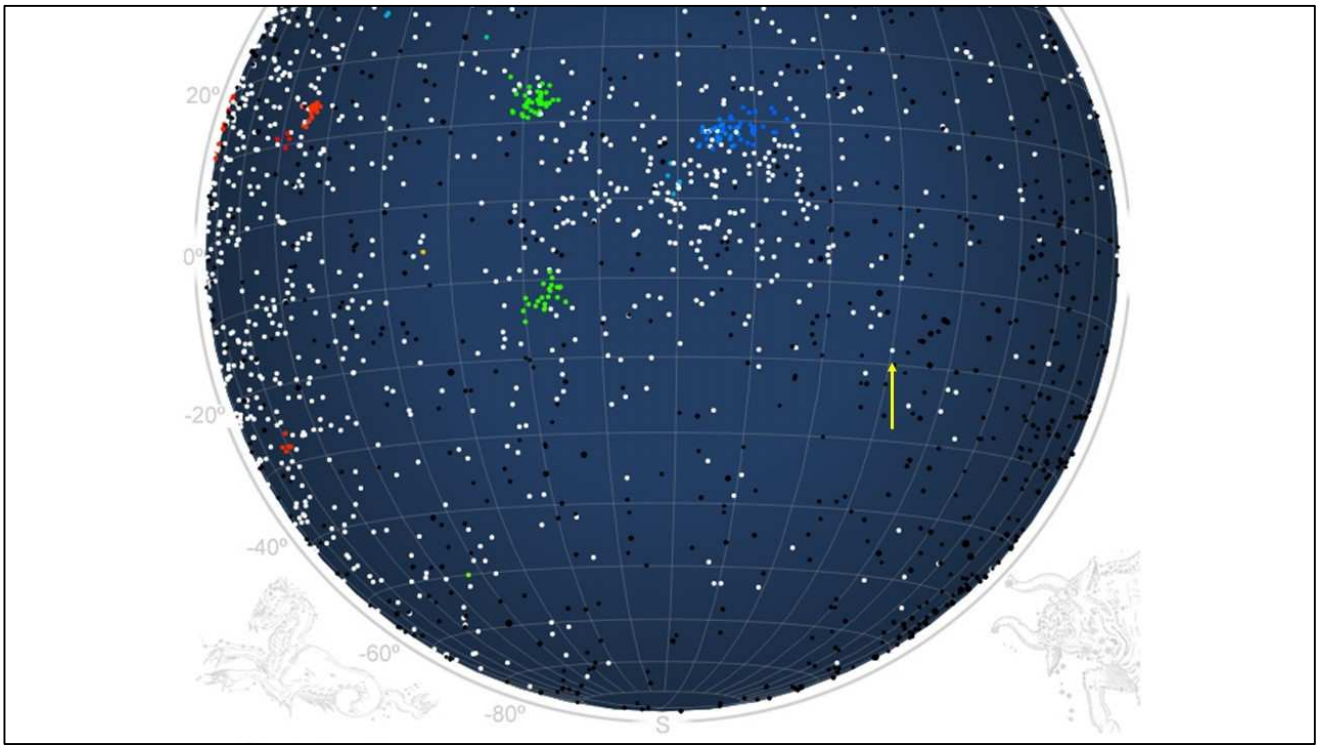



*Fig 3. Radiant position of fireball #354. Map projection is in ecliptic coordinates. Black dots show the positions of stars. Coloured dots are shower meteors, red upper left are July Pegasids (IAU shower #175, JPE), red lower left are eta Eridanids (#191, ERI), green upper are Northern June Aquilids (#164, NZC), green lower are Southern June Aquilids (#165, SZC) and blue are alpha Capricornids (#1, CAP) and xi2 Capricornids (#623, XCS). White dots are non-shower meteors. Different colours are indicators of speed, not shower association; red are fast, green are medium speed and blue are slow meteors.*

No other meteor showers were shown to be active in the vicinity of Event 354, and the fireball is recorded as sporadic. Orbital elements were derived by triangulation of the images and are given in Table 1. The orbit is typical of a Jupiter Family Comet (JFC) but there is no known parent body with similar orbital elements.

**Fireball SAFC #360**

The appearance time was 20h22m47s UTC on July 27, 2020. The path was captured by camera 6000 at Bredell, and on camera 6028 at Hartebeesthoek, and the capture frames are shown in Figure 4.

| | Event 354 | Event 360 |
|---|---|---|
| **Date** | July 13, 2020 | July 27, 2020 |
| **Appearance time UTC** | 21h49m38.3s | 20h22m47.0s |
| **Solar longitude** $\lambda_\odot$ | 111.65837° | 124.968130° |
| **Right ascension** $RA_{app}$ | 273.55° | 290.52° |
| **Declination** $Dec_{app}$ | –40.38° | –8.18° |
| **Right ascension** $RA_g$ | 272.007° ± 0.019° | 291.501° ± 0.001° |
| **Declination** $Dec_g$ | –41.595° ± 0.078° | –6.397° ± 0.001° |
| **Pre-atmospheric vel.** $V_{inf}$ | 19.92 km/s | 19.61 km/s |
| **Geocentric velocity** $V_g$ | 16.54 ± 0.02 km/s | 16.170 ± 0.001 km/s |
| **Perihelion distance** q | 0.83170 AU | 0.77703 AU |
| **Aphelion distance** a | 3.0046 AU | 2.1251 AU |
| **Eccentricity** e | 0.7232 ± 0.0010 | 0.6343 |
| **Inclination** i | 8.454 ± 0.035 | 7.464 |
| **Argument of perihelion** ω | 55.498 ± 0.035 | 246.721 |
| **Long. of ascending node** Ω | 291.6421 ± 0.0002 | 124.9810 |

*Table 1. Orbital elements and radiant details for the two fireballs, Events 354 and 360*

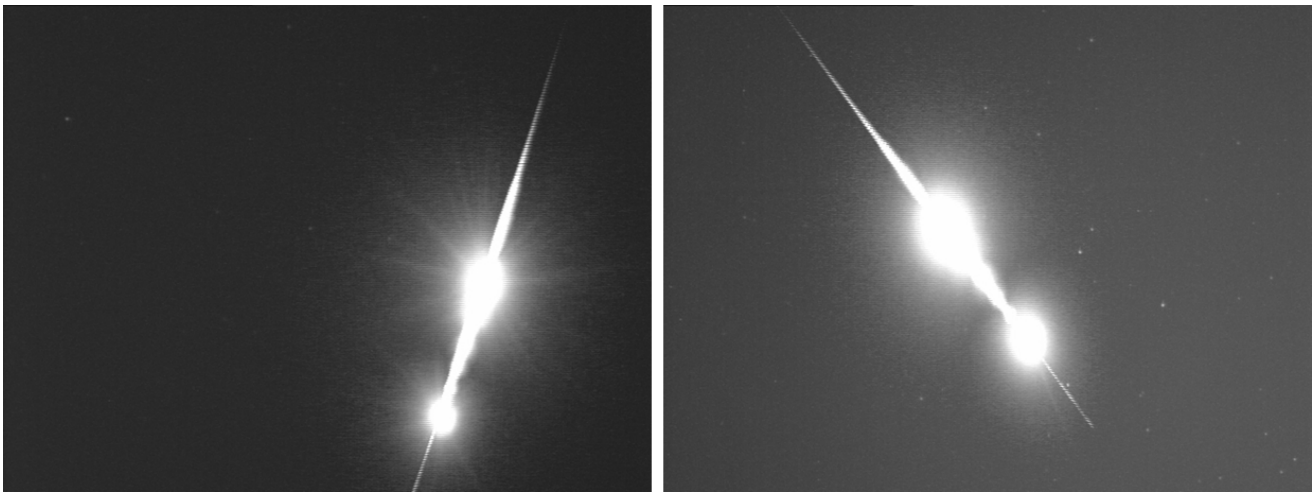


*Fig 4. Video captures of Event 360 from station HA camera 6028 on left and from station BR camera 6000 on right. Note the flaring behaviour, typical of bright alpha Capricornid meteors.*

The fireball was also independently captured on an all sky camera operated by Cory Schmitz at Greenside Observatory, Johannesburg, and is shown in Figure 5.

*Fig 5. Capture of Event 360 from an 8 second exposure using an all-sky camera operated by Cory Schmitz.*

The meteor was first seen above latitude 26.4397°S, longitude 27.8119°E, altitude 106.34 km, and ended above 26.5691°S, 27.7226°E, altitude 62.09 km, with a pre-atmospheric velocity $V_{inf}$ = 19.61 km/s. The path is shown in Figure 6, and is approximately in a southerly direction crossing Gauteng, over an almost identical track to Event 354, but in an opposite direction. The ground paths of both fireballs are separated by only 7.5km! The fireball emanated from an apparent radiant at RA = 290.52° (19h22m04.8s), Dec. = –8.18°, and is indicated by the arrow on the global capture map in Figure 6.

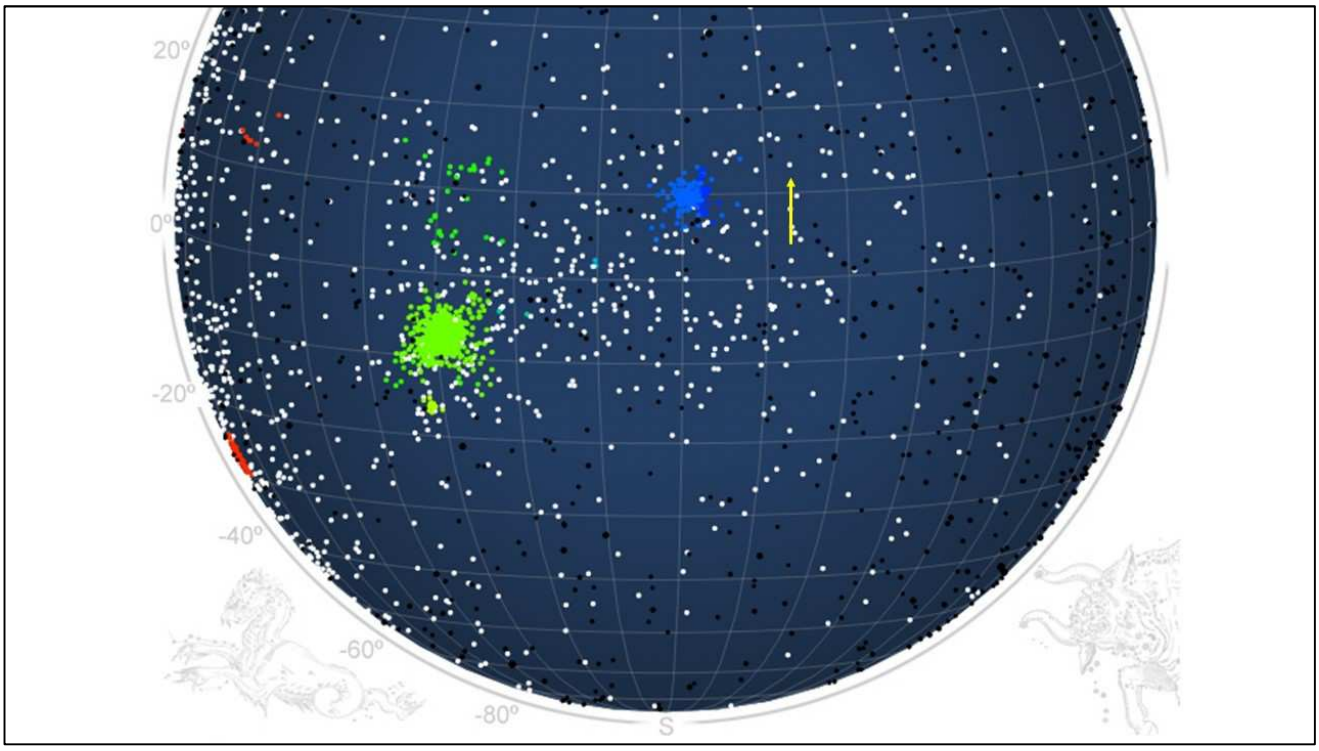



*Fig 6. Radiant position of fireball #360. Blue dots in the centre are alpha Capricornids (#1, CAP). The large green patch comprises mainly Southern delta Aquariids (#5, SDA), but include also from top downwards Northern June Aquilids (#164, NZC) Northern delta Aquariids (#26 NDA), Southern June Aquilids (#165, SZC) and Piscis Austrinids (#183, PAU).*

Orbital elements were derived by triangulation of the images and are likewise given in Table 1. The flaring behavior during ablation is typical of that often shown by bright alpha Capricornid meteors, and the radiant is in the vicinity of that shower, which has RA = 306.5°, Dec = –9.2°, $V_g$ = 23 km/s (IAU shower code #1, CAP).

**Conclusions**

Two bright meteors were detected two weeks apart by CAMS@SA cameras, with paths crossing Gauteng south east of Westonaria, and separated by only 7.5 km. The trajectories of both meteors were steeply inclined, with Event 354 leaning towards north, and Event 360 towards south, despite the apparent similarity in directions in Figures 1 and 3. Event 354 was a sporadic fireball with radiant near to the tail of Scorpius. Event 360 has a radiant in the vicinity of the alpha Capricornids, and is possibly a member of that shower. The flaring behaviour and similarities in the orbital elements of the fireball and meteor stream further strengthen that conclusion.

**Acknowledgements**

Thanks to Dr Peter Jenniskens, NASA Ames and SETI Institute, and CAMS Principal Investigator for data reduction, orbital elements and radiant details of the two fireballs, and to Cory Schmitz for permission to use his image shown in Figure 5. Figures 3 and 6 are reproduced from the NASA Meteor Shower Portal at http://cams.seti.org/FDL/. Figure 2 is reproduced from a Google Earth image downloaded 6 August 2020, credit to Google and AfriGIS (Pty) Ltd.

## Recent Southern African Fireball Observations Events # 350-363

*Tim Cooper, Comet, Asteroid and Meteor Specialist, Shallow Sky Section*

This article continues the sequential numbering of reported fireball sightings from southern Africa. By definition, a fireball is any meteor event with brightness equal to or greater than visual magnitude ($m_v$) –4. The following events were reported to the author and details are reproduced as given by the observer [any comments by the author are given in brackets]. All times were converted to UT unless stated, and all coordinates are for epoch J2000.0.

**Event 350 – 2020 June 16 – Melkbosstrand and Brackenfell, Cape Town, Western Cape**

Observed by Carla Voorn at 15h40 during bright twilight, the sun was just setting [sunset at Cape Town was at 15h44]. She was a passenger in a vehicle travelling south on the N7 and heading towards 175°. $m_v$ = –6, duration between 2-5 seconds, light green colour, no persistent train and no sounds heard. From a description of the

path relative to landmarks, including Table Mountain in the distance, the path was from az/alt 210°, 36° to 239°, 23°.
Observed by Elzanne Olivier who gave the time as around sunset, and the sky was still quite light, very bright green streak appeared low above the horizon, duration 2-3 seconds, then disintegrated into smaller pieces or 'sparks' for a further one second. From a description of the path relative to nearby landmarks I determine the path from az/alt 265°, 20° to 268°, 15°. No sounds heard
Triangulation of the derived coordinates gives the path entering the atmosphere just west of Cape Town and travelling offshore in direction 275°.

**Event 351 – 2020 June 16 – Robertson, Western Cape**
Observed by Marcela Wild at 22h08, through a north-facing window, as bright as the full moon, so $m_v = -13$, duration 5-10 seconds. Colour was predominantly turquoise (blue/green), the head also showed a purple (red/blue) sparkling appearance. From an image sent by Marcela showing the path as seen through a window and with respect to the surrounding landscape, path determined from az/alt 350°, 43° to 345°, 27°, that is RA/Dec 16h41, 12.4° to 16h10, 27.3°, from near kappa Ophiuchi and towards epsilon Corona Borealis. The path is consistent with an anthelion meteor, which emanate from Sagittarius at this time of year.

**Event 352 – 2020 June 27 – Margate, KwaZulu Natal**
Observed by Liesl Percy-Lancaster at 17h30, very bright red ball which appeared to be burning, with red tail, just above the horizon, duration 3.5 seconds, starting at approximately az/alt 39°, perhaps 5° descending at an angle of about 30° to horizontal and ending at azimuth 50°. No sounds, no fragmentation, and the fireball burned out before reaching the horizon.

**Event 353 – 2020 July 8 – Scottburgh, Pietermaritzburg, KwaZulu Natal**
Observed by Myles Usher at 17h18, 'large bright green ball, much larger than a normal shooting star', from azimuth 270° to 150°, initial altitude not given but descending right to left at an angle of 15° to horizontal, duration 1-2 seconds, before losing sight behind trees. No sounds heard.

Observed by several individuals from the Pietermaritzburg area who reported the sighting to The Witness newspaper. One reported 'a big green ball, flew through the sky with quite a speed' and a second reported 'big ball in the sky with a bluish tail'. Attempts to obtain further information met with no response, but all reports were consistent with a bright fireball moving west to east, crossing offshore south of the KZN South Coast.

**Event 354 – 2020 July 13 – Bredell and Hartebeeshoek, Gauteng**

Observed by CAMS@SA at 21h49m38.3s UTC. The entire path was captured by camera 6000 at Bredell (operated by Tim Cooper), as well as on both cameras 6021 and 6028 at Hartebeesthoek (operated by Philip Mey). The camera 6000 capture is shown in Figure 1. The meteor was first seen above 26.5603°S, 27.6474°E at 100.32 km, and ended above 26.4536°S, 27.7337°E at 54.65 km. Apparent radiant RA = 273.55°, Dec = –40.38°, $V_{inf}$ = 19.92 km/s, and a plot of the path is shown in Figure 2, with the radiant near the tail of Scorpius. The orbit is that of a Jupiter Family Comet (JFC) but there is no known parent body. A full report appears elsewhere in this issue of MNASSA.

*Fig 1. Event 354 Video capture from station BR camera 6000.*

**Event 355 – 2020 July 18 – Mossel Bay, Southern Cape**

Observed by Yolandi Peens at about 17h30, 'saw a round bright light followed by flames', brighter than the full moon, duration 3-4 seconds. The head was white, the tail was red and appeared like flames. Yolandi produced an image of the scene which showed stars and plotted the path of the fireball on the image, which allowed determination of the az/alt of start and end points as 204°, 27° to 226°, 12°, which is RA/Dec 07h39, –68° to 07h24, –43°, starting in Volans and ending in Puppis.

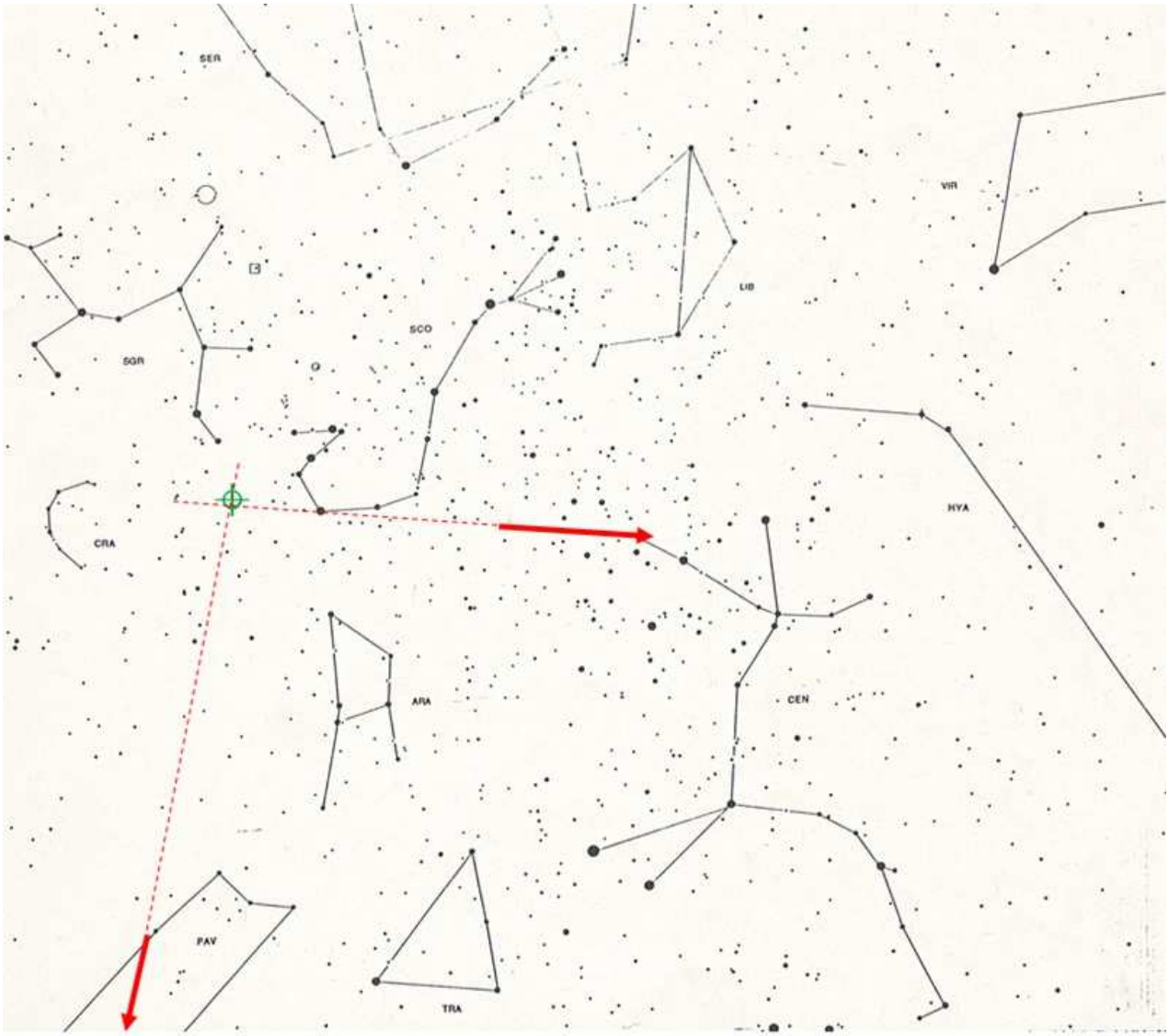



*Fig 2. Event 354 Path of meteor, apparent radiant shown as a green symbol near to the tail of Scorpius.*

**Event 356 – 2020 July 18 – Strand, Kraaifontein, Milnerton, Western Cape**

Observed by Anton van der Merwe about 19h55, brighter than the moon, bright green colour, duration 6 seconds and left a persistent train visible for 5 seconds. Disintegrated into several fragments at the end of its path. Az/alt of start and end points were 315°, 75°, to 240°, 75°, that is RA/Dec 16h14, –22° to 15h53, –40°, from Scorpius to Lupus.

Observed by Riaan Koegelenberg who saw part of the passage through a south facing window, duration approximately half a second, first azimuth 253°, last azimuth 212°, descending at an angle of perhaps 45° from right to left. Disintegrated into several fragments with a bright orange colour.

Observed by Riaan Beukes who also captured the last part of the passage on a cell phone. He was alerted by a bright flash and on looking up saw the fireball,

immediately followed by a second flash and then disintegrated into several fragments, duration 3 seconds. From the time stamp on the video the appearance time of the fireball was determined as 19h42. Analysis of the video shows a bright blue/white fireball, descending right to left at an angle of 25° to vertical. Riaan was already taking video at the time, and so the first flash can be seen lighting up the field of view, after which the passage of the fireball was acquired. Four stars are visible in the video, which enabled calibration of frame grabs to derive an accurate path. The fireball appears at the top of the field of view at RA/Dec 14h06, –61°20', very close to beta Centauri, and ends at 11h59, –74°00', (az/alt 199°, 38°) path length = 17.3°, and duration 1.8 seconds, giving an angular velocity of 9.6°/sec. The duration from first flash to disappearance is 2.3 seconds. The end points of the three observers are consistent with disintegration just south of Cape Point, as shown in Figure 3. Since the start of the fireball was not seen by all three however, the start point and direction could not be determined. The second bright flash and disintegration can be seen in screen grabs from Riaan Beukes video footage in Figure 4.

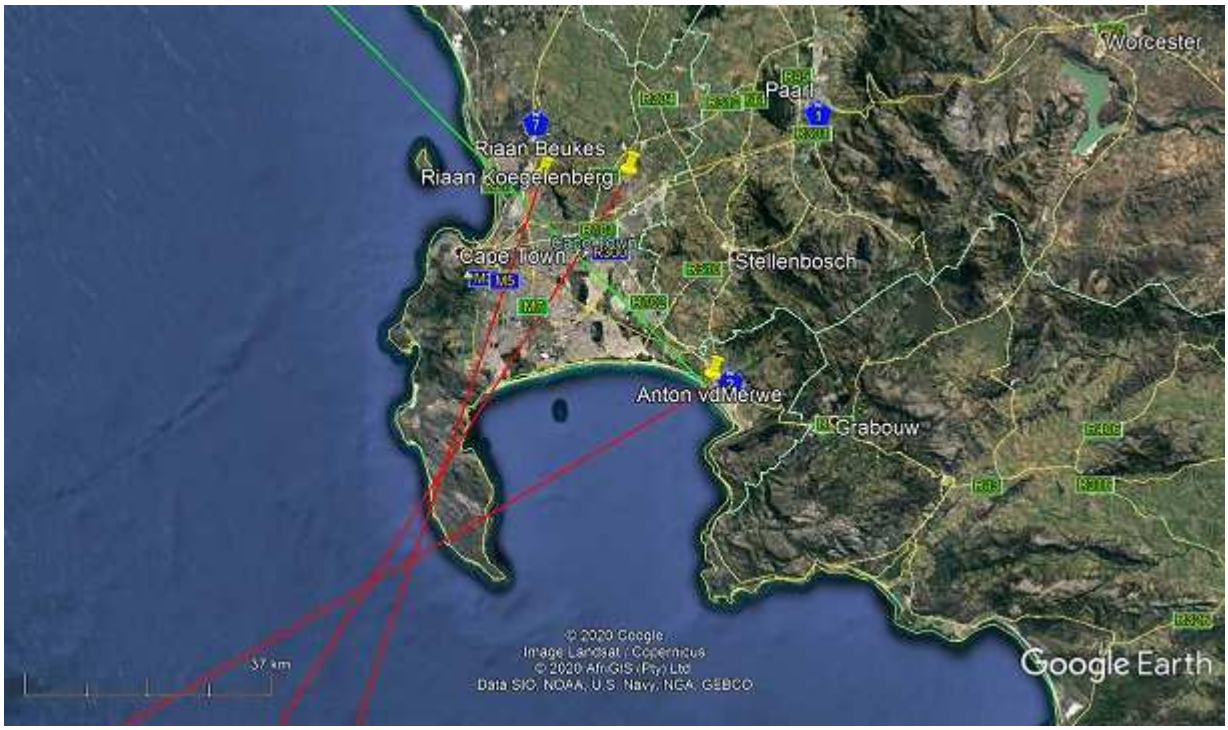



*Fig 3. Event 356 Start (green) and end (red) azimuth directions. There is good agreement amongst the three observers for the end point, around Cape Point. The start of the fireball was not seen by Riaan Beukes, and was obscured to his right in the case of Riaan Koegelenberg.*

Riaan Beukes also mentioned hearing a sound coincident with the second bright flash which he described as a sharp 'dat' sound, and this sound can clearly be heard in the video footage as a sharp 'crack'.

*Fig 4. Event 356 Appearance of the disintegration behaviour in three frame grabs from video footage, left at maximum light during second explosion showing two fragments, middle showing two probable large fragments after explosion, and right showing four fragments after disintegration and immediately before burning out.*

**Event 357 – 2020 July 18 – Touws River, Western Cape**

Observed by Eddy Nijeboer from Leeuwenboschfontein Observatory at about 20h07, facing south saw a bright blue/green fireball, $m_v = -12$, duration about 1.5 seconds, path from az/alt 150°, 35° to 180°, 10°, that is RA/Dec 22h25, –65.6° to 05h20, –66.4°. The fireball split into three pieces before descending below the horizon, which is a distant mountain range up to an altitude of about 10°. The fireball appeared to explode beyond the horizon as evidenced by 'exploding light shocks'.

Observed by Shai Harman from the same location, time given as about 20h00, $m_v = -14$, duration about 7-8 seconds, blue/green colour, path from 161°, 45° to 187°, 20°, that is RA/Dec 20h25, –71.7° to 07h08, –75.3°. Broke into three fragments which were visible for 1-2 seconds before disappearing from view. Shai said he was observing the sky with experienced amateurs who 'have witnessed fireballs in the past, but never of this magnitude. A spectacular sight'

Note the paths given by the two observers are parallel but separated by 12°.

**Event 358 – 2020 July 18 – Touws River, Western Cape**

Observed by Eddy Nijeboer at 21h07, during the same observing session as Event 357, $m_v = -10$, bright blue light lit up the interior of his observatory, and on looking up saw the last second of the fireball's passage, path from az/alt 260°, 30° to 250°, 20°, that is RA/Dec 13h41, –23° to 12h45, –27°. It had already fragmented into three pieces and disappeared behind the mountain.

**Event 359 – 2020 July 23 – Uitenhage, Eastern Cape**

Observed by Nicola McEwan between 18h00 and 18h15, [fainter] than the moon but considerably [brighter] than any stars in the night sky. The moon was a three day old crescent, magnitude –8.5, and set around the same time as the sighting. The head and tail were bright orange, and had the appearance of a fiery ball leaving a trail of orange fire in its wake'. From a sketch provided the fireball descended vertically in azimuth 110°, to the right of Jupiter, which was then magnitude –2.7 in azimuth 91°, altitude 40°. The fireball was first seen about altitude 25°, and disappeared below the horizon.

**Event 360 – 2020 July 27 – Bredell and Hartebeeshoek, Gauteng**

Observed by CAMS@SA at 20h22m47s UTC. The path was captured on camera 6000 at Bredell, and on camera 6028 at Hartebeesthoek. The capture frame from camera 6000 is shown in Figure 5. The meteor was first seen above 26.4397°S, 27.8119°E, altitude 106.34 km, and ended above 26.5691°S, 27.7226°E, altitude 62.09 km. Apparent radiant RA = 290.52 °, Dec = –8.18 °, $V_{inf}$ = 19.61 km/s. The derived orbital elements and radiant position, and the flaring behavior are all strong indications this was an alpha Capricornid fireball. A full report appears elsewhere in this issue of MNASSA.

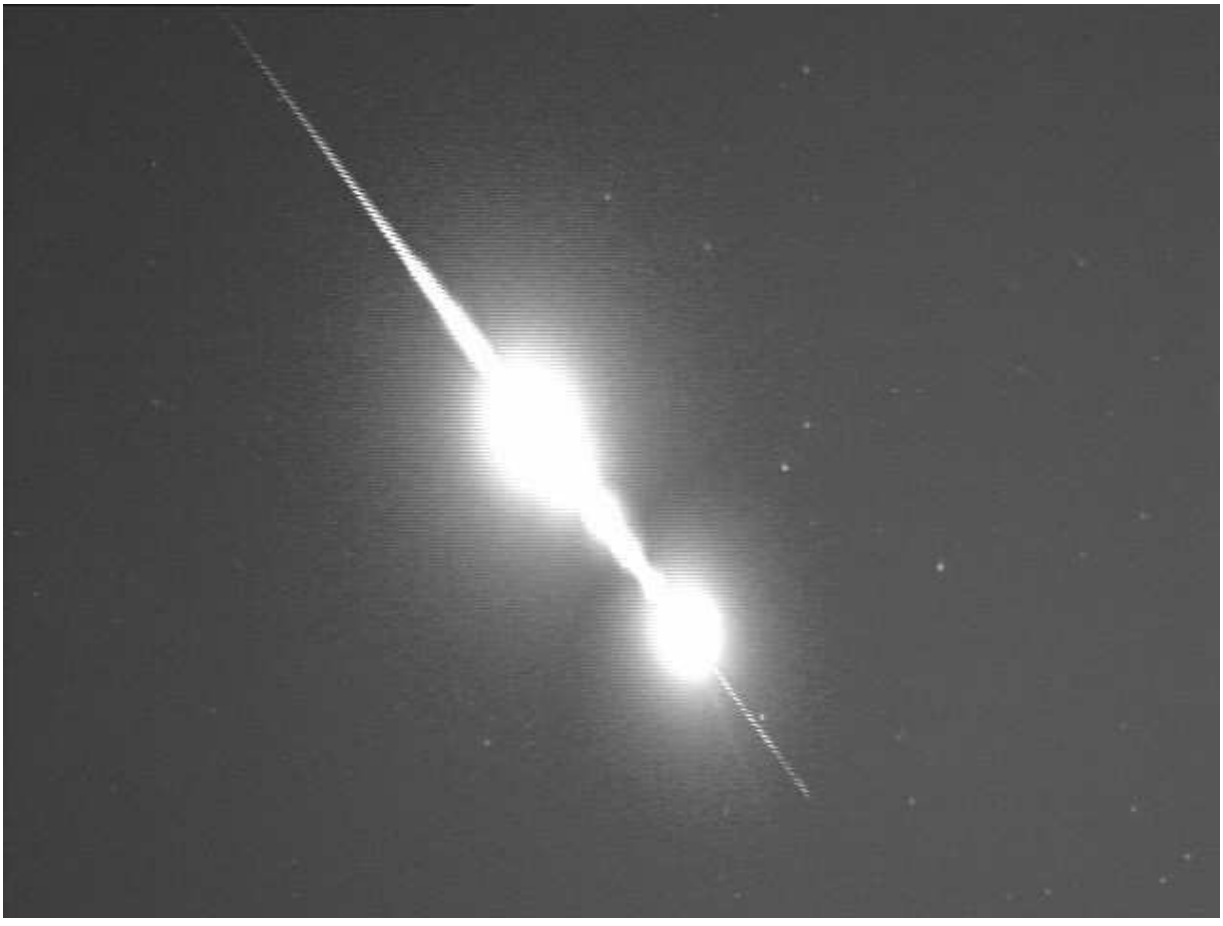


*Fig 5. Event 360 Video capture from station BR camera 6000.*

**Event 361 – 2020 August 1 – Cape Town, Western Cape**
Observed by Anton Krige, time given as 21h55, mv = –7, light yellow colour, duration about 3.5 seconds, path from az/alt 324.1°, 22° to 320.0°, 8°, that is RA/Dec 17h26, +24.3° to 16h36, +33.6°. The fireball left a persistent train visible for 2 seconds. Anton said it moved about 'one fifth the speed of a shooting star', increased in brightness with a terminal flash just above the horizon and then disappeared. No fragmentation observed and no sound heard but the fireball was observed through a closed window.

Observed by Yoshan Nico Oree, time given as 21h50, duration less than one second, as bright as the full moon, which was visible at the time, 97% illuminated and magnitude –12, altitude 77° in azimuth 322°. There was a terminal flash after which the fireball was obscured by Table Mountain. Nico said 'it seemed particularly close, almost surreal, big white flaming ball with bluish purple flames trailing it'. From a sketch of how the fireball moved relative to Devil's Peak and the saddle between the peak and Table Mountain the az/alt of first visibility and the point at which the fireball descended below the saddle was determined as 317°, 18° to 314°, 11°, that is RA/Dec 16h47, +24° to 16h19, +27.4°.

Tracing the paths backwards there is a reasonable agreement with the alpha Capricornid radiant.

**Event 362 – 2020 August 2 – Cape Town, Western Cape**
Observed by Shai Harman at 17h00, as bright as the moon, which was then 99% illuminated, magnitude –12.2 in azimuth 103°, altitude 22°. Duration 3.5 seconds, az/alt of start and end points 320°, 35° to 298°, 20°, that is RA/Dec 12h50, +11° to 11h13, +10°. Path length 23.6°, angular velocity 6.7°/sec. Colours noted were blue and green, and the fireball broke into two pieces before disappearing.

**Event 363 – 2020 August 7 – Brakpan, Gauteng**
Observed by Izelle Ballot just after 17h00, duration about 5 seconds, a bright light caught her attention, 'bright orange ball with thick tail moving quickly. It seemed very close'. From a sketch provided, the path was determined approximately as az/alt 135°, 35° to 110°, 30°, at which point it passed behind a neighbouring roof, descending at a very shallow angle from RA/Dec 20h22, –51° to 20h34, –29°, and ending lower right of Jupiter, which was then magnitude –2.7 at altitude 44°. The path does not correspond with any known radiants and the event was sporadic.

**Acknowledgements**
Thanks to Kos Coronaios (ASSA Observing Director) for forwarding various reports from the public.

# A rare methane-bright outbreak in Jupiter's South Temperate domain

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## Introduction

Energetic high altitude eruptions in Jupiter's atmosphere, which we refer to as outbreaks, are not uncommon in the North and South Equatorial Belts (NEB and SEB) as well as higher latitudes. However, few have been observed in the Temperate regions. An intense methane-bright outbreak in the South Temperate Belt (STB) latitudes was observed by the lead author on 2020 May 31. Although the outbreak, which would become known as "Clyde's Spot" in the Pro-Am planetary community, faded quite rapidly in methane wavelengths, developments were monitored by the amateur community over the following weeks. The outbreak occurred two days prior to the Juno Perijove 27 flyby, and close Pro-Am collaboration resulted in very high-resolution images of the outbreak being obtained by the JunoCam imager during the flyby.

## Outbreak detection

The outbreak occurred in the southern part of a pre-existing small white spot at 31$^{o}$S, embedded in a pale grey streak, and suspected of being a cyclonic vortex and was detected early on the 31 May. Observations from other amateurs confirmed that the outbreak had occurred within the previous 10 hours. It was only slightly brighter than before in RGB, but extremely bright in the 0.89 micron $CH_4$ absorption band. It remained methane-bright though much weaker over the following rotations, and from June 1 onwards appeared to consist of two (individually unresolved) parts which moved gradually apart up to June 6, mostly in the E-W direction but with slight cyclonic rotation from June 1-3.


*Fig 1. 'Clyde's spot' in 889 nm methane band initial detection from C.F. on 31 May 2020)*


*Fig 2. 'Clyde's spot' in RGB initial detection from C.F. on 31 May 2020) NASA Juno PJ27.*

The JunoCam images on June 2 showed Clyde's spot as an unusual, roughly oval, bright spot in RGB and $CH_4$, with brighter arcs in its E and W ends that were the pair of methane-bright spots in ground-based images. The spot does not show popup clouds but is marked by numerous concentric arcs which could represent gravity waves in the expanding high-level white cloud (A. Casely). Surrounding streaks confirm that it is within a strongly cyclonic vortex, although it may be over-riding those streaks on the S side.

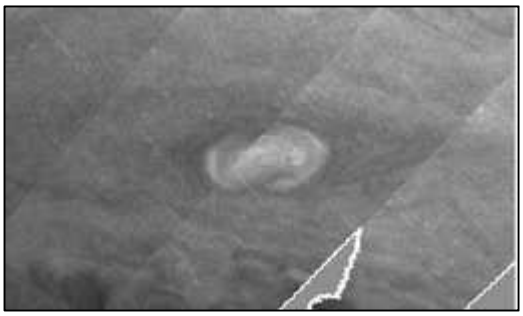

*Fig 3 & 4. Closeups from JunoCam on 2 June 2020 in $CH_4$ and RGB.*


**Outcome of the outbreak**

Amateur images from June 2-3, only small spots at the site of the initial eruption. From June 3 to June 13, v-hi-res images showed at least one white spot and one very dark spot; they changed rapidly in detail, possibly with cyclonic motion. No obvious

changes have developed outside this site, apart from appearance of thin blue-grey lines close to the STBn and STBs jets for ~13 deg west Clyde's spot. In methane images, by June 11 the appearance had reverted to a short oblique methane-dark streak with no bright spot, as it was before the eruption.

**Cycles of STB Structured sectors**

This spot erupted tens of degrees east of the only large anticyclonic oval in this domain, Oval BA. Small cyclonic spots have repeatedly arisen here in the last 20 years and expand to form structured sectors of the STB, which persist as large cyclonic segments for several years until they catch up with Oval BA from the west side. Although a new structured sector has been anticipated, it was only ground-based images early in 2020 that showed two new features which could be its precursors. One was a small, very dark spot ~40$^{o}$ east of BA, which persists; the other was the faint oblique streak, centred on a tiny white spot, ~80$^{o}$ east of BA. Clyde's spot erupted in this latter white spot. Therefore, this eruption may be a previously unknown feature of a cyclonic vortex in this transitional location and stage. Although the outbreak was very short-lived, implying similar outbreaks might be occurring unobserved, its occurrence in this location suggests that it was significant.

**The outbreak in the context of previous outbreaks**

The only similar methane-bright outbreaks previously recorded in the cyclonic STB latitudes were in large structured sectors at the end of their life: the so-called STB Remnant in 2010 and the STB Ghost in 2018 [1,2]. These generated rapidly expanding disturbances that converted these long cyclonic circulations into dark turbulent STB segments. In contrast, Clyde's spot, being in a very compact cyclonic vortex, has remained confined in its immediate vicinity and has not developed further (as of 2020 June 22).

Similar plume outbreaks occasionally occur in small but stable cyclonic vortices in the SEB. This was the way in which at least two recent SEB Revivals [2007, 2010] and two mid-SEB outbreaks [1979, 2017] began, and it is possible that they always do so.

**Conclusion**

This was a single, very energetic plume eruption within the small cyclonic spot. Over the following days the plume expanded locally, and disturbance continued at the original site, but there is no evidence of substantial wider changes. This contrasts with the results of the similar eruptions within larger circulations, which were rapidly converted into turbulent dark STB segments. Clyde's spot was a brief event, never conspicuous in visible light, but detected because of frequent monitoring with

methane images. It may represent a previously unknown type of eruption in a small cyclonic spot in the early stages of development of a STB structured sector. An update will be provided in the presentation.

**References**


1. J. Rogers (2019), 'Jupiter's South Temperate Domain, 2015 – 2018. https://britastro.org/node/17283.

2. P. Iñurrigarro et al. (2019-20). 'Observations and numerical modelling of a convective disturbance in a large-scale cyclone in Jupiter's South Temperate Belt.' Icarus 336 (2020), paper 113475.


## ASSA Annual General Meeting

The 2020 AGM was unique in that because of the Covid 19 pandemic it was a virtual AGM, hosted by the Pretoria Centre courtesy of Chair Bosman Olivier using Webex. A few members of Council had a few dummy runs to sort out potential problems.
The AGM was successfully held on 13 August, 2020 at 18h30 and attended by 40+ members via Webex. Because this was a virtual AGM, no awards could be physically handed out, this was especially relevant for the awarding of the Overbeek Medals. It was decided to make the Medal awards for both 2020 and 2021, so that both could be handed out at the 2021 AGM.

The minutes and supporting documentation will be placed on the ASSA website page https://assa.saao.ac.za/about/council-and-officers/agm-reports/

## ASSA Annual General Meeting - Awards

### Overbeek Medal 2020 - Magda Streicher

Magda Streicher is South Africa's doyenne of deep sky observing and has been so for over 20 years. She has developed a unique way of recording her results; in an age when digital astrophotography dominates both amateur and professional observations, Magda still draws the most accurate and beautiful sketches of her observations. These are accompanied by brief descriptions and get published in MNASSA, Nightfall and several overseas journals as Deep Sky Delights. Her books and catalogues of her observations are well known; most recently her Astronomy Delights, published in 2012 is a beautiful miscellany of her Deep Sky Delights for which she was deservedly awarded the McIntyre award. This year she has added

details of all 88 constellations that she has observed over the past many years, to her volume of Astronomy Delights, creating an incredible, massive volume of over 550 pages! Finally her observation of Sirius B after many years of eye watering attempts, turned to tears of joy when she succeeded recently; she regards this as her crowning glory. Many amateurs have imaged it digitally, with difficulty, but I cannot recall single amateur to have actually seen it! Being Magda, she spent a long time sketching what she saw and published it! Magda has observed the night sky in a way that would have made Jan Overbeek proud; I can think of a no more deserving person to receive the Overbeek Medal for 2020. - *Case Rijsdijk*

**Overbeek Medal 2021 - Clyde Foster**

Clyde Foster's digital imagery of Shallow Sky objects, primarily of the major planets and the occasional comet has grown enormously over the past few years; partially due to his interaction with other amateurs, and a few professional astronomers, both locally and internationally. His recent images of the planets Saturn and Jupiter, mainly the latter, where he has collaborated with the NASA's Juno mission, have produced images with a resolution that almost challenges the laws of Physics!
He has been active member of the ASSA in promoting, and participating in, pro-am collaborations and been overseas several times to do this, where he has presented at international Conferences on Planetary imagery. His discovery of a feature on Jupiter's surface, aptly named Clyde's Spot, indicates the level to which his work has risen and been recognized. I cannot find a more deserving winner of the 2021 Overbeek medal than Clyde Foster. - *Case Rijsdijk*

**A Presidential Award -Ronnie Glass**

Ronnie Glass, having initially joined ASSA's Cape Centre in 1964, has had a long association with the Society. This has not been a passive involvement. Perhaps generally unremarked but certainly not unappreciated, he has given freely of his financial accounting expertise since the late 1970s, supporting seven treasurers over the period of more than 40 years. His carefully considered professional advice, informed by the institutional knowledge that can only be gained through long-term continuity of perspective, has been a valuable asset which will be sorely missed. In appreciation for his outstanding contributions to the Society, I have no hesitation in recommending him for the President's Award. Long may he enjoy his well-deserved retirement. - *Chris Stewart*

**Directors' Awards**

**Rodney Hyman**

The ASSA Instrumentation Section hereby recognises the long-term support of Rodney Hyman to the Society, and in particular to the Amateur Telescope Making fraternity. Notably, without his excellent aluminising service, telescope making would be a far more difficult endeavour. A regular participant of the Telescope Making Class, Rodney has in many other ways provided additional services such as engraving, laser cutting, materials sourcing and electronics expertise. Without these, many amateurs would not have been able to attain such professional finishes to their work - or in many cases even to bring their instruments to completion. Further, Rodney has been a staunch supporter of ScopeX throughout its entire existence. Beyond this, he has greatly assisted in keeping the historic 26.5" refractor at the observatory operational, eliciting much credit to the Society from SAASTA.
For these reasons and many more, Rodney has earned the heartfelt gratitude of the astronomical community. -*Chris Stewart*

**Jose da Silva**

After observing a few exoplanets with Neville Young Jose moved on to a formal exoplanet programme using the telescope at the Unisa observatory.
He became part of an international collaboration between China, USA, UAE, Czech Republic, Spain, Cyprus, Chile and now SA. The aim is to search for habitable exoplanets around non-flare G, K and M (red dwarf) type stars within 100 light years of Earth. Based on his excellent work he was then invited to join an exoplanet project with The Russian Academy of Sciences's Pulkovo Observatory in St Petersburg and is co-author on a paper on the transit timing variation of this same exoplanet, WASP-4b. The paper will be published in the Monthly Notices of the Royal Astronomical Society (MNRAS) in the UK. Last year I considered Jose for the award of an Observing Certificate but anticipating that he would soon move on to greater things delayed the nomination. I now believe he is certainly an excellent candidate for the award of the Director's Observing Commendation which is why I have nominated him. -*Dave Blane*

# ASSA General Meeting - Elected Officials 2020/2021

| Role | Council |
|---|---|
| President | Chris Stewart |
| Vice President | Case Rijsdijk |
| Treasurer | AJ Nel |
| Membership Secretary | Wilmi Nel |

| | |
|---|---|
| Secretary | Lerika Cross |
| Council member | Dr Pierre de Villiers |
| Council Member | Dr Pieter Kotze |
| Council Member | Dr Ian Glass |
| Council Member | Clyde Foster |
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| Cape Chair | Marius Reitz |
| Durban Chair | Piet Strauss |
| Garden Route Chair | Case Rijsdijk |
| Johannesburg Chair | Carmel Ives |
| Pretoria Chair | Bosman Olivier |
| Hermanus Chair | Dr Pierre de Villiers |

| Role reporting into Council | Appointees |
|---|---|
| Convener of Scholarships | Dr Claire Flanagan |
| Web Manager | John Gill |
| ASSA Observing Director | Kos Coronaios |
| ASSA Communications Dir. | Case Rijsdijk |
| ASSA Outreach Director | Kos Coronaios |
| ASSA Archivist | Chris de Coning |
| SAAO Liaison for Website | Dr Christian Hettlage |

| Sections (Groups) | Directors |
|---|---|
| A - Shallow Sky: Asteroid, Meteors, Comets, Lunar, Occultations, Planetary, Satellites, Solar | Clyde Foster |
| B1: Deep Sky | Douglas Bullis |
| B2: Double and Variable Stars Section | Dave Blane |
| C: Photometry, Spectroscopy | Percy Jacobs |
| D: Cosmology and Astrophysics | Bruce Dickson |
| E: Southern African Astronomy History | Chris de Coning |

| | |
|---|---|
| F: Possible vacancy for a Dark Sky Section | In abeyance |
| G: Imaging Section | Martin Heigan |
| H: Instrumentation: including ATM | Chris Stewart |
| I: Citizen Science | Allen Versfeld |

| Editorial Board | |
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| Professional Astronomer | Dr Ian Glass |
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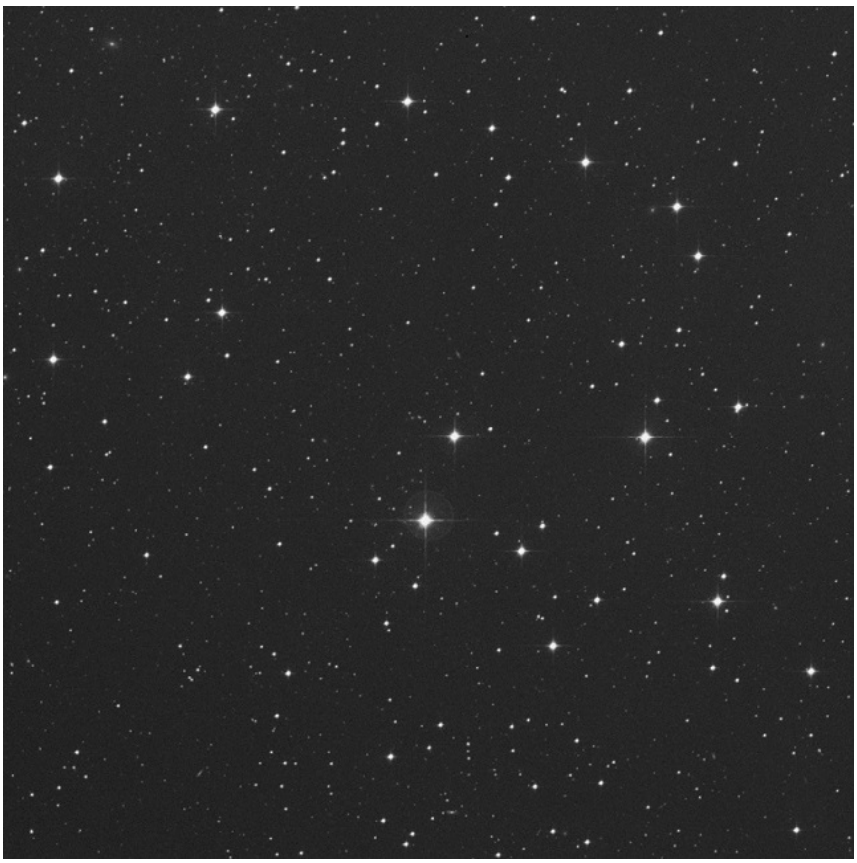
# Asterisms

*Magda Streicher*

**STREICHER 31 – DSH J2233.5-7705**
**Octans**

The main attraction of this very large grouping of stars is that they contain a mix of colourful stars. Although this field is sprinkled with numerous faint stars, the brighter stars making up this grouping stand out well. It could well be just a busy star field sprinkled with numerous faint stars. The group is situated a degree south-west of 5.4 magnitude psi Octantis.

| OBJECT | TYPE | RA | DEC | MAG | SIZE |
|---|---|---|---|---|---|
| | | | | | |
| STREICHER 31<br>DSH<br>J2233.5-7705 | Asterism | 22h33m.33 | -77°05’.36 | 9 | 32’ |

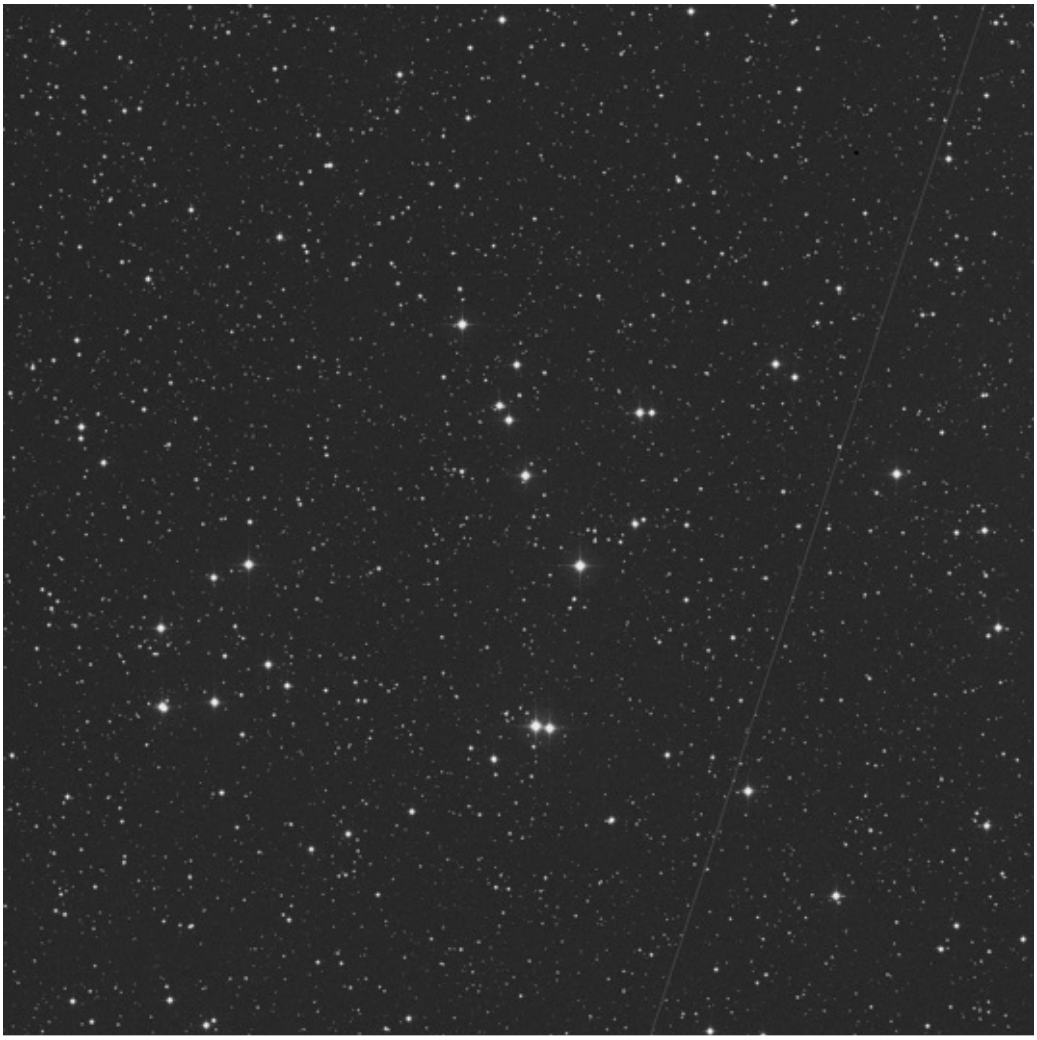


**STREICHER 32 – DSH J0607.2+0025**

**Orion**

Eight stars in an uneven string from north to south that stands out well against the background star field. The average brightness of the stars is magnitude 9. The base to the south is completed by a pair of brilliant white stars that is easy to split. Quite outstanding is a faint clustering of magnitude 9 stars a few arc-minutes to the east. It does not always seem to be a sort of cluster like grouping we know but when observed through a telescope some of these groupings are standing out nicely against the background star field.

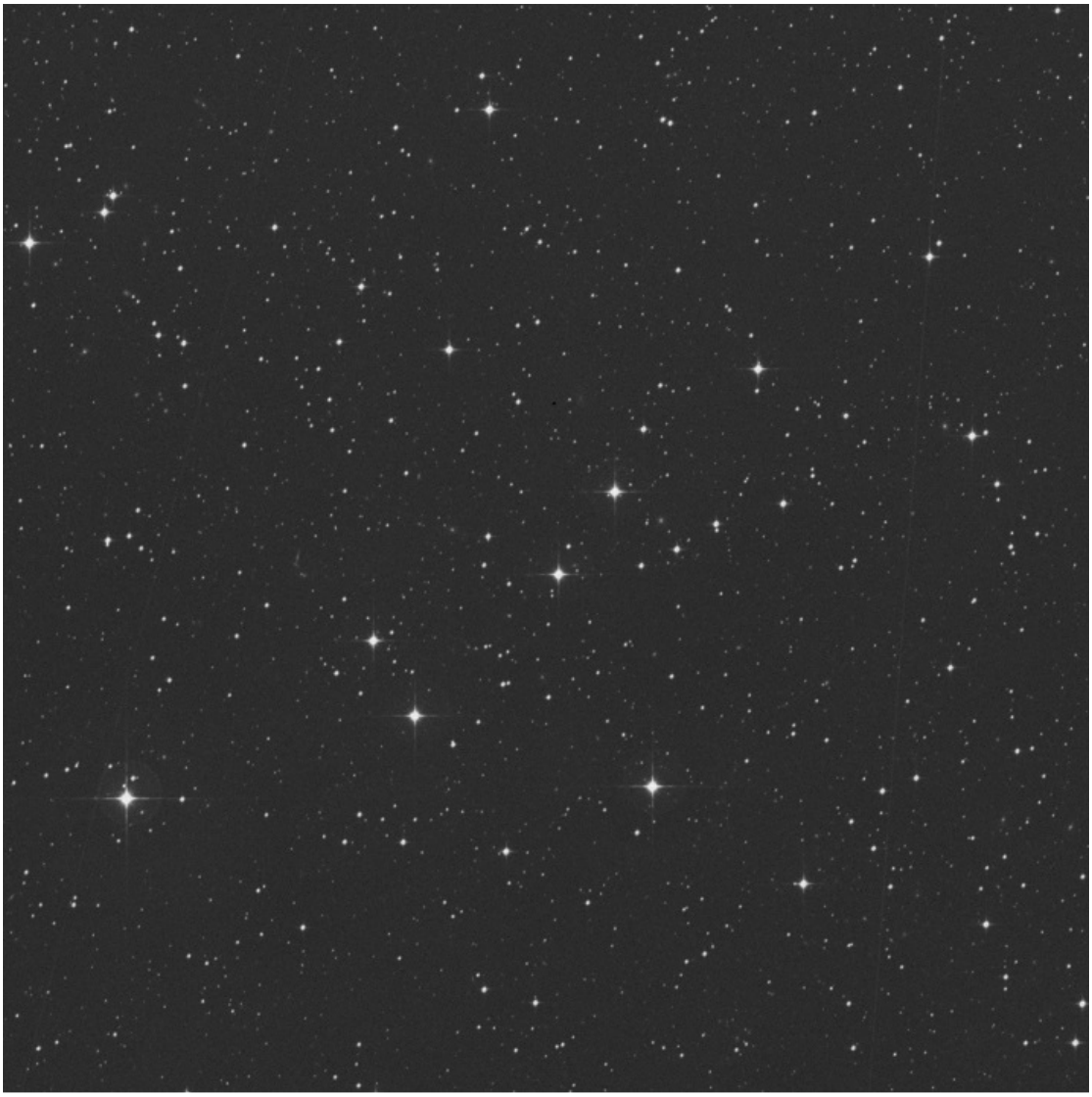
| OBJECT | TYPE | RA | DEC | MAG | SIZE |
|---|---|---|---|---|---|
| | | | | | |
| STREICHER 32<br>DSH<br>J0607.2+0025 | Asterism | 06h07m.12 | +00°25’.40 | 9 | 12’ |



**STREICHER 33 – DSH J0707.8-7214**
**Volans**

This asterism is one of the larger star groupings in a north-west to south-east direction, with stars varying in brightness. With my imagination I clearly see them in a "stick-man" form or the figure of a jumping jack. The magnitude 8-star, HD 56480 on the south-eastern tip forms the head, with the rest of the figure extending north-westward to complete the body and fainter well-defined stiff legs. The brighter stars consist mainly of tints of a yellow colour.

| OBJECT | TYPE | RA | DEC | MAG | SIZE |
|---|---|---|---|---|---|
| | | | | | |
| STREICHER 33<br>DSH<br>J0707.8-7214 | Asterism | 07h07m.53 | -72°14'.18 | 10 | 16' |



**STREICHER 34 – DSH J1559.9-5401**
**Norma**

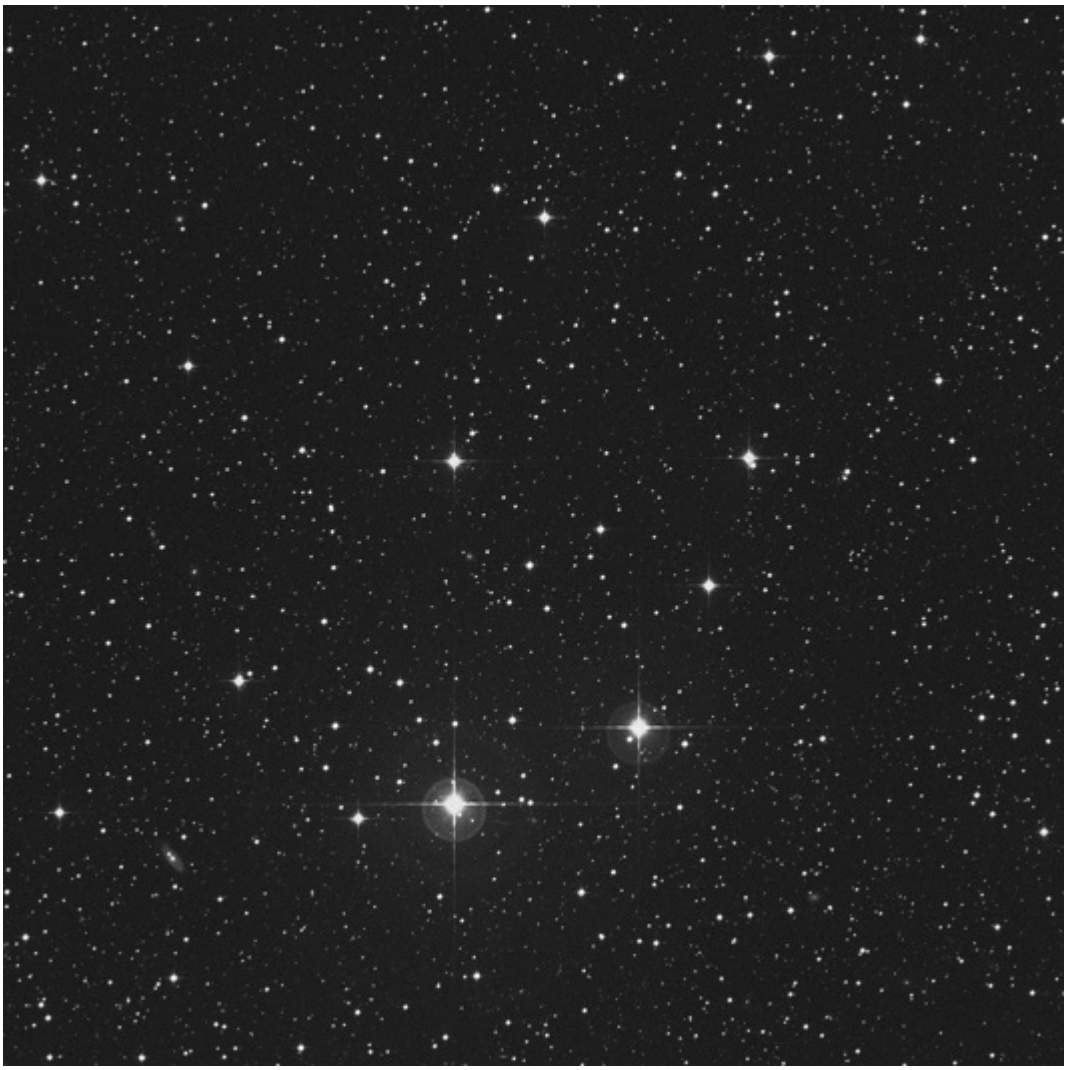
While observing the very faint cluster Moffat 8, I noticed a few brighter stars a further 15’ to the north-west. In particular, there are five stars quite outstanding and intriguing in shape. My first thought was that they might resemble an airplane or the face of a fish. A neat pair of magnitude 10 stars takes up the south-western corner of the grouping. In the area quite a few GN nebulae can be searched out.

| OBJECT | TYPE | RA | DEC | MAG | SIZE |
|---|---|---|---|---|---|
| | | | | | |
| STREICHER 34<br>DSH J1559.9-5401 | Asterism | 15h59m.56 | -54°01’.54 | 8 | 2.3’ |

**STREICHER 35 – DSH J1903.7-5749**
**Pavo**

This collection forms a bright half-moon, with the brightest magnitude star towards the south end from where it extends to the north. The main grouping with fainter stars nested inside the open end of the half circle. It is however a very busy star field with numerous stars making this string actually stand out more. Situated in a tri-angle towards the east with the galaxies NGC 6721 and IC 4806.

| OBJECT | TYPE | RA | DEC | MAG | SIZE |
|---|---|---|---|---|---|
| | | | | | |
| STREICHER 35<br>DSH<br>J1903.7-5749 | Asterism | 19h03m.44 | -57°49'.58 | 8 | 19' |



**Acknowledgment:** All images: archive.stsci.edu/cgi-bin/dss

The **Astronomical Society of Southern Africa** (ASSA) was formed in 1922 by the amalgamation of the Cape Astronomical Association (founded 1912) and the Johannesburg Astronomical Association (founded 1918). It is a body consisting of both amateur and professional astronomers.

**Publications**: The Society publishes its electronic journal, the *Monthly Notes of the Astronomical Society of Southern Africa (MNASSA)* bi-monthly as well as the annual *Sky Guide Africa South.*

**Membership**: Membership of the Society is open to all. Potential members should consult the Society's web page assa.saao.org.za for details. Joining is possible via one of the local Centres or as a Country Member.

**Local Centres:** Local Centres of the Society exist at Bloemfontein, Cape Town, Durban, Hermanus, Johannesburg, Natal Midlands, Pretoria and Sedgefield district (Garden Route Centre). Membership of any of these Centres automatically confers membership of the Society.

**Sky & Telescope:** Members may subscribe to Sky & Telescope at a significant discount (proof of membership is required). Please contact the Membership Secretary for details.

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