

# Australian Astronomy

ASA Factsheet No.28

Eclipse of the Sun  
20 April 2023

**A total eclipse of the Sun will occur on Thursday 20 April 2023**

Exmouth	100%	
Port Hedland	94%	
Broome	91%	
Geraldton	85%	
Darwin	84%	
Perth	77%	
Bunbury	74%	
Kalgoorlie	68%	
Alice Springs	58%	
Adelaide	32%	



*Total eclipses of the Sun in a particular area are rare. There has not been a total eclipse seen from mainland Australia since the Queensland eclipse of 14 November 2012. The next total eclipse to be visible from Australia will not take place until July 2028.*

**WARNING:** It is very dangerous to look directly at the Sun, especially through binoculars or telescopes. **SERIOUS EYE DAMAGE MAY RESULT**  
Safe methods of observing the Sun's disc are provided within.



## Path of Totality

As the Moon's shadow moves from west to east across Earth's surface due to the orbital motion of the Moon, it traces out a quite narrow path called the path of totality.

Just touching the coast of Western Australia before moving out into the Timor Sea, the path of totality of the 2023 eclipse will begin at sunrise in the Indian Ocean to the south-west of Australia. Moving north-west along the coast, the eclipse will move out into the Timor Sea, crossing Timor-Leste and Indonesia before ending at sunset over the Pacific Ocean.

The only part of mainland Australia where the total eclipse can be viewed is the North West Cape of Western Australia. It includes the town of Exmouth and the airport at Learmonth, with the centreline of the narrow path crossing between them. The path will cover much of the Cape Range National Park.

The eclipse across the Cape starts as a partial eclipse at 10:04 am.

In Exmouth, totality begins at 11:29:50 am (50 seconds past 11:29 am) AWST and lasts about 54 seconds with the eclipsed sun 54 degrees above the horizon.

At Learmonth airport, totality starts at 11:29:18 am and lasts about 54 seconds.

On the centerline of the path, totality will last for about 60 seconds.

After totality, the eclipse will continue as a partial eclipse, ending at 1:02 pm.

After crossing North West Cape, adjacent to the town of Onslow, the path of totality also crosses Barrow Island (a restricted access nature reserve) and the Montebello Islands (the site of atomic tests in the 1950s).

The rest of Australia will be outside the path of totality, with the eclipse being seen as a partial eclipse of the Sun starting in the morning in Western Australia and from midday until early afternoon in the other states, as shown (in local times):

Location	Start	Peak	End	Deg.	%
Adelaide	12.24pm	1.30pm	2.35pm	40°	32%
Brisbane	1.44pm	2.45pm	3.42pm	32°	27%
Canberra	1.30pm	2.22pm	3.12pm	33°	19%
Darwin	12.18pm	1.52pm	3.25pm	61°	84%
Hobart	1.25pm	2.06pm	2.47pm	30°	13%
Melbourne	1.15pm	2.09pm	3.01pm	34°	21%
Perth	10.00am	11.20am	12.47pm	45°	77%
Sydney	1.37pm	2.29pm	3.19pm	32°	19%

**Note:** to avoid the possibility of serious eye damage precautions must be taken, as outlined on Page 4.

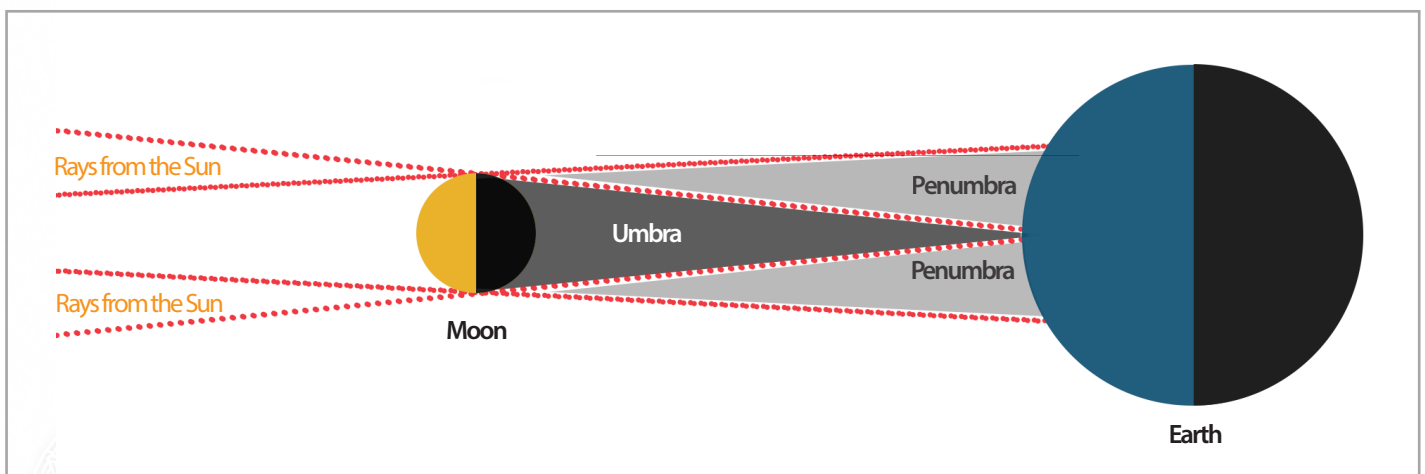
## The Eclipse

### Total or Hybrid?

Some sources describe the April 2023 eclipse as a “Hybrid eclipse”. The term Hybrid describes the path of the eclipse. It does not describe the type of eclipse that can be observed at any point along the path. The path of this eclipse will begin in the Indian Ocean as an annular eclipse (where the Moon does not completely cover the Sun and a ring of sunlight remains around the Moon), changing into a total eclipse before it crosses Australia, Timor-Leste and Indonesia. It will then change back into an annular eclipse at the end its path in the Pacific Ocean. Where the path crosses Australia the eclipse will be a total solar eclipse. Hybrid eclipses have a typically short period of totality, as is the case with this eclipse.

### How solar eclipses occur

A solar eclipse occurs when the Moon, in its orbit around Earth, blocks all or part of the Sun’s disc as seen from the surface of Earth. Only by observing from within the cone-shaped umbra of the Moon’s shadow can we see the Sun’s disc completely obscured. From within the lighter penumbra at least part of the Sun remains visible and we witness only a partial eclipse.



Although a solar eclipse of some kind occurs somewhere on Earth at least twice each year, it is only in some of these events that the Moon completely covers the Sun. Sometimes the umbra misses Earth altogether, passing ‘above’ or ‘below’ our planet. Even when the umbra does intersect Earth, we are very close to its end where the width of the moon’s shadow is very small.

Only those lucky enough to be within the path of totality on 20 April 2023 will see the brief spectacle of the Moon completely covering the Sun. Those within a large surrounding area of Earth’s surface will witness a partial eclipse.

Sometimes Earth’s surface is beyond the cone of the umbra and we see what is called an annular eclipse. In these eclipses a ring of sunlight appears to surround the Moon at mid-eclipse and the Sun is not completely covered from any location on the Earth’s surface. Such an annular eclipse was seen from Australia in May 2013.



## Eye Safety

### Viewing the eclipse safely

During a partial solar eclipse it is very dangerous to look directly at the Sun.

The only safe way to look directly at the uneclipsed, or partially eclipsed, Sun is through special-purpose solar filters such as “eclipse glasses” or handheld solar viewers. However, it is vital that they conform to the correct standard and are used safely.

#### DO

Use eclipse glasses or eclipse viewers sourced from a reputable supplier with filters that are compliant with the international standard ISO 12312-2.

Read and follow all instructions printed on or packaged with your eclipse glasses or viewer.

Check filters prior to use for scratches, punctures, tears or other damage.

Provide adequate supervision to children in your care to ensure that they are using the appropriate filters, that all filters are fitted correctly, and to ensure they do not directly look at the sun.

Ensure that eclipse viewers are fitted over regular, prescription, eye-glasses.

Cover your eyes with your eclipse viewer and stand still before looking up at the sun.

Turn away from the sun **before** removing your eclipse glasses or viewer.

Ensure that you use telescopes safely, following the technique outlined on the following page.

#### DO NOT

Look directly at the Sun.

Used scratched, punctured or damaged eclipse filters or eclipse viewers, or viewers that do not comply with the international standard ISO 12312-2.

Leave children in your care unsupervised.

Look at the uneclipsed, or partially eclipsed Sun through an unfiltered camera, telescope, binoculars, or other optical device.

Look at the Sun through a camera, telescope, binoculars, or any other optical device while using your eclipse glasses or handheld solar viewer — **the concentrated solar rays could damage the filter and enter your eye(s), causing serious injury.**

Look directly through a telescope at the sun - **this can cause almost instant blindness.**

Leave a telescope or camera unsupervised, especially in the presence of children.

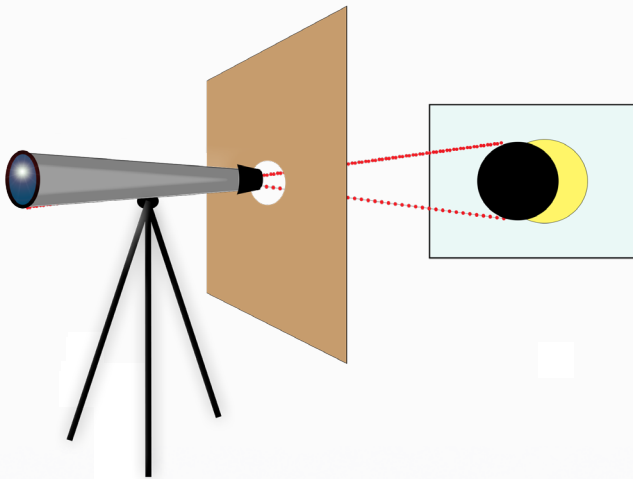
**Note:** it is safe to remove your solar filter/s **only** if you are within the path of totality and **only** within the approx 60 seconds that the Sun is fully eclipsed by the Moon.

If you are within the path of totality, remove your solar filter only when the Moon completely covers the Sun's bright face and it suddenly becomes quite dark. Wait until the last bright spots around the edge of the Sun have disappeared before removing your filter/s. You will have around a minute to watch as the Sun appears behind the Moon like a bright diamond ring.

**Replace your solar filters immediately once the moment of totality has passed.**

## Using a Telescope

It is possible to safely watch the partial eclipse yourself using a small telescope to project the image.



### How to use a Telescope Safely

1. Remove finderscope
2. Place a shade-collar around the lens of the telescope (Cardboard is fine)
3. Place a piece of white paper approx 20cm from the eye-piece
4. With your back turned to the Sun, you will be able to watch the eclipse safely projected onto a sheet of white paper or card.

**DO NOT LOOK THROUGH DIRECTLY THROUGH THE TELESCOPE!**

Viewing the projected image is safe, but looking through the telescope will cause almost instant blindness.

## Pinhole Technique

If you do not have access to a telescope, an alternative, safe method for viewing the eclipse is "pinhole projection".

**Please note:** if you do not have access to card, you can use a similar method to view the eclipse by watching the image cast onto the ground through a gap in your fingers.

Cross the outstretched, slightly open fingers of one hand over the other, creating a criss-cross pattern.

With your back to the Sun, look at the shadow of your hands on the ground.



This also works with leaves and branches. Look for crescent images under trees, as the gaps between the leaves act as pinholes.

### Fun Idea

Why not make a series of holes in the card that spell out your name or location to create a series of crescent images of the eclipsed sun?

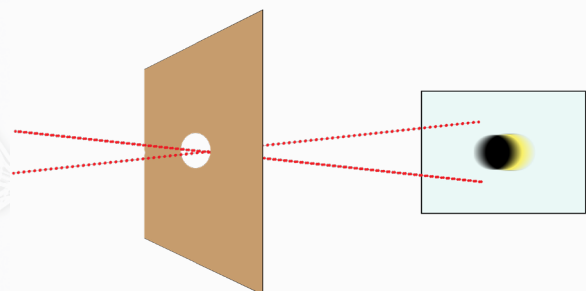
Turn the series of images into a montage or a collage to create a special memento.



### Pinhole Technique

Using a large piece of card with a hole punched in the centre of approx 2 mm diameter, turn your back to the Sun and hold the card so that sunlight passes through the hole and onto another card held about a metre away.

This 'pinhole method' will give you an image of the Sun that is small, but good enough to make out the missing 'bite' on the disc.



**DO NOT LOOK DIRECTLY AT THE SUN THROUGH THE PINHOLE!**

## Photographing the Eclipse

**Do NOT attempt to photograph the Sun directly unless you are experienced in solar photography.**

It is safe to remove your solar filter/s and look directly at the Sun through the viewfinder of your camera **only if you are within the path of totality** and **only when the Sun is fully eclipsed**.

### Method 1 - Phototgraphing the Partial Phases

A simple and safe way to photograph the partial phases is to take pictures of the projected image, using a telescope or the pinhole technique (please refer to Page 5 for instructions).

If taking photos during the partial phases with a smartphone or digital camera, take care not to include the Sun in the image as it may damage your eyes or the imaging sensor of your phone or camera. If the Sun is included, you must only look at the **screen** of the phone or camera. Never look directly at the Sun or through a camera's viewfinder during partial phases of the eclipse. A cardboard screen in front of the camera (with a hole cut to fit the lens) can help with this.

### Method 2 - Photographing Totality

Photography is much safer during totality. With modern smart phones and digital cameras it is possible to produce excellent images of an eclipse simply by using automatic exposure settings. However, as totality lasts for no more than a minute, preplanning is essential.

### Method 3 - Professional or Semi-Professional Photography

Advice on techniques and equipment needed to directly image the Sun can typically be sourced through your local amateur astronomy group, public observatory or planetarium. Professional photographers should contact these organisations directly for specialist advice if required.

To photograph the partial phases of the eclipse, you will need a filter specially made for photographing the Sun. This will not only avoid damage to your camera's imaging sensor during the partial phases of the eclipse, but also ensure that you are able to expose your images correctly.

As it is likely that you will require a lens with a focal length of between 400mm and 2,000mm, and with shutter speeds as long as 1-2 seconds not uncommon, both a tripod and a shutter-release cable are also recommended for best results.

There is no ideal or recommended estimate of exposure settings for photographing an eclipse, due to the huge variation in the dynamic range of the corona, however an excellent calculator created by Xavier M. Jubier is available online at : [http://xjubier.free.fr/en/site\\_pages/SolarEclipseExposure.html](http://xjubier.free.fr/en/site_pages/SolarEclipseExposure.html)

**Important:** NEVER look at the Sun directly through your camera's viewfinder. The lens of your camera concentrates the solar rays. Severe injury to your eye, or even blindness, may result.



## What to expect

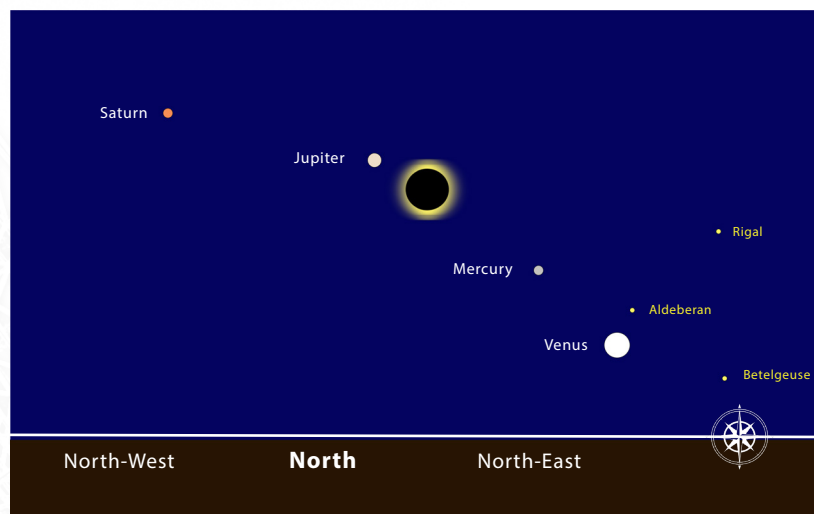
**During a total eclipse the Sun's faint outer atmosphere, the corona, becomes visible. This is one of Nature's greatest spectacles.**

Just before and just after totality the disc of the Sun is glimpsed as a pinpoint of light through a valley at the edge of the Moon. This 'diamond ring effect' is one of the highlights of a total eclipse.

The appearance of the corona varies between eclipses and depends largely on the state of the 11-year cycle of solar activity. On some occasions tiny faint pink regions can be seen at the edge of the eclipsed Sun. These are prominences that can normally only be seen through telescopes equipped with special filters.

During a total eclipse, the sky becomes dark as the moon's shadow fills the sky and there are sunset-like colours all around the horizon. Planets and bright stars become visible.

When looking north in the direction of the eclipsed Sun, the planet Jupiter will be just to the left of the Sun, Mercury will be below and to the right of the Sun and Venus will be further to the right and closer to the horizon. Saturn will be off further to the left, in the north-west.



During the no more than one minute of totality it will be safe to look directly at the eclipsed Sun, however precautions must be made to avoid looking at the partially eclipsed Sun before and after totality.

For those fortunate enough to be within the path of totality during the eclipse, coverage of the Sun will continue until it is completely obscured by the Moon. If clouds allow a view, the total eclipse will be a spectacular event.

For anywhere in Australia outside the path of totality, the eclipse will start with the Moon gradually moving over the Sun initially with a small bite and increasing to a maximum coverage before decreasing again. None of the total solar eclipse will be seen.

## *Preparing for the Eclipse*

### Weather and atmospheric conditions

Weather conditions during the eclipse cannot be predicted this far in advance, but climate statistics can provide an indication.

According to the Bureau of Meteorology summary climate statistics of observations at Learmonth Airport since 1945 (site number 005007), the mean number of cloudy days - where observations at 9am and 3pm show an average of at least 75% cloud cover - in the month of April is 6.5.

The mean number of clear days for April - with an average of 25% or less cloud cover - is 14.6, with the remaining 8.5 days measuring somewhere in between.

The Bureau of Meteorology records the mean number of days of rain (more than 1 mm) in April as 1.1.

For a detailed analysis of climate in the area at the time of the eclipse see Jay Anderson's eclipse weather website: <https://eclipsophile.com/hse2023/>

**As the Sun will be high in the sky, there are many possible viewing sites for the eclipse within the path of totality.**

**Totality will last longer the closer the observer is to the centerline, but sites away from the centerline will still be spectacular. Sites around the beach may be popular.**

**Locations in the Cape Range National Park may provide an interesting foreground for photographers.**

**Check closer to the eclipse date with local authorities for public viewing sites and for organised tours.**

### Travelling to Exmouth

Anyone planning to view totality should be aware of the relative remoteness of North West Cape.

By road, Exmouth is about 1,250 km from Perth, 3,200 km from Darwin and about 1,400 km from Broome. Apart from the last 220 km, access is via National Highway 1, a generally good 2 lane (one either direction) sealed road, with services spaced at irregular intervals.

If driving these distances, it is wise to be relatively self-sufficient carrying adequate food and water and allowing for contingencies.

Be prepared for traffic and congestion around the time of the eclipse



# 20-04 2023

## Acknowledgments

Some of the text in this factsheet was taken from previous ASA factsheets prepared by Dr Nick Lomb of Sydney Observatory and Martin George of the Launceston Planetarium.

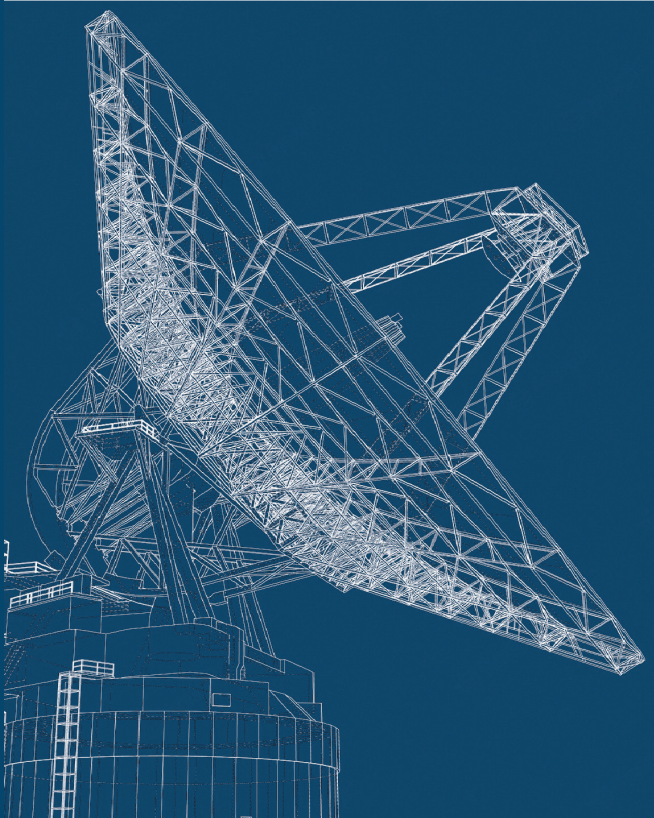
Information on safe eclipse viewing has drawn on information on the American Astronomical Society website <https://eclipse.aas.org/eye-safety>.

Further information is available on the ASA eclipse website:  
[eclipse.asa.astronomy.org.au](http://eclipse.asa.astronomy.org.au)

We acknowledge the assistance of the Centre of Excellence for Dark Matter  
<http://www.centredarkmatter.org>

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