



national science week 2020

Stars and Planets

Your night sky is full of wonderful things to see. Some require advanced instruments to give the photos at the NASA link below, but many do not. With just your eyes and some guidance you can see planets, many stars and constellations, nebulae, and nearby galaxies. And your phone can take good photos. There are also many volunteer astronomy groups across Australia who'd be delighted to help you navigate the sky and understand what you're seeing, and they're great for beginners.

Be prepared

Try this: Make a **red light** if you can. This allows you to move around safely in the dark, plus read charts for finding your way around the sky. Your eyes are fantastic instruments that adapt to darkness after several minutes by using their rod receptors, enabling you to see faint objects. But that ability is instantly lost if you try using any light other than red, because your rods become overwhelmed. If you own a red LED torch or flashlight, use it, otherwise you can wrap an ordinary torch in red plastic cellophane like used for wrapping presents or flowers, and hold it in place with a rubber band or tape. Make your phone's screen show only red light, using the link below. If this doesn't work for you, then wrap your phone in red cellophane. It only allows red light through.

Dress for your weather conditions that night and find somewhere safe outside to sit comfortably. It should be somewhere that hopefully doesn't have many bright lights that wash out your being able to see and appreciate the night sky. This stray light reaching your eyes might come from streetlights, houses and shops, cars, billboards, and other sources and is wasted energy. It contributes to *light pollution* that hinders observing but also interferes with the wellbeing of nocturnal wildlife.

Wait for 10 minutes as your eye sensitivity improves. Notice the stars **twinkling**. Imagine you're at the bottom of a swimming pool looking up at the ceiling. The water rippling above you causes what you see to be distorted and moving. Our atmosphere has the same effect on the stars and planets, making them twinkle.

See the different **colours** of the stars and their different **brightness**. Some are new hot blue stars; some are old red giant stars and others are yellow average stars like our Sun or might look white to your eye because they are dim. Some stars are bright due to giving off lots of light, but



A six hour time exposure of the night sky looking south from the Atacama Desert in Chile. The stars move clockwise in a 24-hour circle centred exactly south on the South Celestial Pole due to Earth's rotation. The same would be seen from Alice Springs which is at a very similar latitude. Credit: A.Duro ESO.



they also might just be very close to us. Dim stars might give off not much light, or they just might be a long way away. And some stars even change their brightness from night to night. Of all the stars you're seeing in the sky, they are all inside our home galaxy, the Milky Way. The imaginary patterns made by the stars in the sky are called **constellations**.

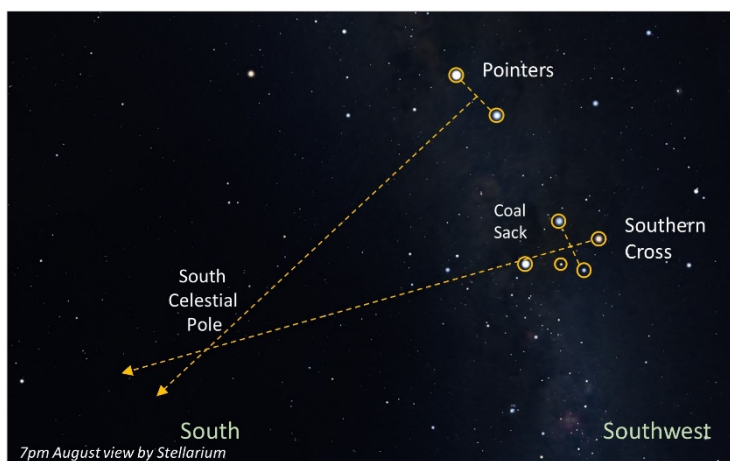
Let's gaze at the heavens

Try this: Face **south** using the chart closest to your town's latitude. East is over your left shoulder, and west is over your right shoulder. Find the smallest constellation in the sky; the **Southern Cross**. That's the kite-shaped one on the Australian flag. Like the hands of a giant clock, all the stars in the south rotate about a single imaginary point in the sky during the night, called the *South Celestial Pole*. Your phone's compass app will point south in that direction. It takes 24 hours to turn around once as the Earth turns in space. On an August evening, the kite looks like it fell over onto its right side so you might need to rest your head on your right shoulder to see it. There'll be two bright "pointer" stars above it, that point the way down to the Cross.

Do you see all five stars of the Southern Cross? Those with dark skies might see more. If you can't, then it might be due to local **light pollution**. Using the survey link below, estimate how good or bad your light pollution is by entering what the Cross looks like, and submit your answer online. There's a dark patch right next to the Cross, called the *Coal Sack*, and this nebula is an area where the stars are being blocked by thick dust and gas in space.

Now imagine drawing a line inside the Cross between the kite's top and bottom star, and then stretch that line out across the sky to the left and down until it's about seven Southern Crosses long. Do you see a small fuzzy patch? There's another bigger fuzzy one lower down to its right as well. These look like tiny clouds, but they don't move in the wind and are called the **Small and Large**

Magellanic clouds, named after Ferdinand Magellan who led a circumnavigation voyage in the 1500s. They are small galaxies near to the Milky Way.



To find south if ever lost, find the two bright pointer stars, Alpha and Beta Centauri. Draw an imaginary line in a T-shape from their middle across the sky. Find the Southern Cross. Extend an imaginary line from its long axis out across the sky. Where the two lines meet is very close to the *South Celestial Pole* and south is that direction on your horizon.

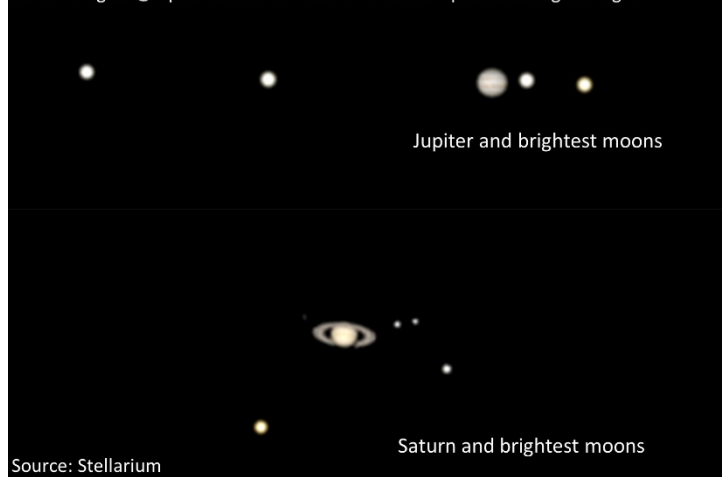
You'll see the milky appearance of our giant home galaxy stretching right across the sky to your left, forming the Indigenous constellation of an outstretched **Emu**. In spring months, those who live in northern parts of Australia, or have very dark north skies, might see our neighbour, the Andromeda galaxy, as a long fuzzy patch above that horizon. It's the furthest away thing (2.5 million light years) that you can see with your unaided eyes.

Try this: Face **north** using the chart closest to your town's latitude. West is over your left shoulder, and east is over your right shoulder. What looks like the brightest star in the sky to the northeast, and about two handspans above the horizon, is not a star but rather the mighty planet **Jupiter**. With binoculars or a telescope you'll see it as a white disc with dark markings. If you have very keen eyesight and a dark location, by eye alone you might see up to four tiny stars all in a line immediately



next to Jupiter. These aren't stars, but rather the largest moons of Jupiter; Io, Europa, Ganymede and Callisto.

View with a small telescope or big binoculars in the northeastern sky on 16th August @ 9pm. The moons orbit around their planet during the night.



Now look less than half a handspan down and to the right, towards east. By eye, you'll see a slightly yellow starlike object, being the planet **Saturn**. Binoculars show it as being oval-shaped due to its ring, and a telescope will show amazing detail.

Prop your phone up on the ground, so any hand movement doesn't ruin the picture, and try taking a photo of Jupiter and Saturn. Remember to switch your flash off and use the timer function. Photographing the night sky with a phone takes practice and generally requires special apps so as

temporarily to override factory settings that otherwise would stop manual focusing and time-lapses. Some links for this are below. If you already own binoculars or a telescope, try taking a photo later by holding your camera up to the eyepiece while looking at the Moon. The result can be stunning.

Now look left and upwards from Jupiter by half a handspan. This group of stars is **Sagittarius**, the Archer. It looks like a **teapot** that's fallen over and is standing on its handle. It's a few times bigger than the Southern Cross. Near the spout of the teapot is the centre of the Milky Way with its supergiant black hole, but you won't see that.

Keep moving left and up until you're about 4-5 handspans above the horizon, looking right above your head to the highest point, called the *zenith*. Here, you see the stars of **Scorpius**, the **scorpion**. It does look like a scorpion and is about 1-2 handspans across. Notice the scorpion's curved tail on the right, with the bright red supergiant star, Antares, forming its heart, and with two pincers to the left in a T-shape.

Try this: See the **Earth rotate**. Pick any star over to the north and line it up so it seems to be just touching a background object, like a tree. Stay still for a few minutes and watch it slowly move away to the left of the tree. The star isn't really moving to the left (which is west), but rather Earth is turning in the opposite direction to the right (to the east) and so it gives us the illusion of the star having moved.

Try this: If you'd like to try printing your own **sky maps** to use for other times, dates, places, and other planets, try the free software in the links below. Or install one of the phone apps that let you point your phone at an object and it identifies it for you.

On rare occasions, a bright comet may be visible to the eye. It can look like a fuzzy new star or even have a tail. Comets can hang in the sky for weeks or months because they're far away in the Solar System with the planets, but most usually need binoculars or a telescope to see. A link for known comets is below. No bright ones are expected in our skies this year, though comets can surprise everyone.



Resources

Astronomy Picture of the Day: <https://apod.nasa.gov/apod/astropix.html> Click *Archive* for others.

Astronomy Groups & Observatories: www.astronomy.org.au/amateur/amateur-societies/australia/

Turn your phone screen red: www.blublox.com/blogs/news/how-to-turn-your-iphone-screen-red or www.support.google.com/pixelphone/answer/7169926?hl=en or www.youtube.com/watch?v=pbEOkPYNfXw

Light Pollution: www.australasiandarkskyalliance.org and www.globeatnight.org/webapp/ and www.darkskyvic.org

Global Light Pollution Monitoring Network: <https://tess.stars4all.eu/map/>

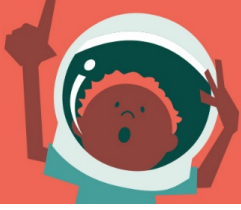
Astrophotography with your phone: www.skyatnightmagazine.com/astrophotography/astrophotography-tips/smartphone-astrophotography-use-your-phone-to-capture-the-night-sky/ and the *Smartphone Astronomy* Facebook group www.facebook.com/groups/610566305705250/

Useful apps: Skyview Lite, Sky Safari. You point your phone at an object in the sky and it identifies it.

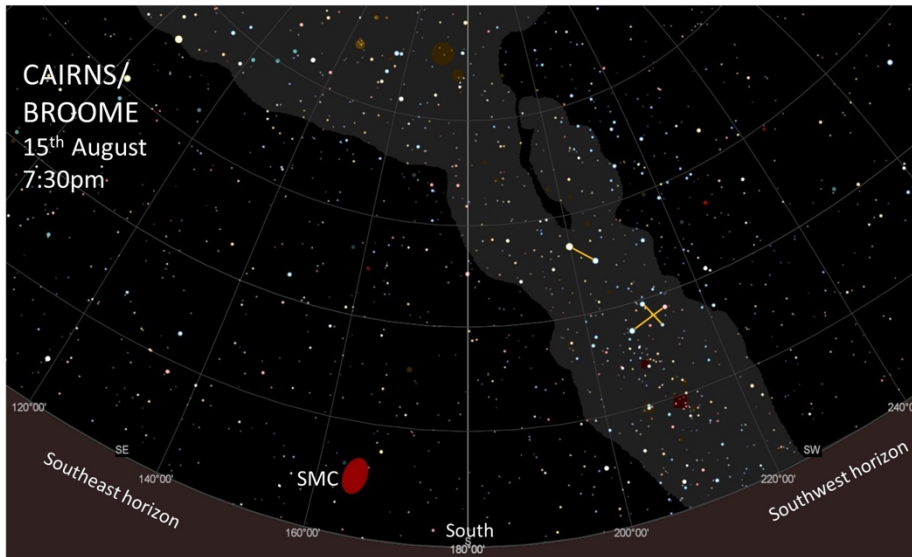
Sky charts online: www.in-the-sky.org/skymap.php and enter your town at top right or www.skyandtelescope.org/interactive-sky-chart/

Planetarium sky software: www.stellarium.org and www.celestia.space and www.ap-i.net/skychart//en/start (Cartes du Ciel)

Comet predictions: www.aerith.net/comet/future-s.html Only bright comets are seen by eye. Look for ones showing a Mag value of 4 or less. New comets sometimes appear unexpectedly.



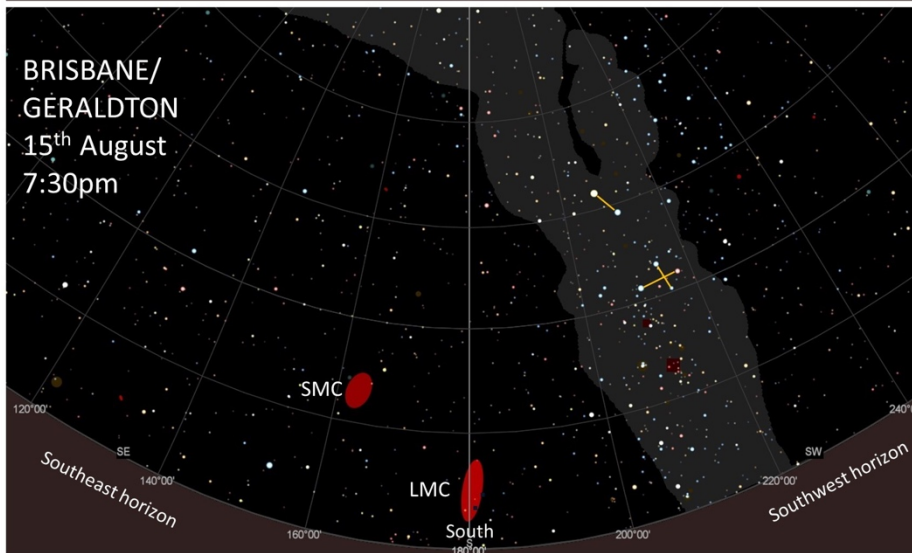
Sky Charts looking south



Each chart shows all stars visible to your eye in a dark location. You might see fewer if there's light pollution. The brighter the star, the bigger its white dot.

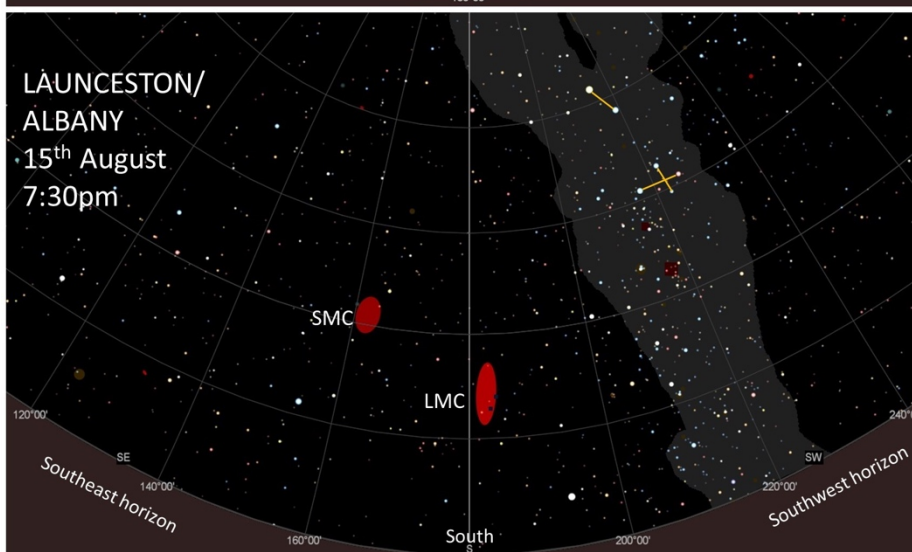
Use the chart closest to your town. To help choose, on a map of Australia hold a ruler horizontal to where you are.

Look south and hold your chart up in front of your face. Your phone app's compass bearings are marked on the horizon in degrees. South is 180 degrees. The horizon is drawn curved so as to fit it all on the page.



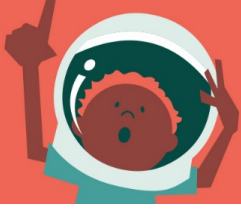
See the plane of the Milky Way arching from top left to bottom right in front of you. Midway between south and southwest, go up 2-3 handspans to find the Southern Cross, and above it the two bright pointer stars.

Find the two Magellanic Clouds. They're drawn as red ovals, but will look like a fuzzy little faint white cloud in the sky for you. If you're near Cairns, you won't see the Large one (LMC) because it already set below your horizon.

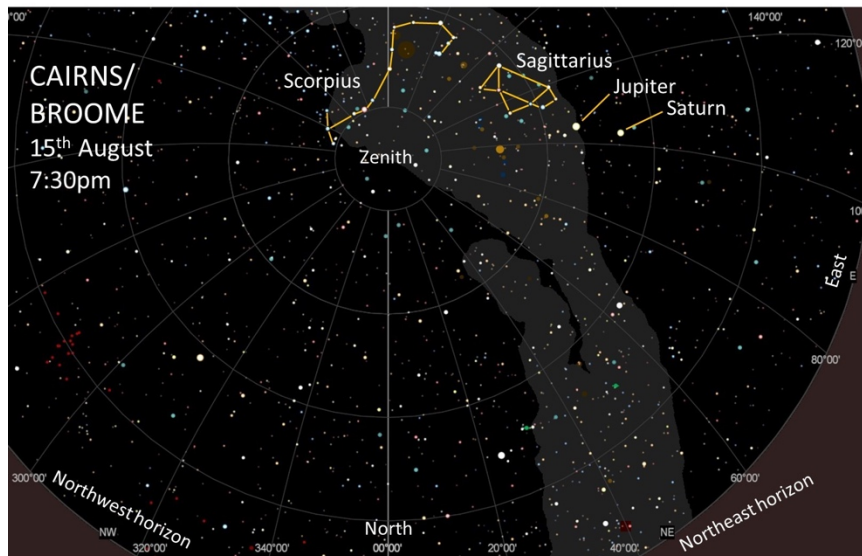


The sky will rotate slightly from night to night, and from hour to hour, but the charts are useful for all of August.

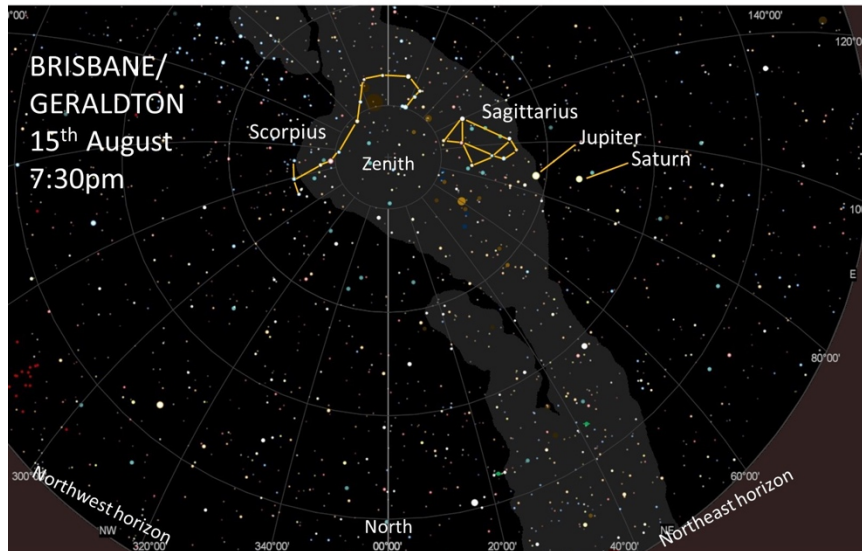
All charts are by Cartes du Ciel in the links.



Sky Charts looking north

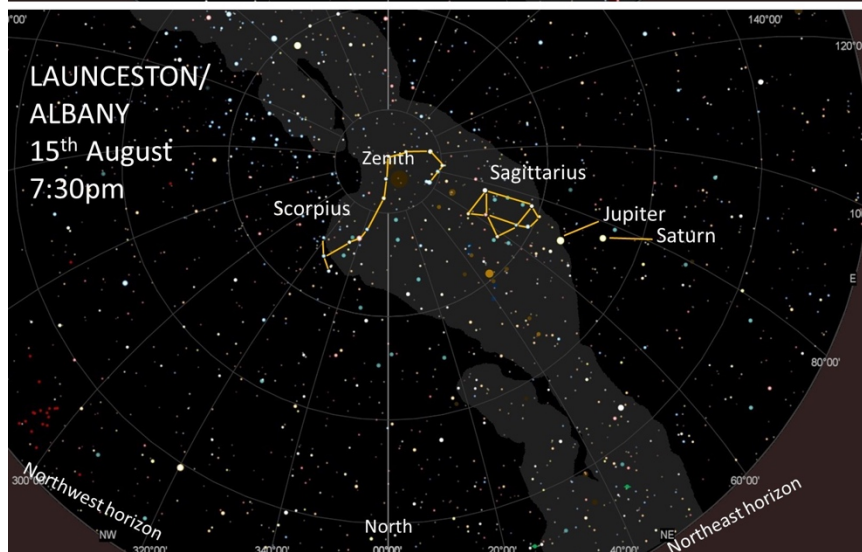


Look north and hold your chart up in front of your face and then lift it further above your head. The zenith is the point in the sky directly overhead for you. Point the chart's zenith at your real zenith. Your phone app's compass bearings are marked on the horizon in degrees. North is 0 degrees. The horizon is drawn curved so as to fit it all on the page.



See the plane of the Milky Way arching from in front of you to bottom right. The brightest starlike object you see is Jupiter, and a few finger widths to the right and down from it is a fainter Saturn.

Between Jupiter and your zenith is Sagittarius (an upside-down teapot shape) in the Milky Way. Nearby on the left is Scorpius (the scorpion).



The sky will rotate slightly from night to night, and from hour to hour, but the charts are useful during August, though the planets will move slowly against the background stars.

All charts are by Cartes du Ciel.

For those living far west in Australia, by 7:30pm your time once it's dark, the sky will have rotated clockwise only a small amount, and so all the north and south sky charts will still be useful.