What You Can See in the Night Sky Without a Telescope



Look Up

TONIGHT

Your Southern sky, starting tonight

White Star Outdoors

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In the Blue Mountains west of Sydney, a church minister spent his clear nights doing something nobody else on Earth has matched.

He found exploding stars. A supernova is a star that blows itself apart, and for a few weeks it can outshine its whole galaxy. He spotted 42 of them by eye, more than anyone in history who has hunted them that way.

He didn't have a big observatory, and where he lived only about a quarter of the nights were clear.

So how did one man on a mountain beat the world?

He did it with memory.

He learnt what more than a thousand galaxies were supposed to look like, then visited them one after another, taking a few seconds to find each one and ten or twenty seconds to look.

When something new was sitting there, he knew, because he knew that sky the way you know your own kitchen.

His father was a botanist who could name a thousand plants around Sydney. Neither of them was born with that gift.

They both built it the same way, by looking again and again.

You can start building that same skill tonight, using nothing but your own eyes.

Think about the last time you stepped outside, glanced up and saw a sprinkle of stars and not much else.

Now picture yourself on a cold, clear night with the Milky Way pouring overhead, pointing out the Southern Cross to someone you love, then turning just in time to watch the space station sail over, right when you said it would.

I wrote this guide for the person who wants that night, starting tonight, without buying a thing.

I believe your eyes are the best telescope you'll own for your first few months.

Most people rush out and buy one, then point it at a sky they can't find their way around.

I believe twenty minutes of sitting still in the dark shows you more than a bigger mirror ever will.

And I believe the best night sky in Australia comes in winter, on the coldest nights, while most people are indoors with the heater on.

The payoff is bigger than people expect.

Give your eyes the full time in the dark and some observers find they become 20 to 40 times more sensitive.

From a dark site you can see two whole galaxies beyond our own with no equipment at all, and the nearer one is 163,000 light-years away.

And across the Tasman, a whole country sets a public holiday by the winter rising of one small cluster of stars you're about to learn to find.

Inside you'll find out:

- How to make the sky at minute 25 look nothing like the sky at minute 2
- How to tell a planet from a star in seconds, with no app at all
- How to find the Southern Cross from a city backyard and use it to find south
- How to count the stars in a tiny cluster and test your eyesight at the same time
- Which week each month the Milky Way is waiting for you, and why winter shows it best

- How to be outside at the exact minute the space station glides over
- When binoculars or a telescope are worth the money, and the mistakes that waste it

You don’t need to learn the whole sky.

Learn four shapes well and you’ll know your way around better than plenty of people who own a telescope.

By the last page you’ll be able to walk outside, look up, and know what you’re looking at.

The minister on the mountain knew his sky like his own kitchen. Let’s start getting you to know yours.



Your Eyes Are the Best First Instrument You'll Own

The best observers in the world still train their eyes.

One of the sharpest-eyed amateurs alive spotted dark spokes in Saturn's rings before a spacecraft ever photographed them.

Later he set other stargazers a challenge: find three galaxies with no equipment at all, using only a trained eye and a dark sky.

He was showing how far the naked eye really goes, and it goes a long way.

Under a truly dark sky your eyes pick up so much that the sky isn't even black.

It glows a soft dark grey, lit by the air itself and by starlight bouncing around in the atmosphere.

> **All you need is your eyes. You don't need fancy equipment.**
> An Australian amateur astronomer

Your eyes do change as you get older, and it helps to know how.

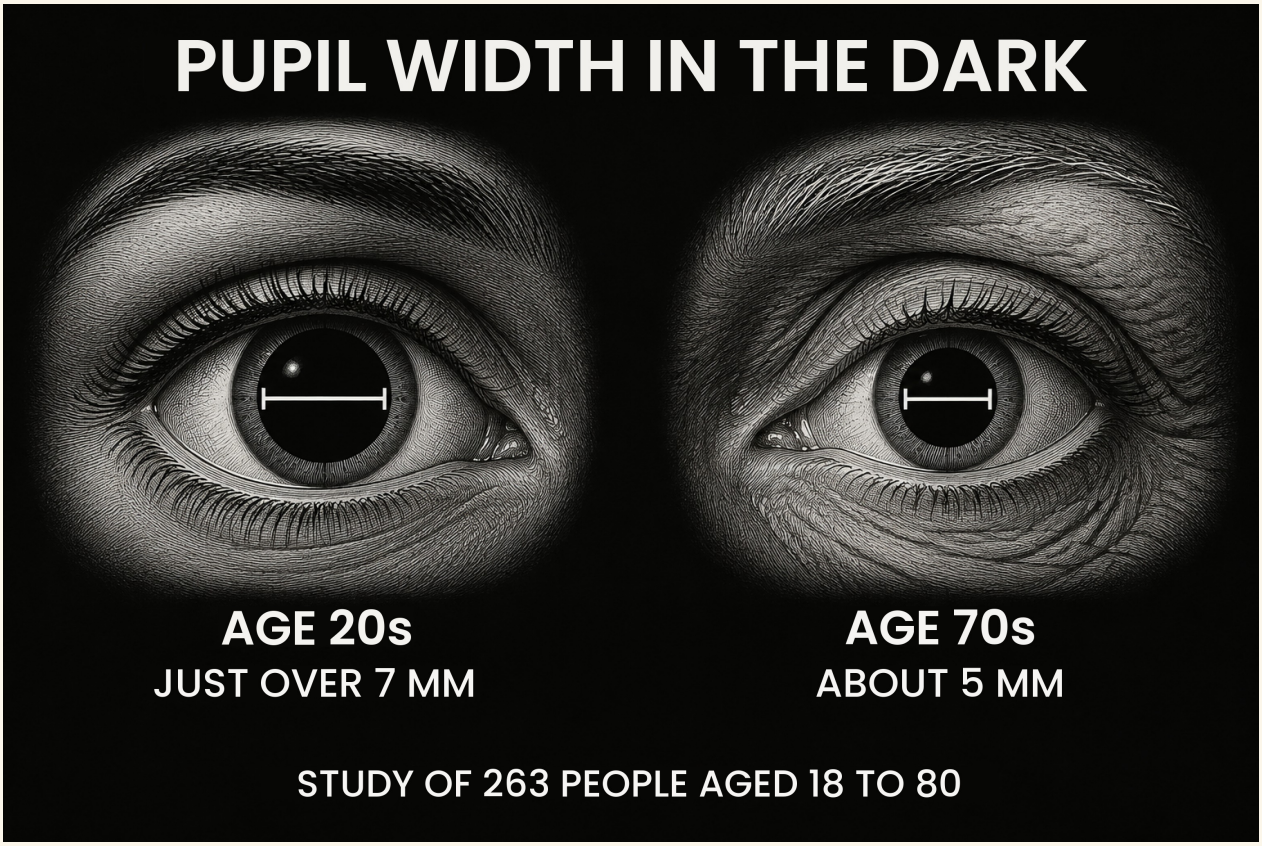
The black dot in the middle of your eye, the pupil, opens wider in the dark to let in more light.

A study of 263 people aged 18 to 80 measured how wide their pupils opened in the dark.

People in their twenties averaged a little over 7 millimetres, and people in their seventies averaged about 5.

So if you remember seeing far more stars as a kid, you're right, and part of that is your own eyes.

That's why the dark habits below matter more every year, because they help you get every bit of light out of the eyes you have.



Give Your Eyes 20 Minutes:

The Red Control Room

The back of your eye has two kinds of light catchers.

Cones sit in the middle and handle colour and fine detail, but they need plenty of light.

Rods sit around the edges and only see in black and white, but they keep working in near darkness, and they're what you stargaze with.

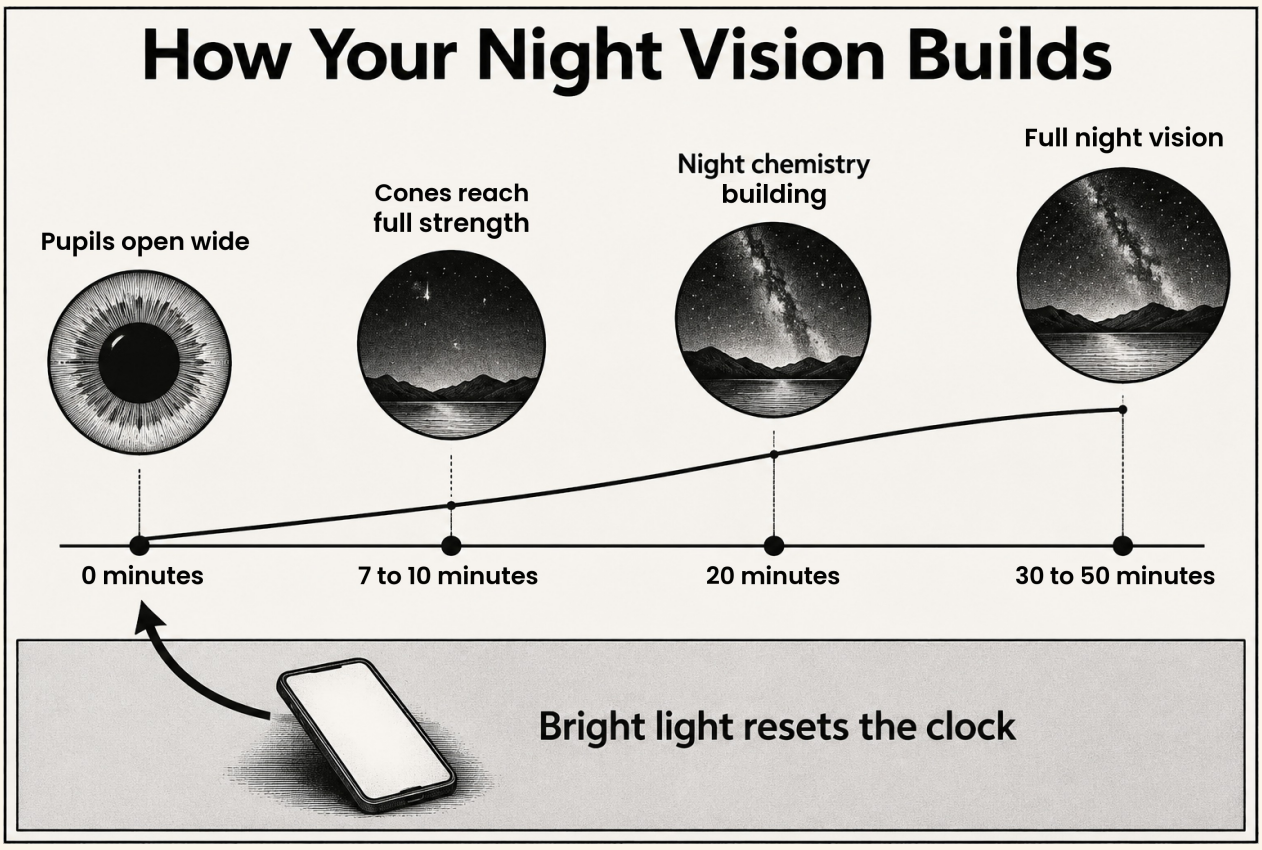
Rods run on a chemical called rhodopsin, sometimes called visual purple. Your body doesn't make it in daylight.

Once you're in very dim light it starts building, and it takes about 20 to 40 minutes to get most of the benefit.

Your pupils open wide within a few minutes, so the real wait is for the chemical.

A few seconds of bright light wipes out that chemical, so your eyes have to start the 20 to 40 minute wait all over again.

Your phone screen, the light inside the car or one passing pair of headlights is enough to do it.



Your eyes keep getting better for the best part of an hour, as long as nothing bright gets in the way.

Submarine crews have dealt with this for a long time.

Before night work at the periscope, they switch the control room to dim red light so their eyes stay ready for the dark outside.

The Red Control Room is that same idea for your backyard or a car park, a short set of rules you follow from the moment you step outside.

How to start

1. Cover a small torch with red cellophane and a rubber band, or paint the lens with red nail polish. Keep it dim, because even red light can get bright enough to undo the work.
2. Leave your phone in the car, or switch it to airplane mode with the screen turned right down and keep it in your pocket.
3. Pick a spot facing away from the road, and turn your back on any headlights.
4. Sit down and do nothing for 20 minutes. If you're after something faint like the Milky Way, give it 30 to 50.
5. You'll know it's working when stars keep appearing in patches of sky that looked empty when you first sat down.

Some observers find their eyes become 20 to 40 times more sensitive after that wait in the dark.

That makes **The Red Control Room** the biggest free upgrade in the whole hobby, and it's why the sky at minute 25 looks nothing like the sky at minute 2.

Once your eyes are ready, use the edges of them.

Because the rods sit around the outside, faint things show up best when you look slightly to one side of them.

This is called **averted vision**. Stare straight at a faint smudge and it fades away, but look a little beside it and it comes back.

Look beside, and keep moving Let your gaze drift gently around a faint object instead of fixing on it. Squinting and staring harder both fail for the same reason: they aim the colour cones at something only your rods can see.



The Moon:

Why It Looks Huge on the Horizon and Why It Turns Orange

Start each night with the brightest thing up there, then work your way down to the faint stuff. Very often that's the Moon.

With your eyes alone you can see the shape of its phase, the sharp bright edge, and the dark grey patches that make the face.

Astronomers call those patches maria, which is Latin for seas.

Now for the best trick the Moon plays.

When it rises huge and golden over the horizon, it's actually slightly smaller than when it's high overhead.

That's because when it's overhead you're standing on the side of the Earth closest to it, so at the horizon it's about 1.5% farther away.

You can prove it yourself. Hold a pea at arm's length as the Moon rises and it will just cover it. Do the same when the Moon is high up and the pea still covers it.

The giant Moon happens in your head, a trick your brain plays that has fascinated people for more than 2,000 years.



A pea at arm's length covers the Moon whether it's sitting on the rooftops or high overhead.

The orange colour is real, though. Low in the sky, the Moon's light passes through far more air on its way to you.

That air scatters away the blue and leaves the warm colours behind, and dust in the air deepens it further.

Love the Moon, but know it's also the biggest light in your sky. For a few nights around full Moon it washes out everything faint.

The full Moon is the best night for the Moon and the worst night for almost everything else, so save your Milky Way trip for the week when it's out of the way.

> **Shrink the giant Moon** Look at a big rising Moon through a rolled-up paper tube, or bend over and look at it upside down between your legs. Either way it suddenly looks its normal size.

Planets Don’t Twinkle:
Your Free Planet Detector

A star is so far away that its light reaches you as one thin thread.

On the way down it passes through moving pockets of warm and cool air, and each pocket bends it a little, so the star jiggles and flickers.

That’s twinkling.

A planet is much closer, so it shows up as a tiny disc, too small to see as a disc but big enough to matter.

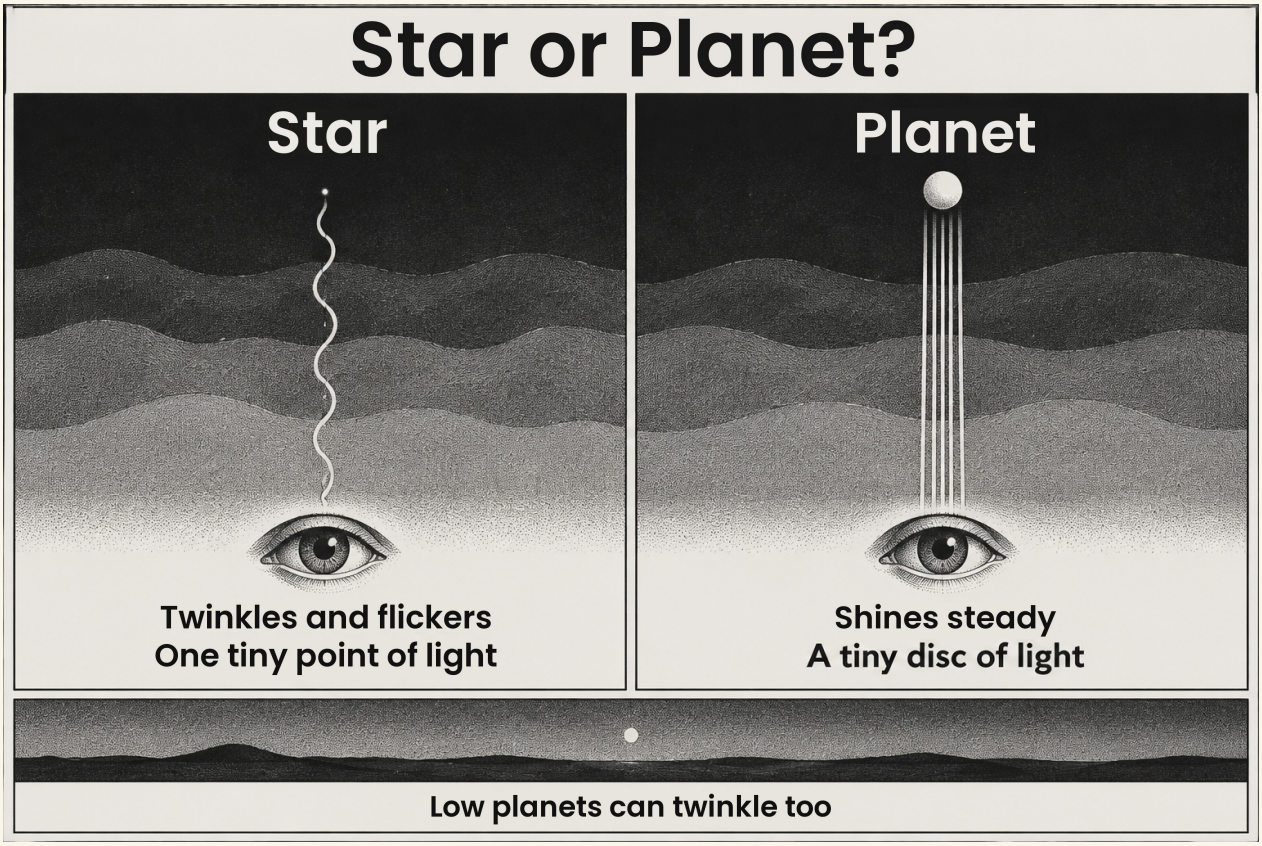
Every part of that disc sends its own thread of light through a different patch of air.

The flickers cancel each other out, and the planet shines steady.

So a bright light that holds steady is almost always a planet. Venus and Jupiter are the brightest and steadiest of all.

Saturn is usually steady, and Mars holds steady when it’s bright.

A planet sitting very low can still twinkle, because its light crosses a long, rough stretch of air to reach you.



Watch any bright dot for half a minute and the twinkle test will tell you which one you've got.

The same moving air can make a bright star like Sirius flash different colours when it sits low, which is a beautiful thing to watch in its own right.

A planet won't do that.

Which planets are up changes from month to month, so once your eyes have found a steady light, let a free sky app tell you its name.

Put in your location, hold your phone up, and it shows what's in that part of the sky.

As one Australian amateur put it, you don't need a fancy paper map any more.

How to start

1. Soon after dark, find the three or four brightest dots in the sky.

2. Watch each one for about half a minute. The one that shines steady while the others flicker is your planet.
3. Open a free sky app, point it at that spot and read the name. Then put the phone away so your night vision stays put.
4. Hold your fist out at arm's length. One fist is roughly 10 degrees of sky, so count how many fists up from the horizon it sits and you'll find it again tomorrow.

Four Shapes to Learn First:
The Southern Cross, Orion and Scorpius

The minister on the mountain didn't learn the whole sky at once.

He learnt exactly what each galaxy should look like, so anything odd stood out. Do the same with a handful of star patterns.

Learn them so well you'd notice if one was out of place, and the rest of the sky starts to fall into order around them.

Start with the Southern Cross. Its four main stars are bright enough to pick out from a city backyard.

From around Melbourne's latitude and further south, including all of New Zealand, it never sets, so it's up somewhere in the southern sky every night of the year.

Right beside it shine two bright stars called the Pointers.

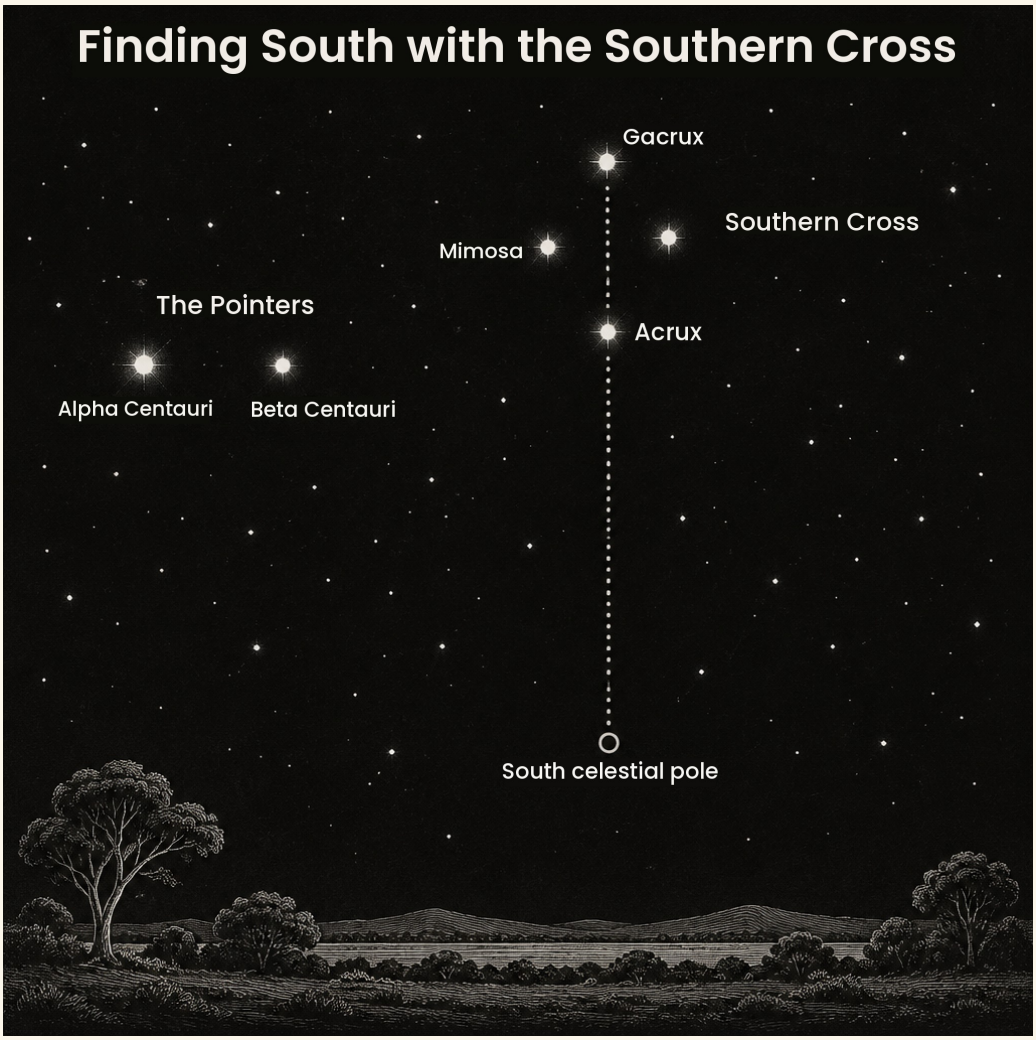
The brighter one is Alpha Centauri, the third-brightest star in the night sky and the closest star system to us after the Sun.

The other is Beta Centauri.

A line through the two of them points straight at the Cross, so when you find the Pointers, you know you've found the real Southern Cross.

The Cross also finds south for you. Draw a line from Gacrux, the star at the top, down through Acrux at the bottom, and keep going. It leads to the south celestial pole, the point the whole southern sky turns around.

We have no bright pole star down here, so the Cross does that job. In the Northern Hemisphere the Pole Star does it instead.



Follow the long arm of the Cross downward and you're looking toward true south.

On early winter evenings the Cross lies on its side close to the southern horizon.

If you ever pick up a pair of binoculars, look just beside Mimosa for a small, glittering cluster called the Jewel Box.

On spring and summer evenings, look for Orion.

From Australia and New Zealand it appears upside down, with the three stars of the belt sitting above the sword.

In the Northern Hemisphere it stands the right way up, which is how it's drawn in most books.

In winter, Scorpius climbs high.

It really does look like a scorpion, with a bright red star called Antares at its heart and a long tail curling around at one end.

The thickest, brightest part of the Milky Way runs right past that tail, through Sagittarius, which brings us to the biggest sight of all.

> **Learn a few cold** The Cross with its Pointers, Orion, Scorpius and the Pleiades, plus the band of the Milky Way, will carry you through your whole first year. A few shapes you know by heart will show you more than forty you half remember.

The Pleiades:

Six or Seven Stars in a Soft Huddle

The Pleiades are a tight little family of stars that look like a slightly fuzzy huddle of six or seven points.

That soft glow around them is real. It's starlight lighting up the dust floating near the stars.

They also make a lovely eyesight test. Most people can count six stars, and people with sharp eyes count more.

Use **averted vision** here: look just to the side of the cluster and let the extra stars slip into view, then count again.

Down here they're a spring and summer sight.

In late October they rise in the east during the evening and climb higher as the night goes on.

By November and December they're up all night.

Books written for the north call them an autumn and winter sight, because their seasons are the other way round from ours.

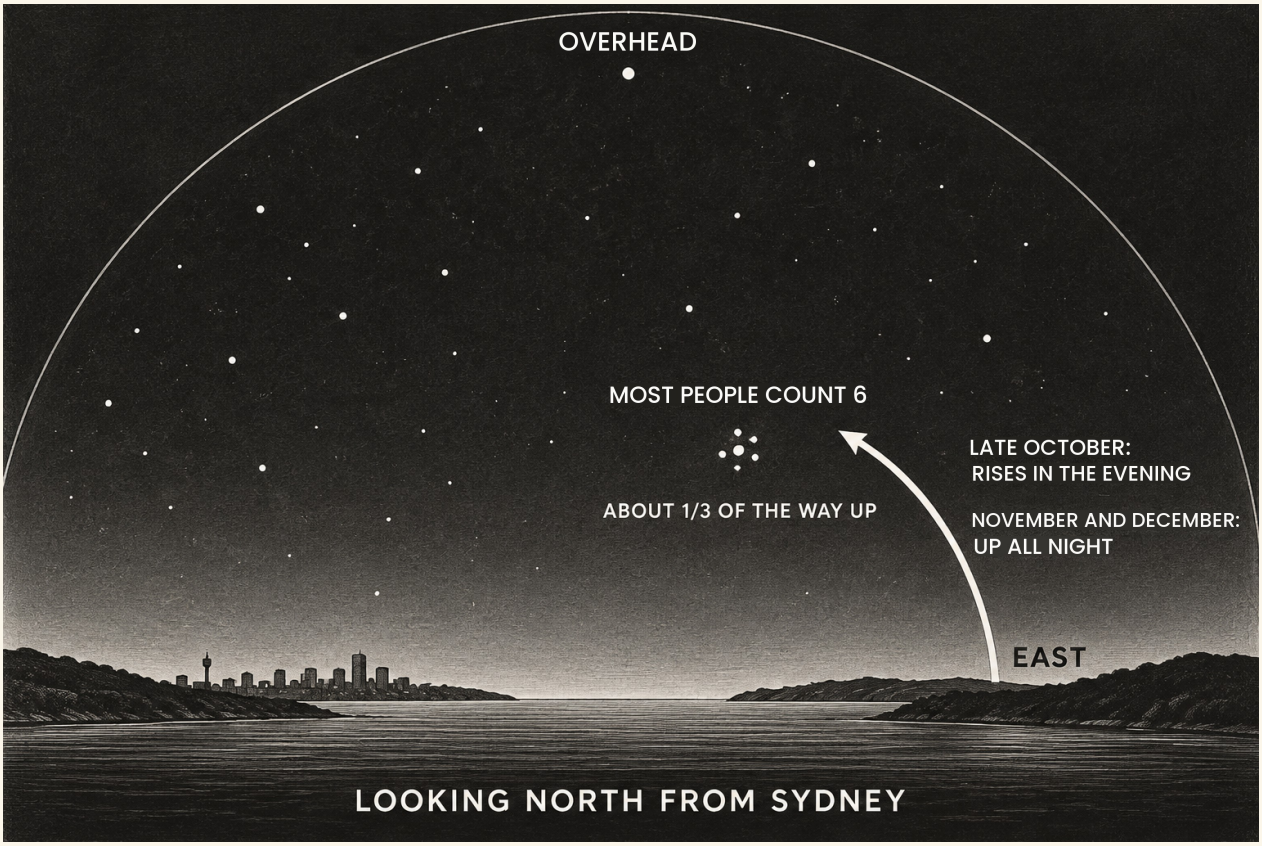
Look for them in the northern sky. From Sydney they only climb about a third of the way up and never pass overhead.

So expect a small, delicate cluster, much softer than the bright photos you may have seen, because those photos soak up light for a long time.

In Aotearoa New Zealand the Pleiades are Matariki.

When they reappear in the winter dawn sky, it marks the Māori New Year, and it's now a national public holiday, next falling on 25 June 2027.

A whole country sets a holiday by one cluster of stars, which tells you how much people who read this sky first knew from their eyes alone.



The Milky Way:

Why Winter Shows You the Heart of the Galaxy

From a dark site the Milky Way is a hazy, uneven band of pale light arching right across the sky.

It's made of countless stars too faint for your eye to pull apart, so they blend into one soft glow, like spilt milk.

The photographs you've seen soak up light for many seconds, so they show colours your eyes won't.

What you get instead is the real thing, huge and right over your head, and near the centre of the galaxy the band grows several times wider.

Winter is the season for it. Our galaxy is shaped like a flat pancake.

On winter evenings we're looking straight into its crowded middle, and in summer we're looking out toward the thin edge.

Cold winter air also holds less water, so the sky is clearer.

The coldest nights of the year are the clearest, and that's the reward for rugging up.

The Milky Way needs three things from you.

Pick one of the five nights around new Moon, when the Moon is out of the sky, and head somewhere properly dark.

Then give it the full **Red Control Room** treatment, at least 30 minutes with no screens.

The people who miss it nearly always arrive after the Moon has risen, check their phones, or look up after only a few minutes.

A properly dark spot is often closer than you think.

The Palm Beach headland, about 30 km north of Sydney's city centre, has been recognised as a dark sky place.

Australia also has the River Murray International Dark Sky Reserve, and New Zealand has the Aoraki Mackenzie reserve around Lake Tekapo, one of the largest in the world.

Even close to home, hiding from a single streetlight behind a hedge or a hill can matter as much as the distance from town.



The Emu in the Sky is made of the dark lanes, so it only appears once your eyes have had time to settle.

Look closely at those dark lanes.

Aboriginal Australians saw an emu in them, the Emu in the Sky, with its head near the Southern Cross and its neck and body stretching through Scorpius.

It’s a constellation made of darkness instead of stars.

> **It is a hugely vast constellation, and one that completely changes our understanding of what a constellation is, because it’s not made of stars… Once you see it, you can’t unsee it.**
> A Wiradjuri astrophysicist

While you’re there, look above the southern horizon for two small, faint clouds that never drift.

They’re the Large and Small Magellanic Clouds, whole separate galaxies, and you can only see them from the Southern Hemisphere.

Every dark night you get under them is a gift worth using.

Shooting Stars and Satellites:
The Hour After Sundown

The International Space Station is the brightest thing in the night sky after the Sun and the Moon when it’s at its best, brighter even than Venus.

It shows up as a very bright, steady dot gliding across the sky in a few minutes.

It doesn’t blink, it makes no sound, and partway across it often fades away and is gone.

The Hour After Sundown is when you catch it. The station has no lights bright enough to see, so you only see it when sunlight is bouncing off it. That happens when it’s still up in the sunshine while you’re standing in the Earth’s shadow, which means the hour or two after sunset, while the sky is still a little blue. Plenty of beginners stay inside thinking it isn’t dark enough yet, and that’s exactly when the station sails over.

It also explains the fade. Partway across, the station flies into the Earth’s shadow, the sunlight switches off, and it disappears right in front of you.

How to start

1. Look up the free Spot the Station website for your town. It gives the time, the direction it appears from, and how high it climbs, where 90 degrees means straight overhead.
2. Pick a pass in the hour or two after sunset and be outside a few minutes early, facing the direction it comes from.
3. Watch for a bright, steady dot that moves smoothly across the sky without blinking.
4. You'll know it's the station when it outshines every star and fades out partway across.

From almost anywhere in Australia and New Zealand you'll get a pass at least once a month, and sometimes several times a week.

In summer, satellites stay visible longer into the evening because the sky overhead stays sunlit for longer.

In the day or so after a Starlink launch, watch for a string of dots following one another across the sky like a train, spreading apart a little more each night.

Telling things apart is easy once you know the signs. A satellite is steady, silent and moves in a straight line.

A plane has blinking red, green and white lights, may turn or change height, and you can often hear it.

A shooting star is a flash and gone, a streak that lasts a second or less.



Two seconds of watching is usually enough to tell which one just crossed your sky.

On an ordinary dark night you'll catch a few shooting stars an hour, and many more during a meteor shower, when they all seem to fly out from one patch of the sky.

Lie back on a reclining chair, take in as much sky as you can, and let your eyes wander.

Your First-Night Checklist

Tick these off and your first night will look nothing like the last time you glanced up.

- Check the cloud forecast for the hours you'll be outside. Under 20% cloud is a good night, and anything near half cloud is a gamble.

- ☐ Check the Moon. For faint things like the Milky Way, pick a night when it's not up.
- ☐ Open a free sky app with your location to see what's up tonight, then put it away.
- ☐ Pack a dim red torch, a folding chair and a warm layer, because the clearest nights are the cold ones.
- ☐ Arrive before it's fully dark and get set up while you can still see.
- ☐ Leave your phone in the car or switch it to airplane mode.
- ☐ Sit for 20 minutes and let The Red Control Room do its work.
- ☐ Start with the brightest thing in the sky, then move on to fainter ones.
- ☐ Run the twinkle test on the brightest dots to find a planet.
- ☐ Find the Southern Cross and the Pointers, then Orion or Scorpius depending on the season.
- ☐ Count the Pleiades if it's spring or summer.
- ☐ Check Spot the Station and be outside for any pass in The Hour After Sundown.

> **Clear isn't always clear** A night with no cloud can still be hazy, and haze dims the faint stars just as badly. If the stars near the horizon look washed out at dusk, spend that night on the Moon and planets and save the Milky Way for a crisper one.

What Binoculars and a Telescope Add, and When It's Worth It

Give your eyes a few weeks first.

Once you know the Cross, Orion and Scorpius by heart, extra light suddenly pays off, because you know exactly where to point it.

Binoculars are the natural next step.

A pair marked 10x50 shows you craters along the edge of the Moon's shadow, Jupiter as a tiny disc with its four biggest moons lined up beside it like pinpricks, and the Pleiades filling with stars.

The Orion Nebula shows a faint green tint, which is the only colour most people ever see in a nebula.

Binoculars are light enough to hold steady, and they keep the sky looking darker in a city.

Pairs marked 7x50 let in extra light, but older eyes can't open wide enough to use all of it.

Then there's the moment that hooks people for life.

Saturn's rings can't be seen with the naked eye at all, but even a small telescope shows them, sharp and unmistakable.

Plenty of lifelong stargazers trace their whole hobby back to that first look at the rings.

> **The first time I found Saturn, I was in my backyard with a second-hand telescope and a cup of coffee going cold on the table beside me. The rings were right there in the eyepiece. Small, and sharp, and unmistakably real. I stayed out far longer than I meant to.**
>
> Warren, White Star Outdoors

What makes a telescope good is how much light it collects, and that comes from the width of its main mirror or lens.

Our buying guide puts an 8-inch telescope at roughly 800 times the light your dark-adapted eye takes in.

The big number on the front of the box, like 600x, is magnification, and it's the least useful number there.

The money gets wasted in four ways:

- Buying on that big magnification number instead of on the size of the mirror or lens.
- Putting a good telescope on a shaky stand, so everything wobbles every time you touch it.
- Picking a bargain box that leaves out a finder and decent eyepieces.
- Buying more telescope than you can carry, so it stays in the cupboard.

Go in knowing what you'll see.

The Moon, Jupiter and Saturn deliver beautifully through any decent telescope, and most other things look like soft grey smudges, because the human eye can't pick up their colour in dim light.

From the city, the Moon, the planets and the bright clusters cut straight through, and the faint galaxies are waiting for your darker trips.

So start tonight with what you already have.

Sit in the dark, count the Pleiades, find south from the Cross and wave at the space station as it fades.

Give it a season and you'll know your sky the way the minister on the mountain knew his, like the inside of your own kitchen.

And when you're ready for the rings, they'll be right there waiting.



See Saturn’s rings from your own backyard

You know the Moon, the planets and the Cross now. Picture Saturn in the eyepiece, small and sharp, with its rings right there.

High Point Scientific sells the telescopes our buying guide recommends, from ones you aim by hand to ones that point themselves.

- The Apertura AD8 is an 8-inch telescope that collects roughly 800 times the light your dark-adapted eye takes in, so the clusters you’ve learned fill up with stars.
- The AD8 comes with eyepieces and a finder and needs no power or batteries, so you carry it out in two trips and start looking.
- The 6-inch Apertura AD6 is about 10 pounds lighter and still shows the Moon, Saturn’s rings and Jupiter’s moons, which suits you if you’ll carry it often.
- If you’d rather the telescope find things for you, the computerised Celestron NexStar 5SE points itself after a short setup each night.

The sky you’ve learned tonight is the same sky your telescope will show you, only much closer.

Choose your first telescope

I may earn a commission if you buy through this link, at no extra cost to you.

If this got you looking up, follow along for more simple, beautiful things to find in the Southern sky.

- **Instagram** instagram.com/whitestaroutdoors/
- **whitestaroutdoors.com/**
- **Facebook** facebook.com/whitestaroutdoors/

Sources

1. Study of dark-adapted pupil diameter by age, 2011. Measured 263 people aged 18 to 80; mean pupil size fell from 7.33 mm at ages 20–29 to 5.17 mm at ages 70–79.