

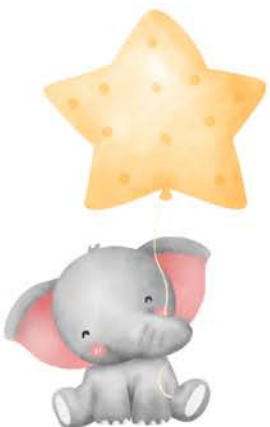


THE SCHOOLS'  
OBSERVATORY

PROUD TO BE PART OF  
LIVERPOOL  
JOHN MOORES  
UNIVERSITY



Let's Explore Stars!

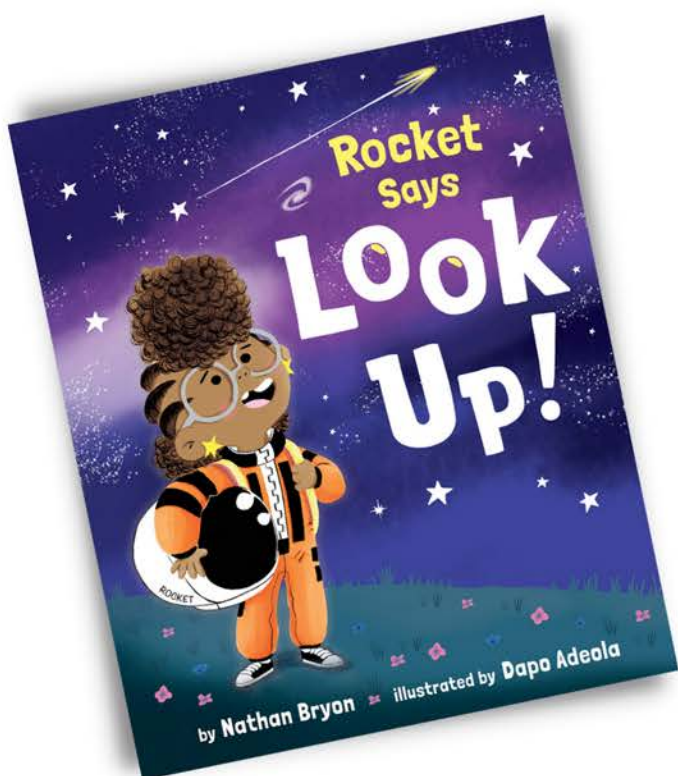


## Background information

The Schools' Observatory use the wonders of space to inspire the next generation of scientists, programmers and engineers. They provide resources for schools, support for teachers and free use of the world's largest robotic telescope through their website, [schoolsobservatory.org](http://schoolsobservatory.org).

The Schools' Observatory is proud to be part of Liverpool John Moores University and are based in LJMU's Astrophysics Research Institute in Liverpool, UK.

In partnership with Durham Book Festival's Little Read, The Schools' Observatory have created packs of themed resources for Early Years Foundation Stage children. These can be used at home or in nursery settings to engage children with the story, "Look up" by Nathan Bryon.



The main character in "Look up" is Rocket. Rocket is very interested in space and the night sky and is looking forward to a meteor shower. Children may not have seen a meteor before but they have probably seen the Moon and some stars. They may even have seen a planet without realising it!

When stargazing, it's easiest to start by looking for the brightest objects in the night sky. These include stars, planets and the Moon. This activity pack focuses on stars.

This booklet has information for you on pages 3 to 10, ideas for activities to do with the children on pages 11 to 17 and finally additional resources and weblinks we think you might be interested in on pages 19 to 19.

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Please note: the images used in this document are not to scale.

## What is a star?

Stars are huge spherical balls of glowing hot gas. This hot gas is called plasma. Stars shine because they are releasing light into space.

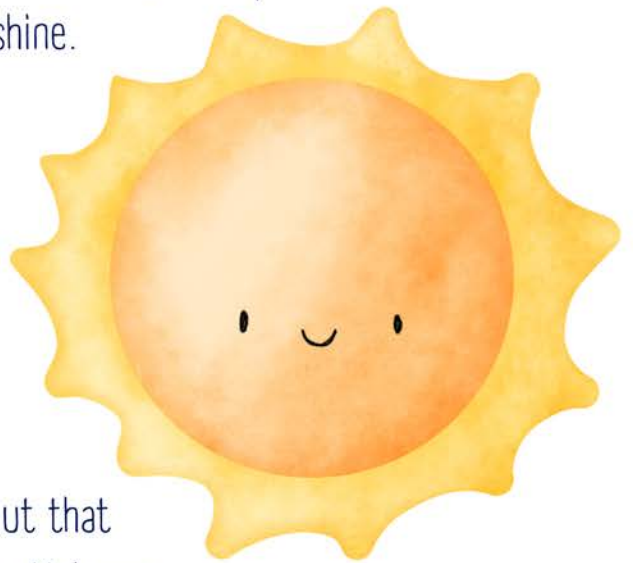
All the energy in a star is made deep in its centre by a process called nuclear fusion. During nuclear fusion, lighter atoms are fused together to make heavier atoms (any object in the Universe is made of lots of tiny building blocks called atoms). This process releases lots of energy as light and heat. This is what makes a star shine.

## How many stars are there?

There are too many to count! But astronomers can estimate how many stars there are. They think the Universe could contain

**200,000,000,000,000,000,000** stars!

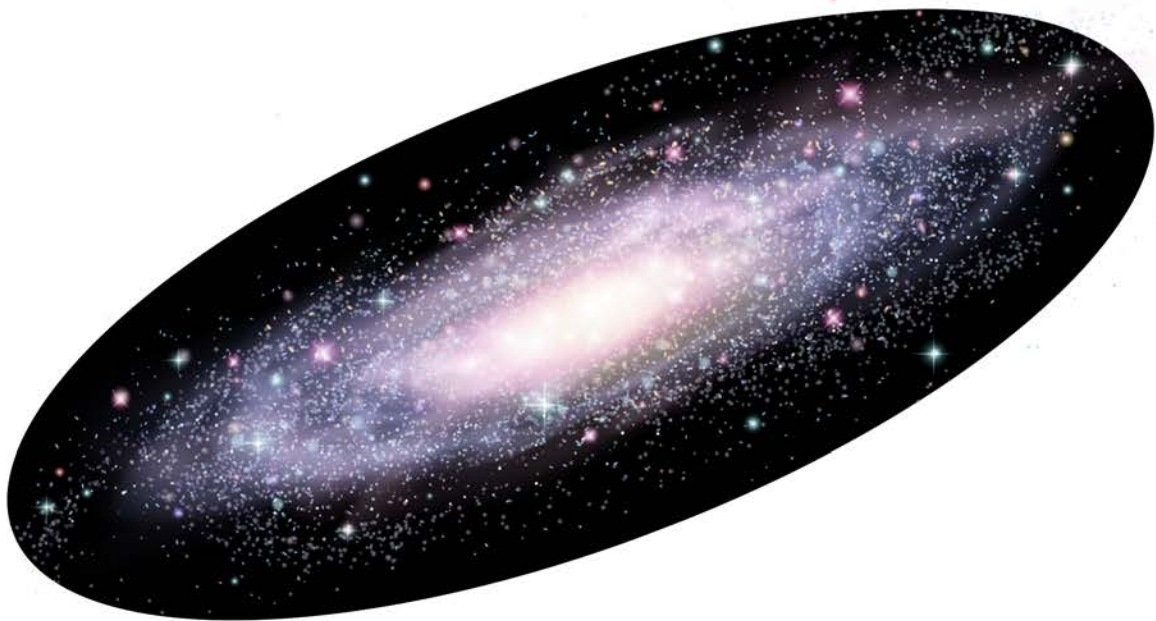
That's 200 thousand, million, million, million! To put that into perspective we think there are more stars in the Universe than grains of sand on every beach and desert on planet Earth!



We don't see all those millions of stars in the night sky. On a clear night, in a dark area, you may see a few hundred or maybe a thousand stars. The rest are too far away and not bright enough for our eyes to see. This is why astronomers use powerful telescopes – not just to magnify objects to see more detail, but also to reveal the fainter, more distant objects.

## What is a galaxy?

A galaxy is a huge collection of stars. The stars are all held together by the gravity they exert on each other, and by the gravity of a huge black hole which lies in the centre of the galaxy. Our Sun and Solar System are part of a galaxy called the Milky Way. We think there are about 100 thousand million stars in the Milky Way. All the stars you see at night are part of the Milky Way. However, our Milky Way is not the only galaxy. The Universe contains many millions of galaxies each containing thousands of millions of stars.



## Is the Sun a star?

Yes! The Sun is a star. It is the closest star to Earth and the only star in our Solar System (for more information about the Sun and the Solar System, see our activity pack The Solar System).

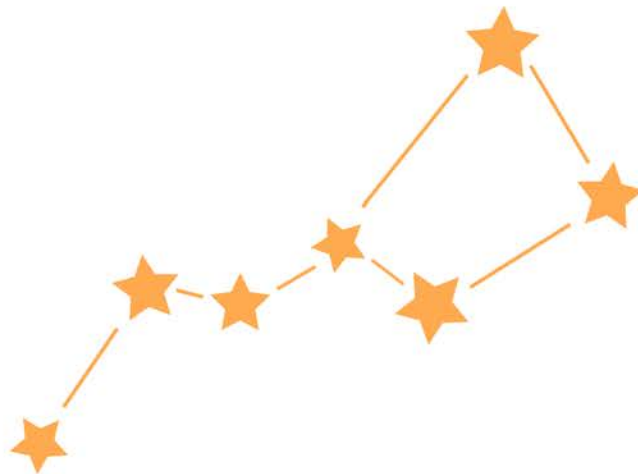
## Do the stars disappear during the daytime?

No. They are still there, but we can't see them. Light from the Sun is so bright that it blocks out light from all other stars in out during the day. This is why we don't see other stars in the daytime.

## Why do I sometimes see more or fewer stars in the night sky?

The darker the sky the more stars you will see. On a very dark night, you may be able to see thousands of stars. One reason you may not see any stars is because clouds in the Earth's atmosphere are blocking your view. But if there are no clouds, and you still can only see 1 or 2 stars, what's going on?

Have you ever noticed that you can see more stars from the countryside than from a town? This is because there is less light pollution in the countryside. Light pollution is what we call too much human-made light which escapes up into the night sky. This light may come from street-lighting, buildings, and advertising boards. To see the most stars, you need to be as far away from other sources of light as possible.



The light of the Moon can also cause problems for stargazing. The Moon is brightest when it is full. These nights are not good for spotting lots of faint stars. It's better to look for stars during the new Moon or crescent Moon phases when the Moon is not very bright (you can explore the Moon using our Moon activity pack).

## Are all stars the same distance from Earth?

No. The stars we see in the sky are spread out through space in three-dimensions throughout the Milky Way. Some are closer to us, and some are further away.

Our nearest star is the Sun. It takes light from the Sun 8 minutes to reach us on Earth. After the Sun, the nearest star is Proxima Centauri. It takes light from Proxima Centauri more than 4 years to reach us!

This is because, even though light travels at the fastest speed in the Universe (300,000 kilometres every second!) – space is huge! The distance that the light needs to cover to reach us takes time. Light from the most distant stars takes thousands of millions of years to get to us.

The closer a star is, the brighter it appears to be. The further away a star is, the fainter it appears to be (though the brightness of a star also depends on how big it is).

## All are stars the same size?

No, but they are all very big! The Sun is a smallish star, but you could still fit 1 million planet Earths inside it! We call stars which are much bigger than the Sun, giant stars and stars which are much smaller than the Sun, dwarf stars. The largest stars are a thousand times larger than our Sun. The smallest stars are about the size of planet Earth.

## Are all stars the same shape?

Yes, all stars are spherical. This is because they are held together by their gravity. The gravity pulls all the gas towards the centre of the star and creates a ball.

## Are all stars the same colour?

No! Stars can be lots of colours including blue, white, yellow, orange, and red. Our Sun is a yellow star. The colour of a star tells us about its temperature. The hottest stars shine blue. The coolest stars shine red. Though all stars are hot! The surface of the coolest stars is still about 2500 °C. The surface of our Sun is about 6000 °C. The surface of the hottest stars is over 30,000 °C.

## Do stars move?

The stars appear to move across the sky each night from east to west, just like the Sun appears to in the daytime. However, the stars do not fly around the Earth every day. In fact, it is the Earth that's moving. The Earth spins around its axis like someone spinning a basketball on their finger. This makes it look to us on Earth like everything is moving around us.

Stars also spin around their own axes, just like the Earth. Stars also orbit around the centre of their galaxy. So, the Sun and its Solar System (including the Earth) is travelling around the Milky Way.

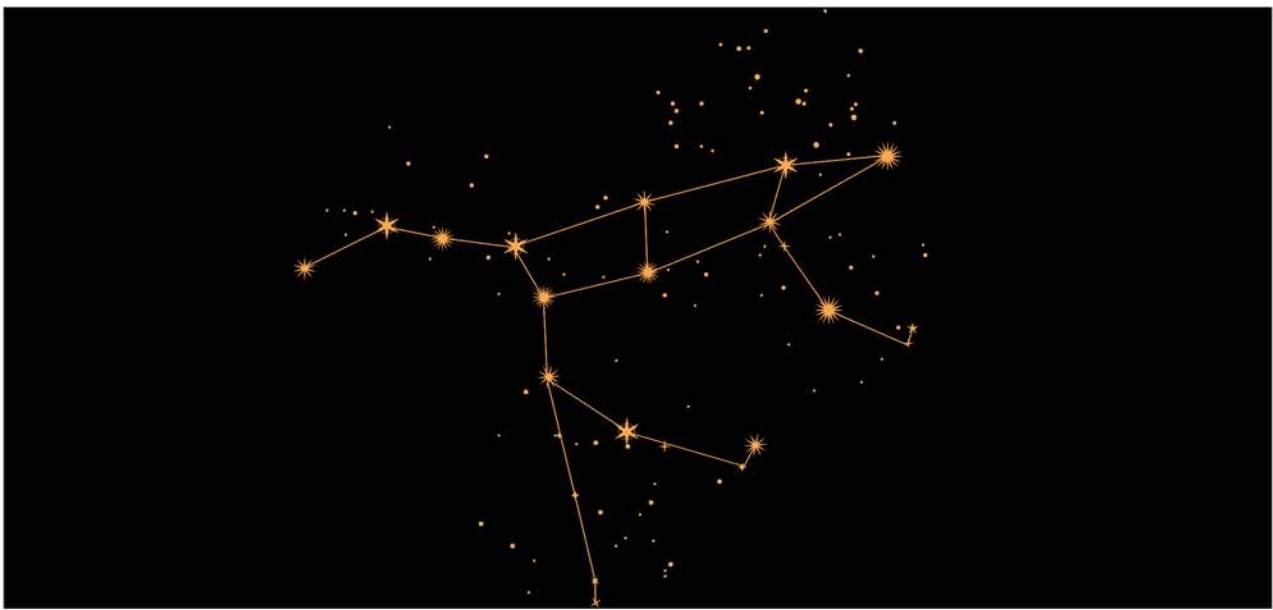
## What about shooting stars?

You may have seen something that looks like a star falling across the night sky. This is actually not a star. This is a meteor (also called a shooting star). Meteors are pieces of rock or dust from space which fall through the Earth's atmosphere. They fall so fast that they glow red-hot. This makes them look like a star. Most meteors burn up in the atmosphere and never reach the ground. However, some larger rocks survive to hit the ground. We call these rocks, meteorites.



## What are constellations?

Constellations are groups of stars which form a picture in our imagination. Many of the constellations we see were imagined and named by people thousands of years ago. A lot of the characters are taken from myths, legends, and stories. You may already know some constellations. Maybe you recognise the 3 bright stars which make up the belt of the constellation Orion? Or you have spotted the Plough or Big Dipper, which is part of the constellation Ursa Major, The Great Bear.



The constellation, Ursa Major – also known as The Great Bear  
Lines have been added to show the shape. Credit: Canva

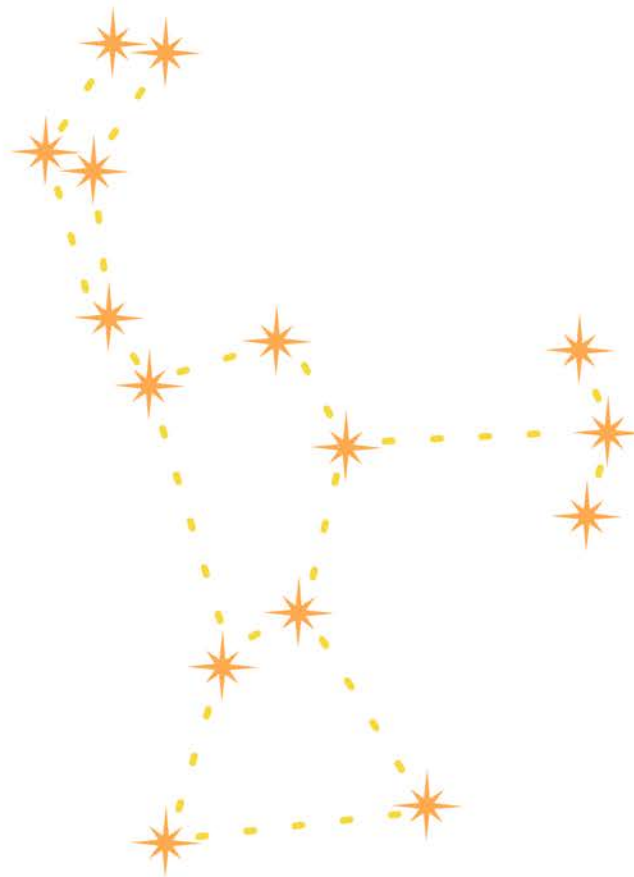
Astronomers use constellations as a map of the night sky. When they talk about a constellation, they mean the area of the sky it is in – not just the stars in it. Astronomers divide the entire sky into 88 areas each containing a constellation.

Different parts of the world have different views of the night sky. This means they see different patterns in the stars and have created different constellations. In the Northern Hemisphere, most people still use the constellations named by people in Ancient Greece and by European explorers in the 15th century.

## Do constellations appear in the same place in the sky each night?

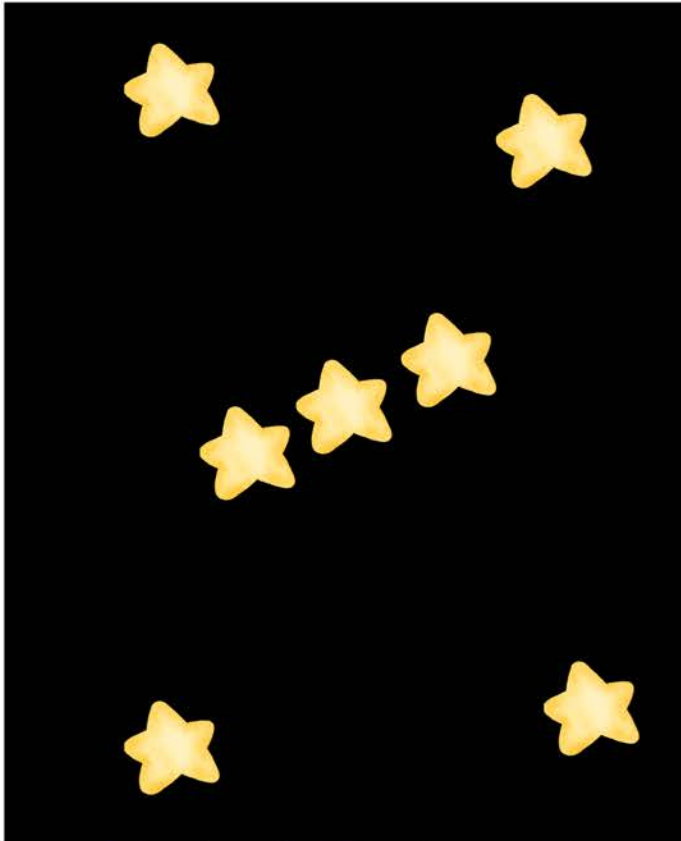
Each night, constellations rise in east, appear to move across the sky, and set in the west. Just like the Sun does in the daytime. This happens because the Earth is spinning on its axis like a top.

The Earth is also moving around the Sun in a large circular path called an orbit. It takes 365 days (1 year) for the Earth to complete each orbit of the Sun. This means the Earth is in a different position at different times of the year and so our view of the stars around us changes. This is why some constellations are only visible in the summer or winter.

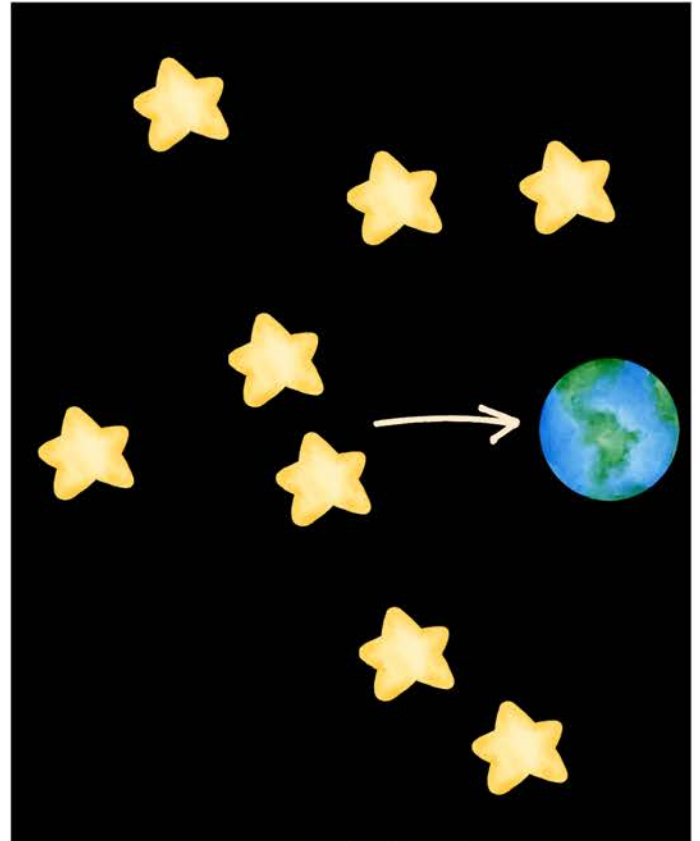


## Are all the stars in a constellation near each other?

Probably not! From our viewpoint, they look close together but remember stars are spread through space in 3-dimensions. The stars which make up 1 constellation are probably at different distances from Earth and very far apart.



Our view of Orion from Earth



What it might look like from the side

## Feedback

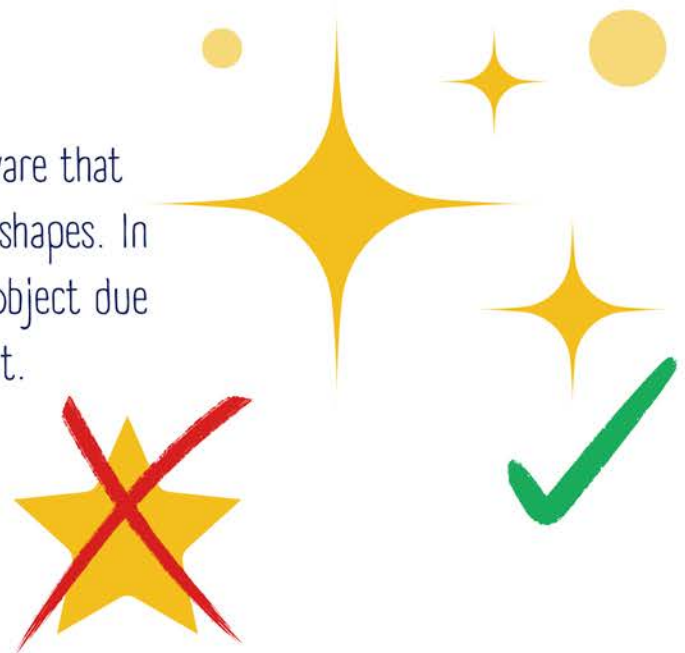
We welcome feedback from practitioners. If you want to let us know how much your children have enjoyed our activity or how we could improve it, please send us some feedback using the details below:

Share your stellar creations with The Schools' Observatory!  
Email [SchoolsObs@ljmu.ac.uk](mailto:SchoolsObs@ljmu.ac.uk) or tag [@SchoolsObs](https://www.instagram.com/SchoolsObs) on social media.

# Stars – Activities

How to introduce the topic of stars and constellations

- Ask children if they know any songs or nursery rhymes which feature stars (for example, twinkle, twinkle little star).
- Ask children if they have seen stars or know any constellations (pictures in the stars).
- Start a discussion about what you can see in the sky – is the same in the day time and at night time?
- Put out books which include stars or the topic of light and dark. For example:
  - Night monkey, Day Monkey by Julia Donaldson
  - Orion and the Dark by Emma Yarlett
- How to Catch a Star by Oliver Jeffers
- You could make links with shapes but be aware that stars in space are spherical, not 5-pointed shapes. In photos they often appear as a 4-pointed object due to the effect of the Earth's air on their light.



## Activity 1 – Exploring light and dark

Dark is the absence of light. Light and dark are best explored if the environment is dark.

Use materials and adjust light levels to create lighter and darker areas in your environment.

- For example – make a den out of blankets, use a cupboard space, close the blinds in a small room.
- Black out materials (used for curtains) are great to use. Specialist ‘dark dens’ can also be purchased.
- Place objects which give off light in the dark area. For example, torches, light boxes, night lights, battery powered candles. Try to include different coloured lights.
- Draw children’s attention to shadows – including their own and those made by objects. What happens when they move towards or away from the source of light. You could also create shadow puppets.

Encourage children to explore how light interacts with different materials.

- Use a torch or light box (or old overhead projector!), or window as the source of light. Provide some or all of the following kinds of materials:
- Translucent objects like coloured plastic sheets or containers. Try to include different coloured objects.
- Objects which reflect light like mirrors, shiny fabric, Christmas decorations.
- Objects with holes in them like sieves or netting.
- Opaque materials like wood, plastic, metal.

# Stars – Activities

## Experiment with the effects of light pollution:

- Children use a rolled up tube of paper or card as a 'telescope'.
- You could spend some time getting the children to decorate their telescopes
- Set up a star projector night-light in a dark space.
- Children observe the stars through their telescope.
- Increase the amount of light in the space (turn on more lights or open the curtains).
- Can they see more or fewer stars?

You can repeat this experiment outside when it is dark – using the tubes as telescopes and looking at the night sky for stars. The children should see a difference in the number of stars they see when standing close to a light source (e.g., a lamppost), and when moving away from it.

## Activity 2 – Stars and stories

Use and adapt the workshop: Stars and Stories. It tells the story of the constellations of Scorpio and Orion. Children then make their own constellation using fewer than 10 stars.

### Equipment needed

- Stars and Stories (PowerPoint slides or PDF available)
  - [www.schoolsobservatory.org/teach/activities/starsandstories](http://www.schoolsobservatory.org/teach/activities/starsandstories)
- Paper
- Pencils / crayons / or star stickers

### Introduction:

- Introduce constellations and ask the pupils if they have seen any before.
- Tell the story of Orion and Scorpius using the slides.
- Explain that constellation stories and names were invented by people and that different cultures may have different names for constellations.
- Go through the slides and ask pupils to guess what each constellation is.

### Activity:

1. Child chooses an animal, object, or character.
2. Child draws or trace the outline in pencil.
3. Support the child to decide what the key points are that make the shape – no more than 10! That's the challenge!
4. Child stick or draw 10 stars on the key points.
5. Another adult or child can guess what the shape is. If they need clues, they can ask the child “yes” or “no” questions.

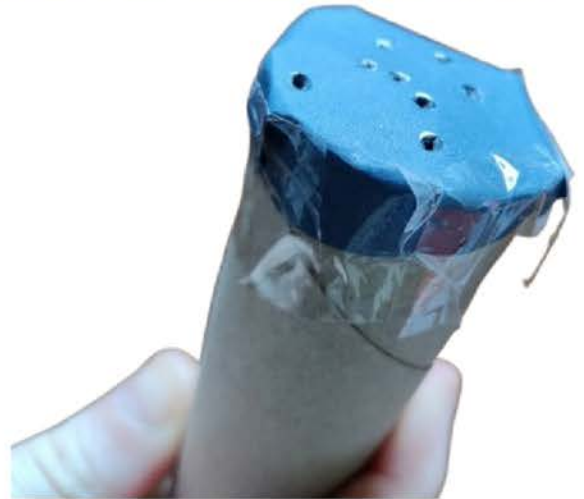
Alternatively, children could arrange objects (e.g. counting blocks) into their chosen shape and a teacher could photograph it from above.

## Activity 3 – Constellation tubes

These are great for looking at constellations without having to wait for night-time!

Equipment needed:

- Toilet roll or kitchen roll tube (or rolled up piece of card)
- Printed constellation sheet
  - [www.schoolsobservatory.org/sites/default/files/activities/Constellation-tubes-templates.pdf](http://www.schoolsobservatory.org/sites/default/files/activities/Constellation-tubes-templates.pdf)
- Scissors
- Pencil for making holes
- Lump of Blue Tak or plasticine
- Glue or Sellotape



Instructions:

1. Cut out one of the constellation circles.
2. Make small cuts around the outside of the circle so you can fold the edges down.
3. Use a pencil to poke a hole through each of the white dots (the stars!) into the lump of blue Tak or plasticine.
4. Use glue or Sellotape to stick the circle around the rim at one end of the tube.
5. Look through the open end of the tube to see the constellation or shine a torch down the open end to project the constellation on to a surface

Prompts for discussion:

- What pattern or shape can you see?
- What lets you see the pattern?
- What happens if the holes are bigger or smaller?
- What happens if you point the tube at different places in the room?



## Activity 4 – Star splatter art

Children recreate a starry sky at night using paints.

### Equipment needed:

- Black paper
- Poster paint in different colours (white, yellow, red and blue are good because these are the colours of stars!) thinned down with some water
- Paint brush or old toothbrush (it won't work if the bristles are wet or too soft)
- Apron
- Something to cover the surface around the paper to stop things getting too messy

### Instructions:

- Cover the head of the brush in the paint
- Hold the brush over the paper
- Run your finger down the brush so the paint splatters onto the paper
- Repeat with different colours of paint
- You could cut out silhouettes of buildings, people, or trees for children to stick over their splatter backdrop.

### Discussion prompts:

- What happens if you move the brush closer or further away?
- Can you make your splatter as slow as possible?
- Can you make your splatter as gentle as possible?
- Pause and look at your picture before you add another splatter. What will you do next?

### Communication, Language, Emotions

Many children are afraid of the dark. There are many story books which include this topic. Use these to discuss fears and increase empathy.

Different cultures have different names for the stars and constellations. Relatives of the children could share their knowledge and experience of stars and the night sky. You can display the word for stars in different languages in the learning environment.

# Stars: Additional Resources & Web Links

## Word Bank

Big	Hot	Size
Colour	Huge	Space
Constellations	Light	Sphere
Dark	Milky Way	Stars
Day	Near	Sun
Enormous	Night	Telescope
Far	Shape	Temperature
Galaxy	Shine	Universe

# Stars: Additional Resources & Web Links

## The Schools' Observatory Website

You can use The Schools' Observatory website to search for more information about the Solar System. We think these are good places to start learning:

[www.schoolsobservatory.org/search/](http://www.schoolsobservatory.org/search/)



- |                  |                    |
|------------------|--------------------|
| Black hole       | Moon               |
| Brightness       | Nuclear Fusion     |
| Colours of Stars | Orbits             |
| Constellations   | Phases of the Moon |
| Day and Night    | Solar System       |
| Earth            | Star size          |
| Galaxy           | Stars              |
| Gravity          | Sun                |
| Light pollution  | Telescopes         |
| Meteors          | Universe           |
| Milky Way        |                    |

## Stars: Additional Resources & Web Links

### Stellarium

Stellarium is a free Planetarium software. It shows a realistic view of the sky, like you would see the naked eye. You can 'fast-forward' time to show sunset and sunrise. You can also zoom in to look more closely at the Moon, stars, planets and other objects. It can also show the constellations.

<https://stellarium.org/>

Stellarium is available via a web browser, as a download for PC or Mac, and as a mobile app. We have put together some basic instructions on using Stellarium:  
[schoolsobservatory.org/sites/default/files/activities/Early-Years-Stars-Using-Stellarium.pdf](https://schoolsobservatory.org/sites/default/files/activities/Early-Years-Stars-Using-Stellarium.pdf)

If you need additional support, you can contact [SchoolsObs@ljmu.ac.uk](mailto:SchoolsObs@ljmu.ac.uk)