The PRETORIA CENTRE
of the
Astronomical Society of Southern Africa
www.pretoria-astronomy.co.za

NEWSLETTER FEBRUARY 2020

NEXT MEETING

Venue: The auditorium behind the main building at Christian Brothers College (CBC), Mount Edmund, Pretoria Road, Silverton, Pretoria.
Date and time: Wednesday 26 February at 19h15.
Programme:

- **Beginner's Corner:** "Discoveries by amateurs" by Michelle Ferreira.
- **What's Up:** by Michael Poll.

---------- 10-minute break. Library will be open. ----------

- **Main talk:** TBA by e-mail to members.
- Socializing over tea/coffee and biscuits.

The chairperson at the meeting will be Pierre Lourens.

NEXT OBSERVING EVENING

Friday 21 February from sunset onwards at the Pretoria Centre Observatory, which is also situated at CBC. Turn left immediately after entering the main gate and follow the road.

TABLE OF CONTENTS

Astronomy-related articles on the Internet

These 2 outbound comets are likely from another solar system.
https://earthsky.org/space/outbound-comets-are-likely-of-interstellar-origin?utm_source=EarthSky+News&utm_campaign=5b6df3e574-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-5b6df3e574-394671529

Rigel in Orion is blue-white. Rigel, brightest star in the easy-to-see constellation of Orion the Hunter, shines with a blue-white colour. Hidden behind its brilliant classic beauty is a fascinating and complex stellar life history.
https://earthsky.org/brightest-stars/blue-white-rigel-is-orions-brightest-star?utm_source=EarthSky+News&utm_campaign=7d064aad6a-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-7d064aad6a-394671529

Which spiral arm of the Milky Way contains our Sun? We're about 26 000 light-years from the centre of the galaxy, on the inner edge of the Orion-Cygnus Arm. This arm is sandwiched by two primary spiral arms, the Sagittarius and Perseus Arms.
https://earthsky.org/space/does-our-sun-reside-in-a-spiral-arm-of-the-milky-way-galaxy?utm_source=EarthSky+News&utm_campaign=d47fbd62e8-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-d47fbd62e8-394671529

This Australian meteor crater is oldest known, says study. It is 2229 million years old. That is older than the Vredefort meteor crater, which is 2020 million years old.
https://earthsky.org/earth/australian-Yarrabubba-meteor-crater-oldest-known?utm_source=EarthSky+News&utm_campaign=bdf6a54c78-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-bdf6a54c78-394671529

Space Shuttle Challenger disaster. It happened on 28 January 1986, 34 years ago.
https://earthsky.org/space/this-date-in-science-space-shuttle-challenger-disaster?utm_source=EarthSky+News&utm_campaign=bdf6a54c78-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-bdf6a54c78-394671529

Newest solar telescope releases its 1st images. The clarity of these images from the Daniel K. Inouye Solar Telescope in Hawaii is thanks to the telescope's 4-meter mirror, the world's largest for a solar telescope. https://earthsky.org/space/first-images-inouye-solar-telescope-jan2020?utm_source=EarthSky+News&utm_campaign=7dd60170b6-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-7dd60170b6-394671529

Launch of Explorer 1. It was the first US satellite. It was launched on 31 January 1958, about four months after Sputnik 1 was launched by the Soviet Union.
https://earthsky.org/space/launch-of-explorer-1-jan-31-1958?utm_source=EarthSky+News&utm_campaign=7dd60170b6-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-7dd60170b6-394671529

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What is Earth's shadow, and when can you see it? Like all worlds orbiting a star, Earth casts a shadow away from the star it orbits, namely the Sun. Next time you prepare for an evening of stargazing, watch Earth's shadow ascending in the east (with the pink "Belt of Venus" above it) while the Sun sets in the west. https://earthsky.org/earth/when-can-you-see-earths-shadow?utm_source=EarthSky+News&utm_campaign=4fcc37b4e9-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-4fcc37b4e9-394671529

Beautiful outcome of a fight between sibling stars. In a cosmic 'stellar fight,' a red giant star engulfed its smaller binary companion star. The chaos, however, created a beautiful space image. https://earthsky.org/space/hd101584-stellar-collision-new-alma-image?utm_source=EarthSky+News&utm_campaign=4b380e2ac8-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-4b380e2ac8-394671529

Solar Orbiter spacecraft launched recently. This is a collaborative mission between ESA and NASA to study the Sun's poles. Solar Orbiter will use successive Venus gravity assists to draw its orbit closer to the Sun and lift it out of the ecliptic plane. https://www.bing.com/news/search?q=solar+orbiter+mission&qpvt=solar+orbiter+mission&FORM=EWRE

Report of observing evening on January 17th 2020 – by Michael Poll

Danie, Michael and Rudolph and Chris were there and there were four visitors as well as two children. There was not quite total cloud but it was bad enough. We did however have a few sky holes but our viewing was limited to pointing out a few bright stars, and glimpses of Venus.

Venus showed a distinct gibbous phase. As viewed from Pretoria, Venus does not get high in the evening sky at all during the current evening elongation – it sets about 2 hours after the Sun from now until mid – April

Some copies of Skymaps were handed out, we did explain how to use the chart, and we located the bright stars that popped in and out of the cloud – Sirius, Rigel, Betelgeuse, Procyon, Canopus, Achernar, Fomalhaut, the latter three are more or less in a straight line. We also picked out Capella low in the north west.

The next observing evening is on Friday February 21st. **Ω**

Astronomy basics: How Earth moves

https://www.youtube.com/watch?v=IJhgZBn-LHg

Feature of the month: Does extraterrestrial life exist?

This is one of the great questions. It is discussed in this documentary:

https://documentaryheaven.com/aliens-are-we-alone/

Observing: The Elephant's Trunk - by Magda Streicher

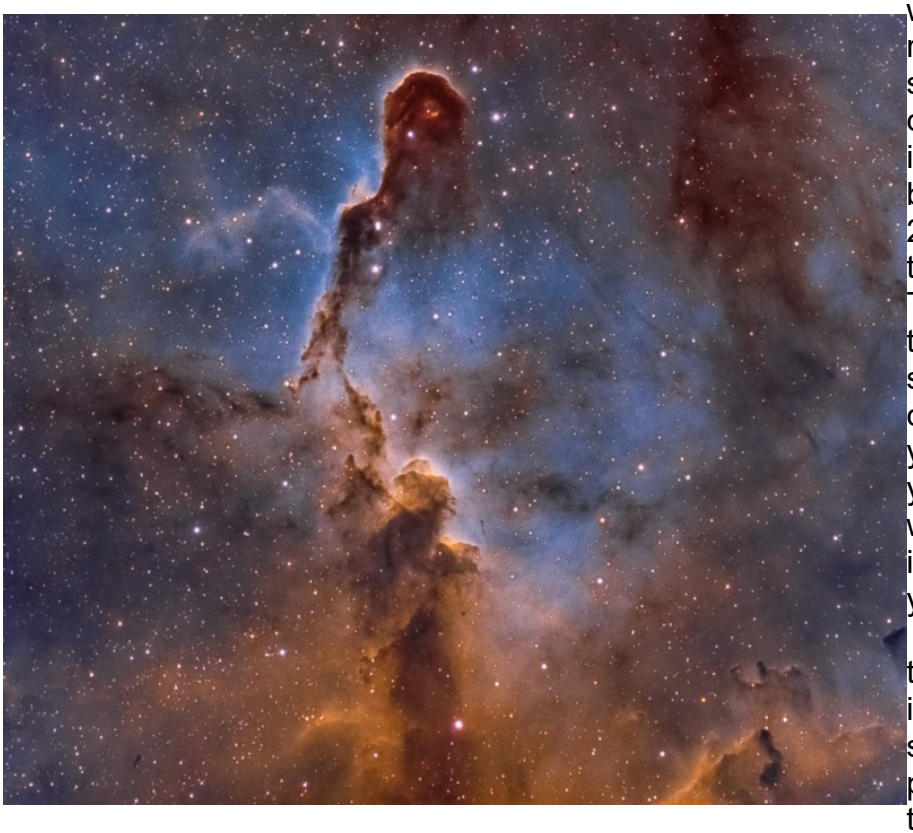
One of the most exceptional objects to be seen in the night sky can be found in the constellation Cepheus.

IC 1396A is not very well known, and is almost certainly not very frequently observed. The fact of the matter is that it is a large, very faint object, but no less exceptional. Its name, The Elephant's Trunk, can be attributed to the dark globule nebula located within the much larger emission nebula IC 1396.

The constellation Cepheus is not visible to us in the southern hemisphere, as it is located in the northern hemisphere. The solution for us is to have a look at it on the photograph of it by NASA's Spitzer Space Telescope, which portrays the area in all its splendour.

The northern end of the dense dark globule is reasonably rounded, and dwarfed by a wider field packed with stars situated within the larger nebula but possible to see through larger amateur telescopes with the greatest of care.

Concentrating on the dark globule, which is considerably fainter than the nebula itself, known as the Elephant's Trunk (IC 1396A), we can say the following from what research tells us: The Elephant's Trunk nebula is a concentration of interstellar gas and dust within a much larger ionized gas region and about 2 400 light-years away from Earth. The piece of the nebula commonly called the Elephant's Trunk nebula has the name because of its appearance at visible light wavelengths, where there is a dark patch within a bright sinuous rim. The bright rim is the surface of the dense cloud that is being illuminated by the very bright, massive star HD 206267, which is just to the west of IC 1396A. The nebula is now thought to be a site of star formation containing several very young, less than 10 000 years old stars, that were discovered in infrared images a few years ago.



The extensive size of the nebula and its influence on the surrounding area are phenomenal and can be truly admired. **Ω**

This image of the Elephant's Trunk was captured in classic Hubble Palette (Hα / OIII / SII) by astronomer Chuck Ayoub using a small 127 mm refractor telescope.

OBJECT	TYPE	RA	DEC	MAG	SIZE
IC 1396	Emission nebula	21 h 39.6 m	+57 ° 30.4'	7	170"

Chairperson's report for the meeting on 22 January 2020 - by Craig Cloke

Beginners Corner

Fred Oosthuizen gave an interesting talk on "Geomagnetic reversal and its possible impact on life". The magnetic field of the Earth is pointing North to South but is in the process of reversing. The magnetic field of the Earth is caused by a spinning core at the center. Geological records indicate that the magnetic field reverses every 200 000 to 300 000 years, therefore the Earth is overdue for a reversal. Certain migratory animals make use of the Earth's magnetic field so a reversal could cause a problem for them. There is evidence that the magnetic North Pole has been migrating but the South Pole has been relatively static.

What's Up

Johan Smit presented "What's Up". The best viewing for the coming month will be towards the end of the month. A valentine's day challenge was issued that members should try and find the "Heart Cluster" NGC2547, Louis Kloke requested that we make this a challenge for the coming month and that members photograph the cluster or draw a picture of it, Johan showed the members where the cluster could be found. The life-cycle of stars can be completely seen this month, the life cycle and classification of the different stars was discussed. Johan indicated where these different stars could be found. Another challenge was issued for the member to try and see the pup (Sirius B – a white dwarf) see if you can split it from the main star. A number of other observing challenges were also issued. Where the planets can be found in the coming month was also indicated.

Main Talk – The Helderberg Air Disaster: Conspiracy, Accident or Design Error

Andre Buys gave a very interesting talk on "The Helderberg Air Disaster". This air disaster is the most tragic air disaster to have happened in South Africa and there are a number of conspiracy theories that abound due to the air disaster. The aircraft took off from Taiwan to Johannesburg with a stopover at Mauritius to refuel, but it never arrived and crashed into the sea.

The first thing that had to be done was to find the wreckage of the aircraft, when they found the wreckage it was evident that the aircraft had completely disintegrated. Due to the disintegration of the aircraft they could conclude that the aircraft had impacted the sea at a high velocity. They found the main wreckage of the aircraft at a depth of 4.5km, where they found two distinct debris fields with very little wreckage between them. This was clear evidence that the aircraft had broken up in the air. The next step was to recover some of the wreckage, with the priority being on recovering wreckage with clear evidence of fire damage. The area with the most severe fire damage was identified as the cargo compartment towards the roof where the cargo door was.

The Margo Commission (1987 – 1990) was appointed to investigate the accident. When the report from the Margo Commission came out there were a number of unresolved issues:

- How did smoke get into the passenger compartment?
- What had caused so much fire damage?

There were a number of investigations after the Margo Commission. Since 1995 a number of the unresolved issues have become allot clearer.

An animation of the flight was shown. SAA acquired its first 747 in 1970, the Helderberg was purchased in 1980, because of the size of the 747 some flights could not be filled and therefore the combi configuration was developed.

Kapton electrical insulation was used in the aircraft due to its light weight, but over time Kapton becomes brittle and can crack, but this takes years. If moisture gets into that crack it can cause an electrical short circuit and result in a fire. The moisture was caused by the passengers breathing and coming into contact with the interior of the skit of the aircraft which was cold causing condensation. In the Helderberg the electrical cables sit next to Mylar thermal insulation which is flammable. A number of aircraft accidents caused by Kapton were discussed.

Carbon monoxide and soot were created by the fire, these gasses are flammable. The fire was so intense that it created a pressure increase which overcame the circulation system. When the aircraft reached 14 000 feet and the opened the doors to clear the smoke, this caused a flash fire of up to 2000 degrees Celsius in the cargo compartment, causing a loss of flight controls and weakening the airframe.

This occurred close to the critical area around the cargo door. When the aircraft then descended to 5000 feet in preparation for landing the loss of flight controls and the weakening of the airframe, caused an over stressing of the aircraft resulting the break up. The sky on the evening was said to be particularly dark and therefore the evening of the accident was shown in stellerium.

In conclusion the accident was caused by a number of design errors and therefore Boeing should accept responsibility.

The meeting concluded with tea and biscuits provided by Michael Poll. **Ω**

Summary of coming presentation on 26 February under "What's Up?" - by Michael Poll

Moon phases:
First Quarter March 2nd ; Full Moon March 9th ; Last Quarter March 16th ; New Moon March 24th .

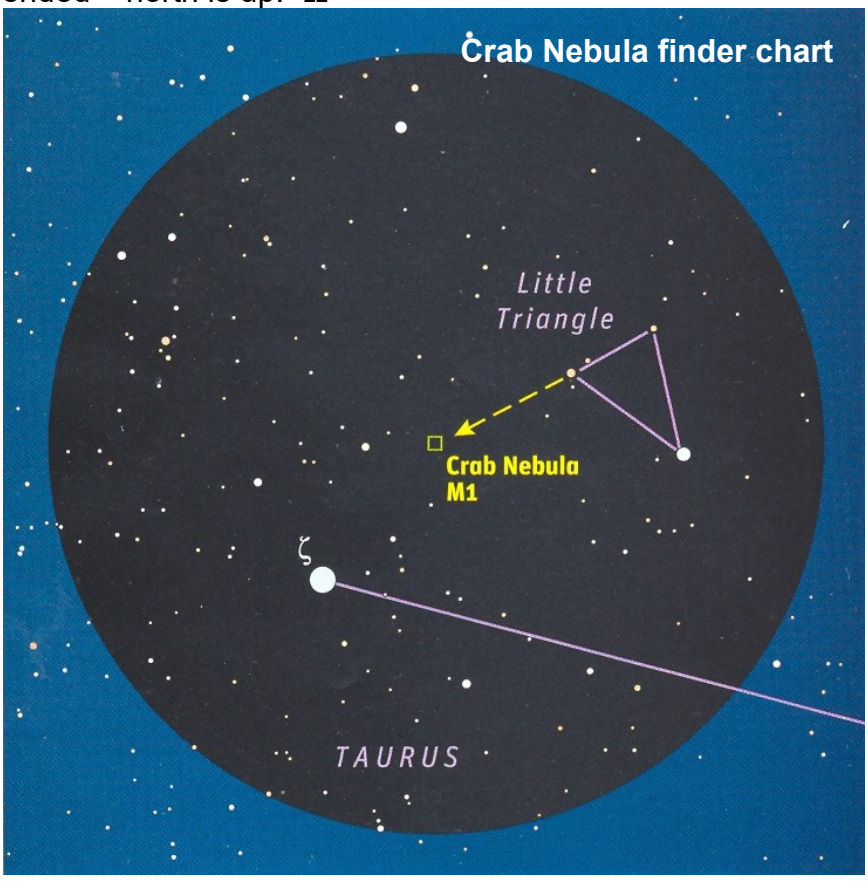
Moon near bright objects : Evening sky
February 27th : near Venus; March 6th : near Pollux; March 8th : near Regulus; March 29th : near Aldebaran

Moon near bright objects : Morning sky
March 18th : near Mars and Jupiter; March 19th : near Saturn; March 21st : near Mercury

Close approach of planets to each other: Morning sky
March 20th : Mars near Jupiter
March 31st : Mars near Saturn (54' apart)

The constellation of Orion will be highlighted – its mythology, times of visibility will be described, and the recent dramatic fading of the star Betelgeuse will be noted. There will be a discussion about the Great Orion Nebula – discovered in 1611, it is a blister of hot gas on a cool molecular cloud. The gas is ionized by UV radiation from hot stars, principally those in the Trapezium, which is a small quadrilateral of stars discovered by Galileo in 1617.

The Crab Nebula in Taurus will also be discussed. The nebula is the expanding remains of a supernova that was observed in 1054. The story of its discovery and the investigation of its nature and properties will be outlined. A finder chart for the Crab Nebula is appended – north is up. **Ω**



NOTICE BOARD

- **Astronomical data mining.** Help astronomers locate and identify super massive black holes and star-forming galaxies. https://www.zooniverse.org/projects/chrismrp/radio-galaxy-zoo-lofar
- **Help to transcribe the ground breaking work of early female astronomers.** https://www.zooniverse.org/projects/projectphaedra/star-notes?utm_source=Newsletter&utm_medium=Email&utm_campaign=announce28jan2020
- **Karoo Star Party.** This will take place from 15 to 19 July 2020 at the Kambro Padstal. Book accommodation early. http://pretoria-astronomy.co.za/pdf/kambro_2020.pdf
- **Free State Star Party.** This will take place from 19 to 21 June 2020 on the guest farm Gansvlei. Book accommodation early. http://assabfn.blogspot.com/p/blog-page_6.html
- **Beanies:** Beanies will be offered for sale @ R40.00 each at every monthly meeting, until they are sold out.
- **Old newsletters:** All old newsletters from January 2004 onward are on our website. They contain a record of our Centre's activities as well as astronomical information.
- **Database:** Members are reminded that a data base of the books in our library is to be found on our website.

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Astronomy-related images and video clips on the Internet

The 25 most bizarre galaxies in the Universe.
https://www.youtube.com/watch?v=KXsFUwWIHUc

Determination of the Earth-Sun distance using the transit of Mercury on 11 November 2019 – author unknown, minor editing by Pierre Lourens

The principle in itself is not very complicated: seen from two observers located at a great distance from each other, on Earth, Mercury photographed at the same time in front of the Sun, must appear to be located in projection, by parallax , at two different locations on the solar disk.

The difference between the two perceived positions depends on the Earth-Sun distance and the Mercury-Sun distance.

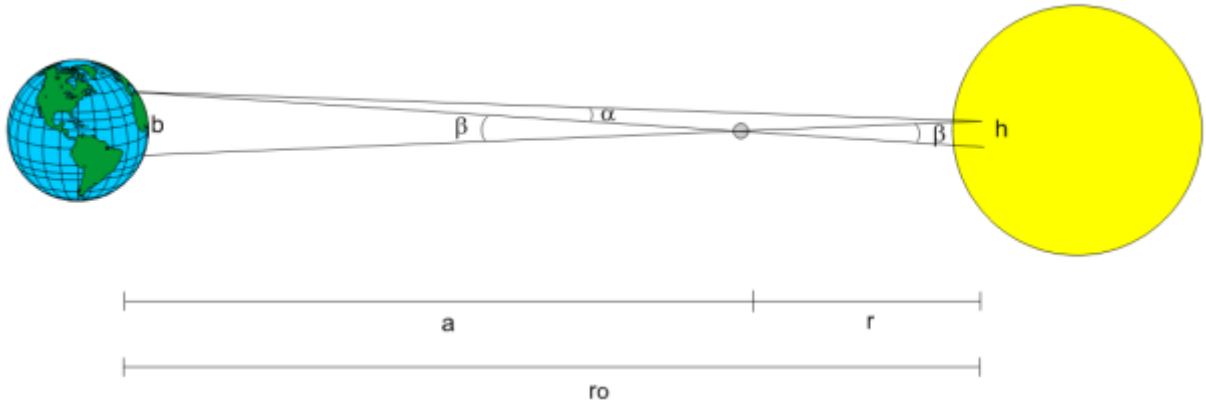
A partnership had thus been set up between the Astro ERATO Lab at the Lycée Jacques Ruffié and a club of amateur astronomers in Pretoria in South Africa.

In practice, the two problems are to determine:

1. the positional shift of Mercury between the two images

2. The distance between the two observers, projected on a line perpendicular to the Sun-Earth line.

A bit of theory:



α: is the angular offset between the two images of Mercury

b: is the distance between the two observers, projected on a line of sight perpendicular to the Earth-Sun line

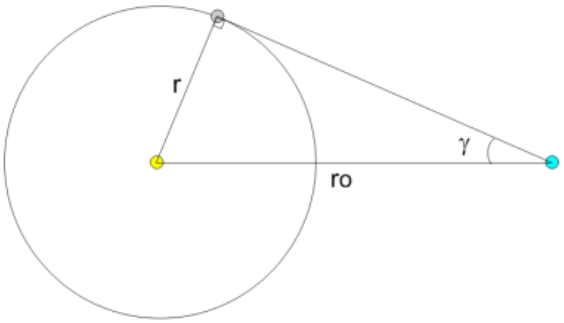
r_0: what is sought, the Earth-Sun distance

$$\alpha = \frac{h}{ro}$$

$$\beta = \frac{b}{a} = \frac{h}{r} = \frac{b}{ro - r} = \frac{\alpha . ro}{r}$$

$$\frac{b}{\alpha} = \frac{ro.(ro - r)}{r} = ro.(\frac{ro}{r} - 1)$$

b and α are measured. **r** is unknown. **r** is determined as follows.



The maximum elongation of Mercury (γ) is measured. The top angle in the triangle is 90º in size.

$$\sin\gamma = \mathbf{r} / \mathbf{r_0}$$

The previous formula then becomes:

$$\frac{b}{\alpha} = ro.\left(\frac{1}{\sin\gamma} - 1\right)$$

$\mathbf{r_0}$ is then given by

$$ro = \frac{b/\alpha}{1/\sin\gamma\ -1}$$

Observations.

These were made from two observational sites: Limoux in France and Pretoria in South Africa.

Above: Limoux in France and the students of the Astro ERATO Lab.

Below: Johan Moolman with his equipment in Pretoria, South Africa. (And a word of thanks to Neville Young, Johan Smit, Percy Jacobs from ASSA and other South African contributors.)

Observation protocol:

-The images are obtained in such a way that the Sun is fully present on the image
-The sensor is chosen to have sufficient resolution
-The observers agree to make an image every 10 min full throughout the transit, which lasts all afternoon.

Determination of the offset between the two images of Mercury: problem of image alignment.

In Limoux, the images are taken with a reflex camera (Canon EOS 6D) in the foyer of the C8 loaned by the Meudon observatory (Astro project at school). The mounting of the instrument is equatorial, so, from one image to another the orientation of the photographed field remains the same.

In Pretoria, Johan Moolman communicates to us first of all very beautiful images, but his mount was azimuthal: a rotation of field thus appears from one image to another, they are therefore useless.

A second series is provided to us by Johan, very efficient, obtained with an equatorial mount. These are useful!

BUT: we were hoping for some sunspots, which would have made it possible to align the images between Pretoria and Limoux. With bad luck, the Sun, in minimum activity, is uniform, with no reference point. Two images cannot therefore be aligned.

A SOLUTION: If we use not two images taken at the same time from two places, but rather ALL the images taken at the two places, we are left with two trajectories of Mercury on the Sun's disk, from France and from South Africa.

Here is the version obtained in France:

So, now, with a little patience and care, it becomes possible to align the two trajectories of Mercury, of course after scaling.

The black dots are those of the South, the whites are those of the North.

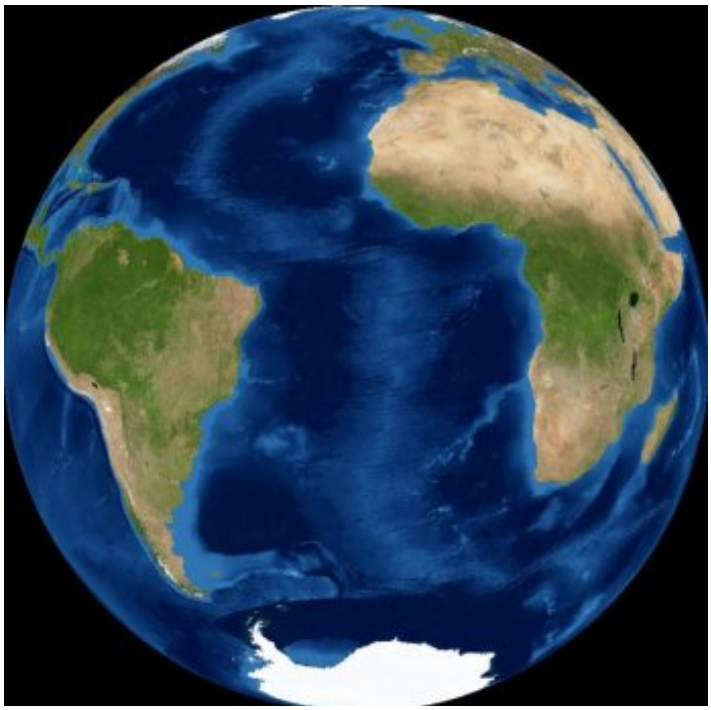
The pupils measure, by comparison with the apparent diameter of the Sun that day, **an offset of 6.5 seconds of angle on average, that's** α.

Difficult weather conditions lead us to use astronomical simulation software (SkyChart from Patrick Chevalley), which leads to a determination of γ = **23 °**.

Distance between the two observers:

This measurement, performed on the line perpendicular to the Sun-Mercury line, is complex to determine by calculating astronomical positions. A trick simplifying the problem was used:

The FOURMILAB website allows you to obtain simulated images of objects in the solar system seen from others, at selected dates and times. It thus makes it possible to obtain this image of the Earth, as being a view taken from the Sun, at the time of transit. A simple proportionality based on the real diameter of the Earth and the **distance measured on the image between Limoux and Pretoria allows to obtain b = 7400 km.**



Final determination of the Earth-Sun distance:

All the values obtained above are combined, in the right units, thanks to the formulas previously established, the final result obtained is

r_0 = 151 million km

That day, the ephemeris predicted **149 million km**.

The value of r_0 that was obtained differs by only 1.3 % from the known value!