



# national science week 2020

## Satellites and Shooting Stars

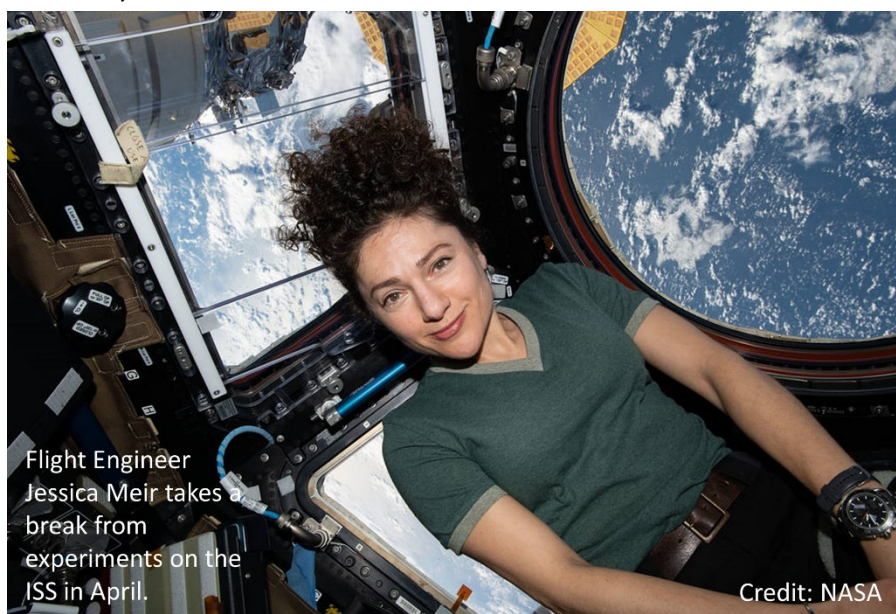
Most things you see in the sky are far away from Earth, but some are a lot closer than you think.

### Look out, it's behind you

**Try this:** Everyone enjoys a lovely colourful sunset or sunrise. As the last tip of the setting Sun disappears over your west horizon and the colours fade from any clouds, flip yourself around and look east in the exact opposite direction. Over the coming minutes, record a video of how the eastern sky turns grey or purple above the horizon, and starts to darken and rise in the sky. This is **Earth's shadow**. As the Sun sets for you, it casts Earth's shadow into space in the opposite direction. See how it rises as quickly as the Sun went down. As the light level drops and twilight sets in, the shadow soon becomes indistinguishable from the night sky. The reverse sequence is seen leading up to Sunrise the next morning, where now the shadow in the western sky appears as dawn is breaking and drops towards the horizon as the Sun rises in the east.

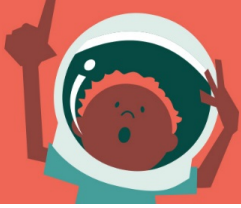
If the Moon happens to pass through Earth's shadow then a lunar eclipse is seen and may cause the Moon to become dimmer if it is near the outer edge of the shadow, or to turn a red-orange colour if deeply inside it. This gives rise to descriptions in the media like Blood Moon and Wolf Moon. But many objects far closer than the Moon pass through the shadow every night.

Over many decades, humans have launched thousands of objects into orbit; sometimes intentionally, sometimes not. Some are in high orbits and will stay there for centuries, but others are in low orbit and prone to fall back to Earth if not given an occasional boost. Most are large satellites used for communications, global positioning, remote sensing, Earth exploration, astronomy, and science research and, of course, spying. And now many smaller ones are being launched for internet expansion. A handful have been very large habitable craft like the *International Space Station (ISS)* which is permanently crewed.



Flight Engineer Jessica Meir takes a break from experiments on the ISS in April.

Credit: NASA

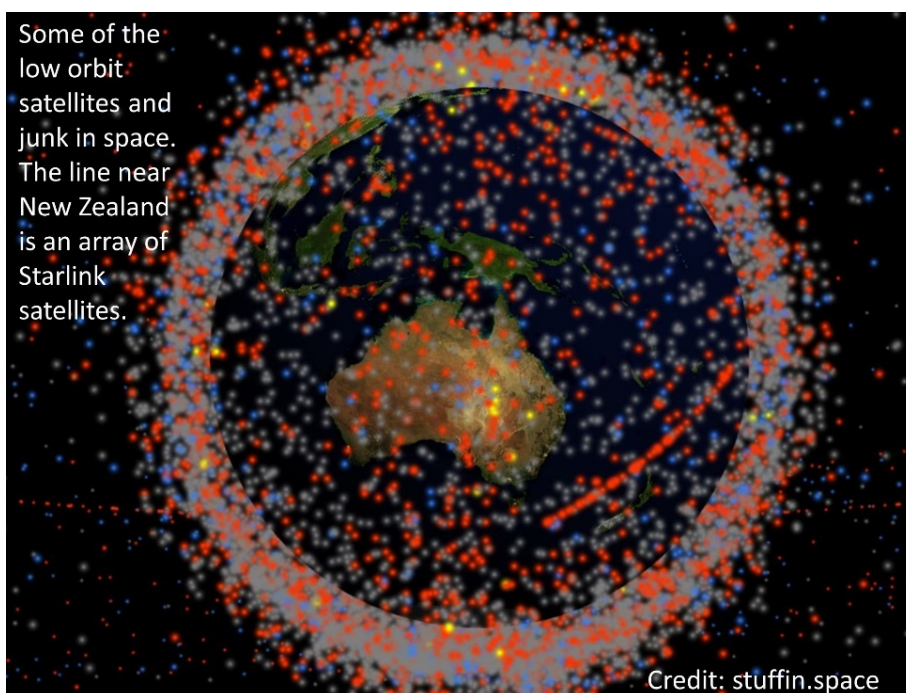


To stay up, low orbit satellites must travel so quickly that they go once around the world every 90 minutes or so, and skim along just the length of Tasmania above Earth's surface, so not far away. They reflect sunlight like a mirror, and from the ground you see them because of this reflection

## It's crowded up there

**Try this:** When the sky has darkened a bit, see if you can spot what looks like slowly moving stars that are visible for a few minutes. They can come from any direction and move in any direction. If you hear one, see coloured flashing lights on it, or it changes direction suddenly, then you've spotted an aircraft, a bird or Superman. Keep watching it and you'll see it right down to the horizon or until it lands. But, if you find one that's silent and disappears in mid-air before reaching the horizon, then you've found a **satellite**. Once a satellite ducks into Earth's shadow, there's no light to reflect to your eyes and it disappears for you. To confirm, keep watching for it to fade and become invisible mid-air.

You can identify the satellite (even secret ones) by noting the time and going to the prediction link below and entering your town. This site provides reliable satellite predictions up to 10 days ahead for your backyard, telling you when to go outside and in what direction and elevation to look.



The ISS can be brighter than the brightest star, is as big as a soccer pitch, and has been known to cause UFO reports. Through a good telescope it looks H-shaped, but by eye alone you won't see detail and it moves so fast that it'd cross the Moon in two seconds. Other favourites are the *Hubble Space Telescope* and more recently the *Starlink* launches containing many dozens of satellites all strung together in a row like pearls in the sky.

Some satellites fly in formation in triangular shapes, or in a line, or flash at you as they spin like a rifle bullet or tumble out of control, but most visible satellites just look like an ordinary star slowly moving. Some are short-lived in orbit, like rocket boosters left over from a launch, or a spacecraft that is taking crew to or from the ISS.





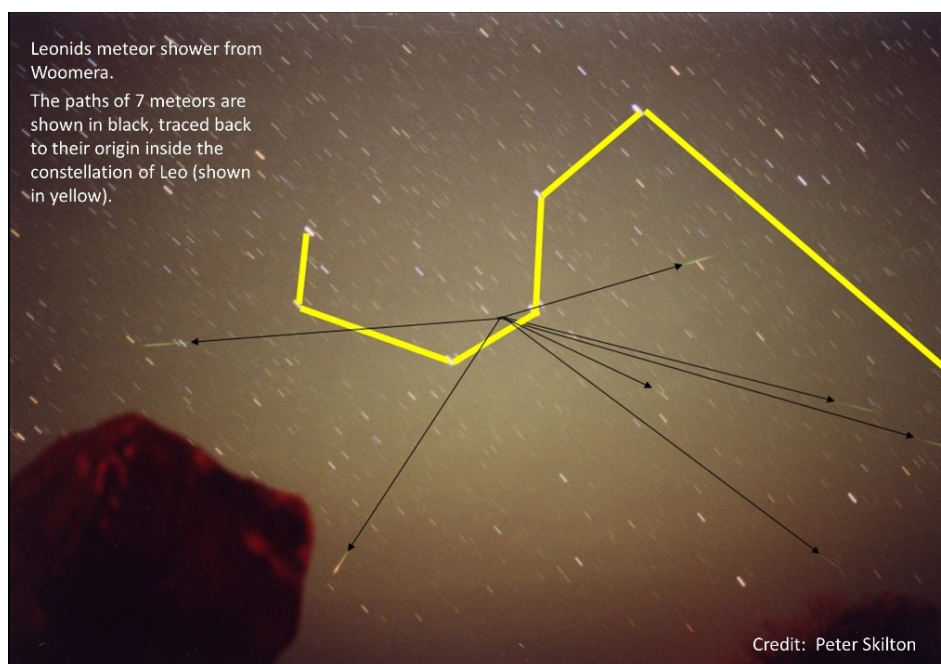
Sadly, there are many tens of thousands of pieces of space junk up there, left over from launches, dead satellites, accidents, and collisions and each must be tracked, no matter how small, because they all pose a collision threat. And every collision makes even more junk!

**Try this:** See live what the ISS astronauts are currently seeing with their orbiting **webcam** at the link.

## Shooting stars

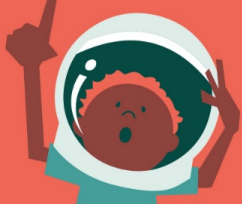
We've all seen *shooting stars*, or more correctly called *meteors*. They're made mostly of metal and rock from asteroid debris, old comet tails and primordial stuff from the Solar System's birth. They aren't stars at all, but to ancient sky watchers they would've looked like a star falling from the heavens.

When these bits of rubble are far away in the Solar System, they're called **meteoroids**. If they enter Earth's atmosphere, they're renamed to be **meteors** when they glow brightly with friction when they enter the atmosphere about 100 km above your head. If they're big enough to reach the ground without disintegrating, they're renamed again to be **meteorites**. It's all the same bit of debris though.



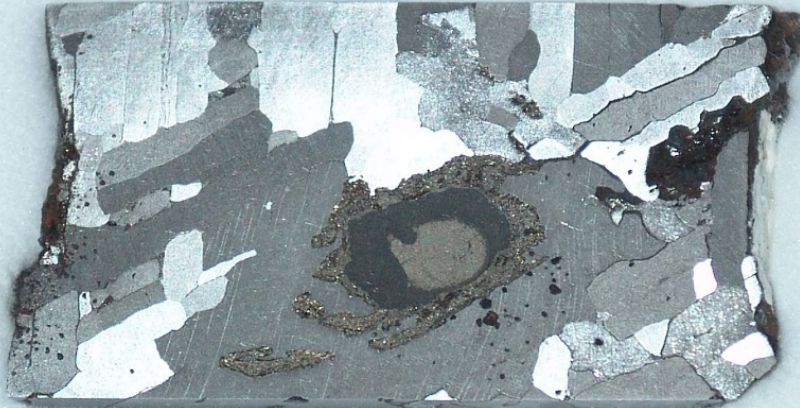
**Try this:** When dark, lie on your back outdoors on a lounge chair or bench somewhere safe. Watch all the sky for meteors. **Sporadic meteors** can occur at any time and from any direction, and oddly tend to be seen in the opposite direction most people choose to look. It's behind you! Watching in pairs is therefore helpful. On certain nights, Earth sweeps through the old remnants of past comet tails, such as Halley's comet, and these give a reliable **meteor shower** each year that is seen to come from a single point in the sky. Shower predictions are in the link below but be aware that some are only visible in the northern hemisphere and media can forget to mention you might not see it here.

**Try this:** If you have an old AM or FM radio, in the evening tune it into a very distant station that you can barely hear. If a meteor comes in, even if behind cloud, it can ionise the air and boost for several seconds the reflection of the weak radio signals. This causes your reception to improve a lot or give pops and ping sounds. It only lasts for a few seconds, but it's due to a meteor. See the **listening** link.



**Try this:** Tape or glue a strong **magnet** to the end of a stick (you can take apart an old speaker to find one inside). Test rocks in your backyard to see if anything sticks. You might **discover an iron meteorite** for your museum. Primary school children in Clyde, Victoria, found a whopper several years ago this way. Whether it's finders-keepers varies from one state and territory to another.

A piece of the Cranbourne meteorite the size of a matchbox, cut open to look inside. Not resembling an ordinary rock, instead it shows long metallic crystals that attract magnets and are common in iron meteorites.



Credit: Peter Skilton

You can also try scooping into a bucket the sludge from inside the **roof gutter** of a tiled home. Wrap the magnet in plastic and see if anything sticks. Meteors that burn up don't disappear. Instead, they break into fine dust that eventually settles down to Earth, making our planet 60 tonnes heavier each day. This extraterrestrial dust can fall on your roof.

## Resources

Satellite and ISS predictions: [www.heavens-above.com](http://www.heavens-above.com) and enter your town at screen top right.

ISS live webcam from orbit: [www.nasa.gov/multimedia/nasatv/iss\\_ustream.html](http://www.nasa.gov/multimedia/nasatv/iss_ustream.html)

ISS apps: ISS Live Now, ISS Detector

Current satellites and space junk: [www.stuffin.space](http://www.stuffin.space) and only the red dots are satellites.

Build a Paper Model of the ISS: <https://blog.doublehelix.csiro.au/build-your-own-international-space-station/>

Australian Meteorite and Tektite Collectors: [www.facebook.com/groups/665853596840755/](https://www.facebook.com/groups/665853596840755/)

International Meteor Organisation: [www.imo.net](http://www.imo.net) go to *Resource* and *Meteor Shower Calendar*.

Meteor Listening: [www.spaceweather.com/glossary/forwardscatter.html](http://www.spaceweather.com/glossary/forwardscatter.html) and [www.livemeteors.com](http://www.livemeteors.com)