

# STEM club

*LET'S EXPLORE THE  
UNIVERSE TOGETHER!*

**EXPLORE THE MOON**

**BUILD THE SOLAR  
SYSTEM**

**CREATE A NEW PLANET**

**LAUNCH YOUR OWN  
ROCKET**

**AND MORE...**

*PROUD TO BE PART OF*

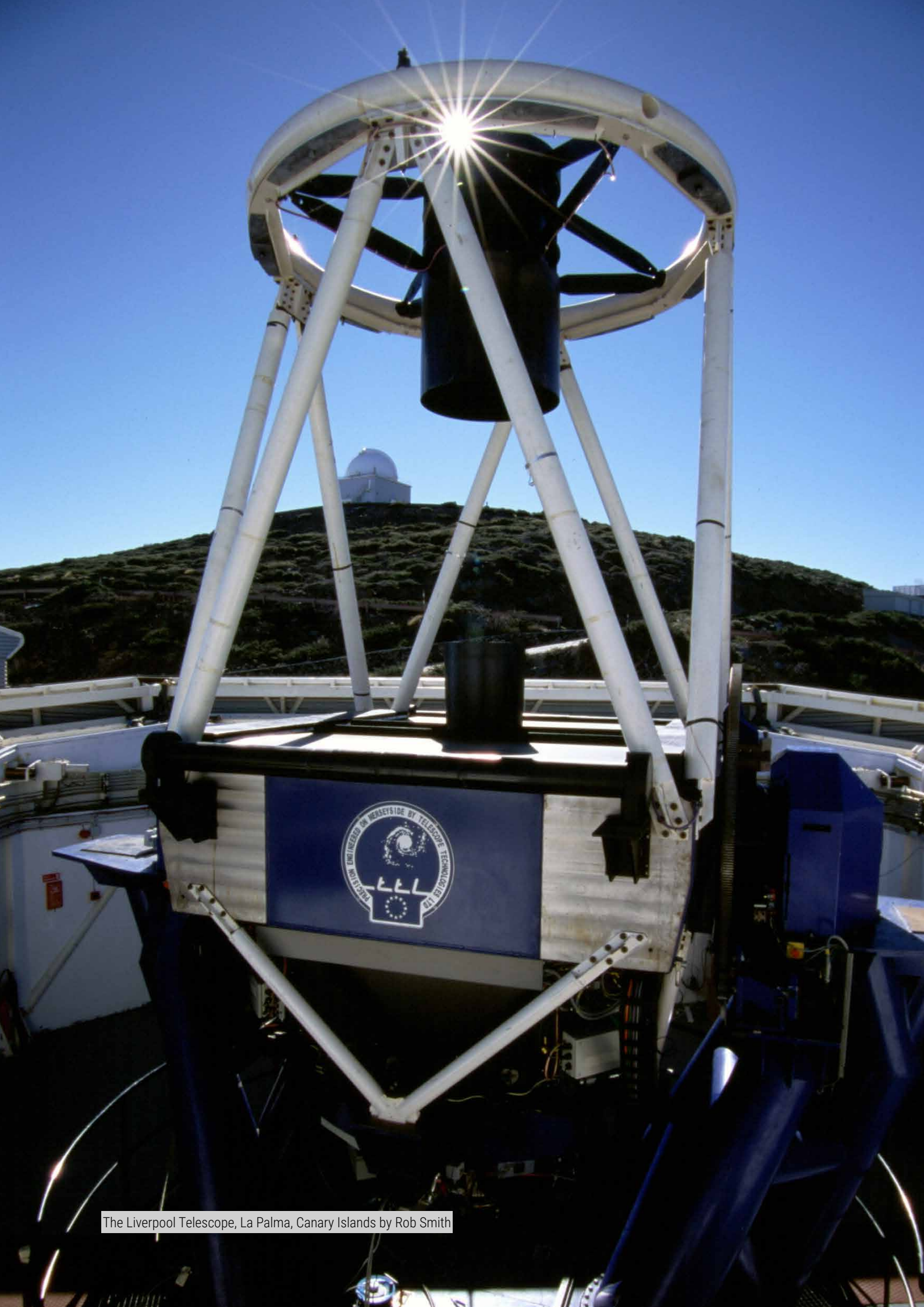


Dumbbell Nebula by The Schools' Observatory

**BRONZE  
PRIMARY EDITION**







The Liverpool Telescope, La Palma, Canary Islands by Rob Smith

# CONTENTS

Primary STEM Club - Bronze Award

Your Name: \_\_\_\_\_ Age: \_\_\_\_\_

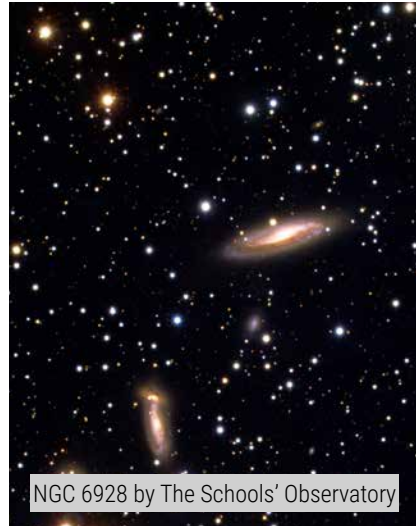
## 4 REGISTER FOR FREE

Sign up with The Schools' Observatory, request an observation of the Moon and complete the quiz.



## 7 THE MOON

Use our software to view your image of the Moon (from the last session). Recreate the lunar surface with Play-Doh. Learn how to use your Lunar Diary.



## 10 SOLAR SYSTEM

Create your own Play-Doh Solar System and learn about the scale of the planets by their size.

## 12 EXOPLANETS

Can you imagine another world? What would it look like? Would it sustain life? Let your imagination run wild and create your own planet.

## 14 ROCKETSHIPS

Explore propulsion by creating your own rocket launcher using only household kitchen items. What makes a good rocket? How high can your rocket go?

## 16 STARS

Count the visible stars in several small areas of the sky, and calculate how many stars can be seen across the whole night sky.

## 18 JUST FOR FUN!

A collection of puzzles and colouring activities to keep even the keenest space scientist busy!



# SESSION 1: REGISTER FOR FREE

In this first session you will be logging on to our website, using the world's largest fully robotic telescope, called the Liverpool Telescope, and having a go at a quiz.

## ACTIVITY 1: GO OBSERVING

You will now use our website to observe the Moon using a computer program. Your STEM Club Leader will give you full instructions.



Which Moon Section did you select? Write your answer here:

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Congratulations you have now requested an observation from the Liverpool Telescope. Over the next few nights the telescope will automatically aim at the spot on the Moon that you clicked and try to take a picture of it. If all goes well, you will be able to see your image in the next session.



## ACTIVITY 2: STEM CLUB QUIZ

Try to answer the following 10 questions. You can use our website, your books, or the internet.

1. How many planets are there in our Solar System?

2. Starting with Mercury, name the planets in order.

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3. Which is the biggest planet in our Solar System?

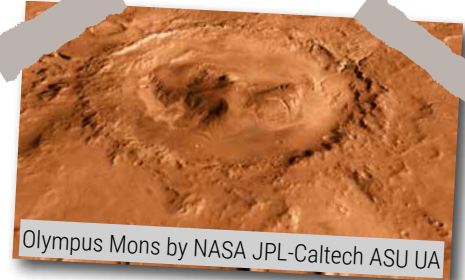
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4. What is the name of the only star in our Solar System?

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5. How many moons does Mars have?

Can you name them?



Olympus Mons by NASA JPL-Caltech ASU UA

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6. What is a galaxy?

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7. Which galaxy are we in?



Galaxy NGC 6384 by  
The Schools' Observatory

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8. What is meant by 'orbit'?

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9. What object does Earth orbit?

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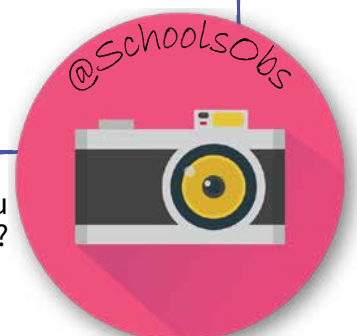
10. What is a telescope?

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Your STEM Club Leader has the answers, check with them and write your score here:

Congratulations, you have finished your first STEM club session. We hope you have enjoyed it. Just for fun can you imagine what an alien might look like? Have a go at drawing your own alien below. Don't forget to name them!

Congratulations, you have finished your first STEM club session. We hope you have enjoyed it. Just for fun can you imagine what an alien might look like? Have a go at drawing your own alien below. Don't forget to name them!



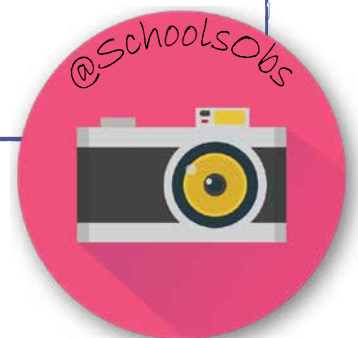
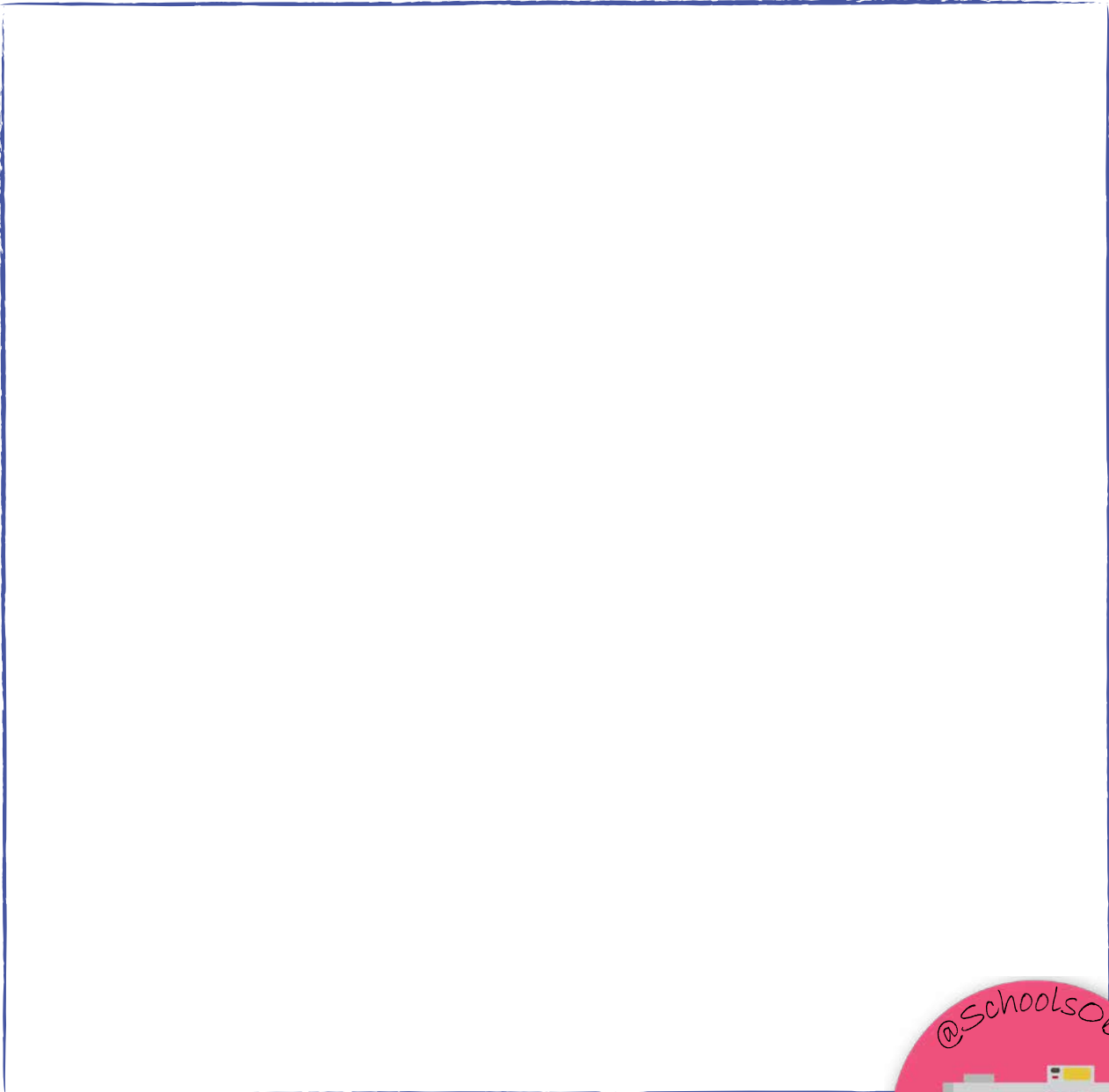
# SESSION 2: THE MOON

In this session you are going to study the Moon's surface and start to keep track of how much of the Moon you can see each evening.

## ACTIVITY 1: VIEWING YOUR MOON

You will now use our website to download your picture of the Moon that you asked the Liverpool Telescope to take in the last session. Your STEM Club Leader will give you full instructions.

*Draw or print out a copy of your Moon image here:*

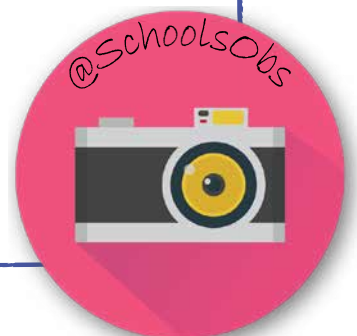




## ACTIVITY 2: PLAY-DOH MOONS

Have a go at using Play-Doh to create your own Moon. Use a sharpened pencil to create the craters and the mountains.

Ask your STEM Club Leader to photograph your Play-Doh Moon and stick your picture into the space below:

A large, empty rectangular box with a blue border, intended for students to paste their photograph of the moon they created from the activity.





Phases of the Moon By The Schools' Observatory

# ACTIVITY 3: LUNAR DIARY


This activity will take you the next 4 weeks to complete!

Every day for the next month, take a look at the sky and look at the shape of the Moon. The time that the Moon rises and sets will change each night, as well as its position in the sky. Draw what you see in the Lunar Diary below.

## Lunar Diary

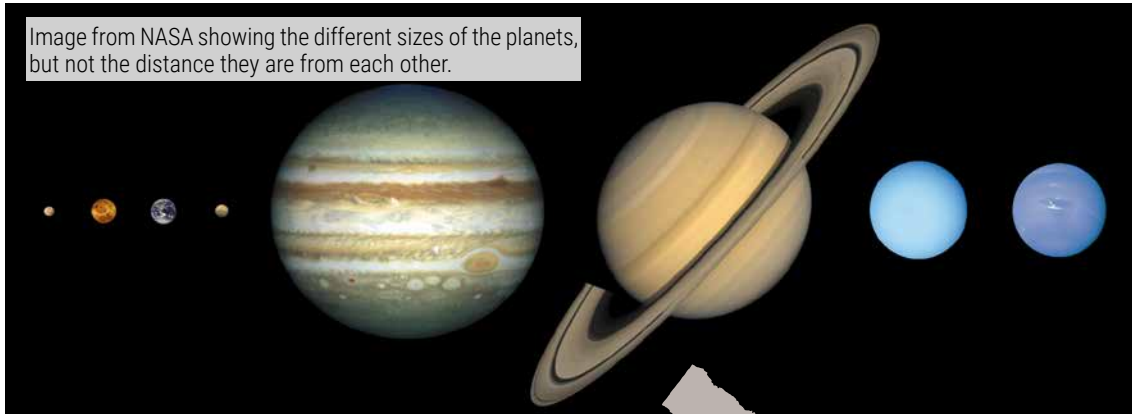
Day 1 	Day 2 	Day 3 	Day 4 	Day 5 	Day 6 	Day 7 
Day 8 	Day 9 	Day 10 	Day 11 	Day 12 	Day 13 	Day 14 
Day 15 	Day 16 	Day 17 	Day 18 	Day 19 	Day 20 	Day 21 
Day 22 	Day 23 	Day 24 	Day 25 	Day 26 	Day 27 	Day 28 

If the weather is not good enough to see the Moon, you could draw a sad face instead.



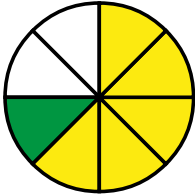

# SESSION 3: SOLAR SYSTEM

In this session you will be creating each planet in our Solar System to scale. Your STEM Club Leader will give you some pots of Play-Doh, name cards to place your planets onto and something to cut the Play-Doh with.



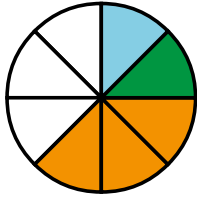
Hints:  
 1. You may find it easier to roll the ball into a sausage shape and then divide that up.  
 2. Tick off the steps as you go along.

Key	
	Mercury
	Venus
	Earth
	Mars
	Jupiter
	Saturn
	Uranus
	Neptune
	Left over Play-Doh

- 1 
  - You will be given some tubs of the same colour Play-Doh, mix them all together to create a sausage shape.
  
- 2 
  - Divide the whole sausage of Play-Doh into 8 equal parts.
  - Roll 5 parts together to create the planet Jupiter.
  - Roll 1 part to create the planet Saturn.
  
- 3 
  - Combine the remaining 2 parts and then cut into 8 equal parts.
  - Take 2 parts and add to Jupiter.
  - Take 2 parts and add to Saturn.
  - Take 1 part to create Neptune.
  - Take 1 part to create Uranus.
  
- 4 
  - Combine the remaining 2 parts and then cut into 8 equal parts.
  - Take 3 parts and add to Jupiter.
  - Take 3 parts and add to Saturn.

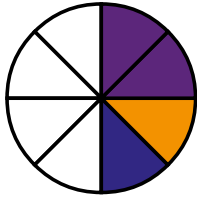


5



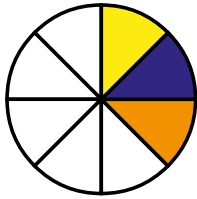
- Combine the 2 remaining pieces and then cut into 8 equal parts.
- Take 1 part to create the Earth.
- Take 1 part and add to Saturn.
- Take 3 parts and add to Neptune.

6



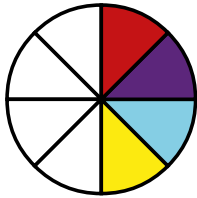
- Combine the remaining 3 pieces and cut into 8 equal parts.
- Take 2 parts to create Venus.
- Take 1 part and add to Neptune.
- Take 1 part and add to Uranus.

7



- Combine the remaining 4 pieces and cut into 8 equal parts.
- Take 1 part and add to Jupiter.
- Take 1 part and add to Uranus.
- Take 1 part and add to Neptune.

8



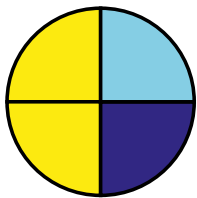
- Combine the 5 remaining pieces and cut into 8 equal parts.
- Take 1 part and create Mars.
- Take 1 part and add to Venus.
- Take 1 part and add to Earth.
- Take 1 part and add to Jupiter.

9



- Combine the remaining 4 pieces and cut into 8 equal parts.
- Take 1 part and create Mercury.
- Take 1 part and add to Venus.
- Take 1 part and add to Saturn.
- Take 1 part and add to Uranus.
- Take 1 part and add to Neptune.

10



- Combine the remaining 3 pieces and cut into 4 equal parts.
- Take 1 part and add to Earth.
- Take 1 part and add to Uranus.
- Take 2 parts and add to Jupiter.

Each ball now represents the relative size (volume) of each planet but remember they would be much further apart.

You can find a recipe for homemade Play-Doh here:

[www.schoolobservatory.org/things-to-do/make-play-doh-solar-system](http://www.schoolobservatory.org/things-to-do/make-play-doh-solar-system)

Adapted from Worlds in Comparison by Dennis Schatz (Pacific Science Center)  
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 390 Ashton Avenue, San Francisco, CA 94112 [www.astrosociety.org](http://www.astrosociety.org)



# SESSION 4: EXOPLANETS

The Sun is a star at the centre of our Solar System. There are 8 planets that orbit the Sun. Dwarf planets, asteroids and comets are orbiting the Sun too.

Outside of the Solar System there are lots of other stars. Planets orbiting stars outside the Solar System are called exoplanets.

Planets in the Solar System are different sizes and made of different materials. Exoplanets can be different sizes and materials too. Planets and exoplanets can be gassy, rocky or icy.

One of the exoplanets discovered is a similar size to Earth. It is called L 98-59 b.



Can you think of a better name for the exoplanet L 98-59 b?

Imagine you have discovered a new planet orbiting a star outside the Solar System. Use the next page to draw a labelled poster of your exoplanet. Include pictures and descriptions so that a passing alien could recognise the planet from your poster. Here are some questions you might want to think about...

1. What is the name of your new planet?

2. How big is your planet? (How big is it compared to Earth or Jupiter?).

3. What is your planet made of? (rock, ice, gas or something else?).





4. Does your planet have any moons? If so, how many?

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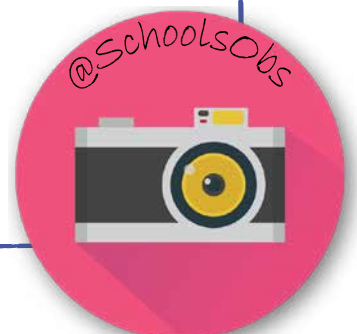
5. What is the temperature of your planet?

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6. Can humans live on your planet?

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Your exoplanet:



# SESSION 5: ROCKETSHIPS

You are going to make and launch your own bottle rocket, maybe not into space, but hopefully into the air. You will get to experience Newton's third law in action, which states:

**“FOR EVERY ACTION THERE IS AN EQUAL AND OPPOSITE REACTION”**



Resources needed by The Schools' Observatory

## RESOURCES

☆ Empty bottle	☆ Baking soda
☆ 3 pencils	☆ 1 bottle cork
☆ Tape	☆ Sheet of kitchen roll
☆ White vinegar	☆ Scissors

Optional: ruler, tablespoon, measuring jug.

## WARNING



*This activity can be great fun but please make sure you only launch your rocket when your STEM Club Leader is present, as the bottles can become highly pressurised and launch at great speeds.*



1. Tape the pencils to the outside of the bottle, make sure the bottle is stable and the nozzle of the bottle is at least 10 cm from the ground.



2. **Optional** - if your cork is too big, using a pair of scissors carefully shape the cork so that it fits the bottle nozzle (ask an adult if you need help). The cork shouldn't be loose but not too tight either, or else your rocket won't launch!
3. We are now going to prepare the 'fuel packets'. Take a single piece of kitchen roll and place 2 tablespoons of baking soda in a line down the middle. Then fold in the edges and roll the kitchen roll up to contain the baking soda.

The end result is a long thin roll of paper containing the baking soda. This should be narrow enough to fit into the bottle, though for now keep it to one side. Pour some of the vinegar into the bottle, around 200 ml is ideal.



4. Slide your 'fuel packet' into the bottle and quickly push the cork into place. Stand the rocket up (nozzle pointing towards the ground) and **MOVE WELL AWAY** from the rocket. **DO NOT** return to the rocket even if nothing appears to be happening.

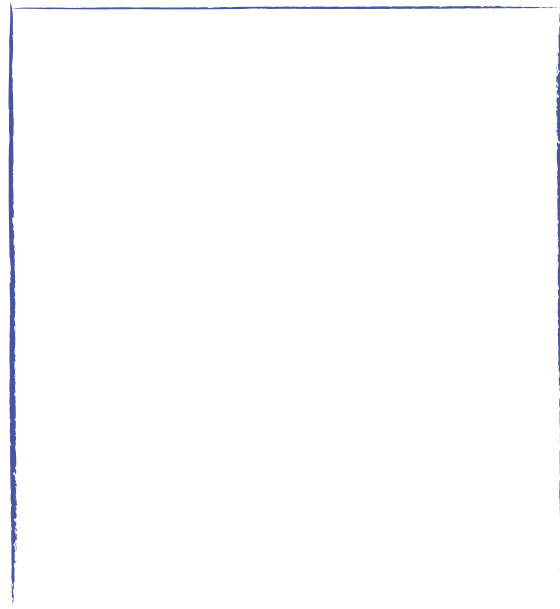
## IMPORTANT



***If the rocket fails to launch, make sure an adult goes to get it. The cork was probably pressed in too tight and this will mean the bottle is highly pressurized so great care should be taken in retrieving it and removing the cork.***

5. The soda and vinegar react to create a lot of carbon dioxide gas. The gas is trapped in the bottle. The pressure will build and build until it is too great. The pressure forces the cork down and out of the nozzle. When the fuel and cork go down, the bottle goes up! This may only take a few seconds.

Draw or stick a picture of your rocket here.



How did you get on?



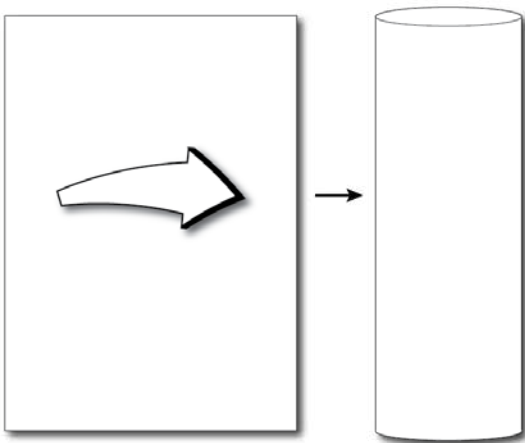
# SESSION 6: STARS

There are lots of stars in the night sky, far more than you could possibly count. The number of stars you can see will depend on the amount of light pollution in your area. If you have lots of street lights and cars you will see fewer stars than if you were out in the countryside.



In this session, you will be estimating the total number of stars visible in the sky. You will count the stars you can see in a small patch of the sky, and then multiply that number by the total number of patches that make up the whole sky.

1. Roll the A4 paper lengthways into a tube, trying to keep the overlap as small as possible.



## REQUIRED RESOURCES

☆ One piece of A4 paper

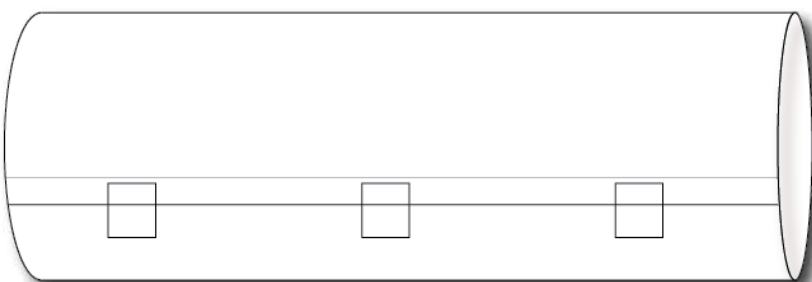
☆ Sticky tape

☆ One pencil

☆ Calculator

☆ Clear skies!

2. Secure your paper tube with sticky tape.





3. Take your tube outside and allow your eyes to adjust to the dark. The longer you wait the better as this can take up to 20 minutes, but even 5 minutes will help. Don't look at ANY light sources, especially smartphones or tablets. The longer you can wait, the more light sensitive your eyes will become and you will be able to see more stars. If you need to use a light to see, try to use a red light.
4. Look through your tube and select a piece of the night sky that is free of any clouds. Count how many stars you can see through the tube, being very careful not to move the tube.
5. Record your count in the table below.
6. Repeat steps 3 and 4 for four different parts of the night sky. Each time be careful to select a part of the sky that is free of clouds. Keep the tube as still as you can. This will give you 5 results in total.
7. Add up the five results you have and record your subtotal in the table below.
8. Multiply your subtotal by 39. This will give you the Total Stars visible in the sky where you are. Due to the shape of the Earth (sphere) you can only see one half of the sky (one hemisphere). To calculate how many stars are visible to the entire planet (both hemispheres) you need to double your answer.

Of course the number of stars in the Universe is much, much higher. Most of the stars are so far away that we cannot see them with just our eyes. We need to use telescopes.

Postcode	Result 1	Result 2	Result 3	Result 4	Result 5	Subtotal	Total Stars

9. Once you are back inside go to: [www.schoolsobservatory.org/things-to-do/count-stars](http://www.schoolsobservatory.org/things-to-do/count-stars) and check your answers by entering your **Subtotal** into the box then click 'Calculate'. This will confirm the number of stars visible in your part of the night sky.
10. Enter the postcode of your location then click 'Add to our map' to add your results to our light pollution map.



*How difficult was it making these observations? What could make it easier next time?*

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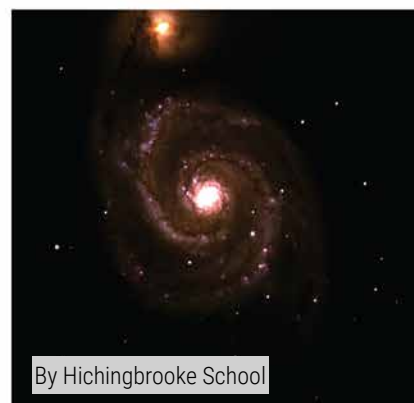
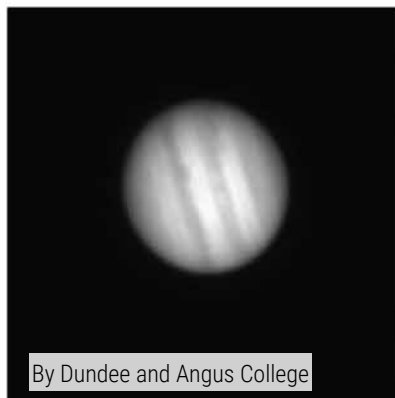
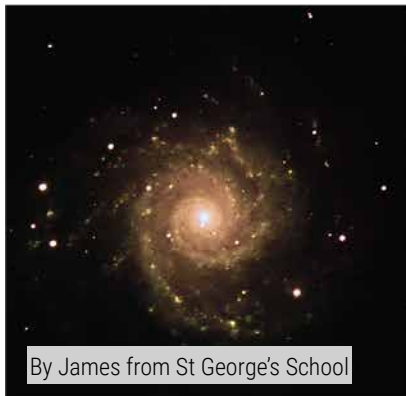
# JUST FOR FUN!

## SHARE YOUR IMAGES WITH US

We love to see the images you have created from your observations! Share your images with us and they might feature in our [Galleries!](#)

Ask your STEM Club Leader to share your images with us by:

★ Tagging @SchoolsObs on [Twitter](#) or [Instagram](#)



*By sharing your images with us, you consent for The Schools' Observatory to use your image on our website and social media accounts and/or for publicity.*



# WORD SEARCH

See if you can find all the space words in the puzzle below. The answers are on page 22.

s j m a w t v s t a r l k a u  
o p e v w g a l a x y o e s d  
z g b i w n w w s u r a n u s  
f e m z s f k j u p i t e r k  
v q m o o n a t i o n a l l s  
n k c k e x o p l a n e t j r  
x s m e r c u r y x j z x o d  
v s f l s c h o o l s r y p r  
z f w m a r s a p l a n e t b  
n e p t u n e d r x s p a c e  
s a t u r n s c v e n u s i m  
n j j p y q g p x p p n g n g  
g f q n t e l e s c o p e c a  
b k b o b s e r v a t o r y a  
u b q u v h f y e a r t h h b

earth

exoplanet

galaxy

jupiter

mars

mercury

moon

neptune

observatory

planet

saturn

schools

space

star

telescope

uranus

venus

Answers - page 22

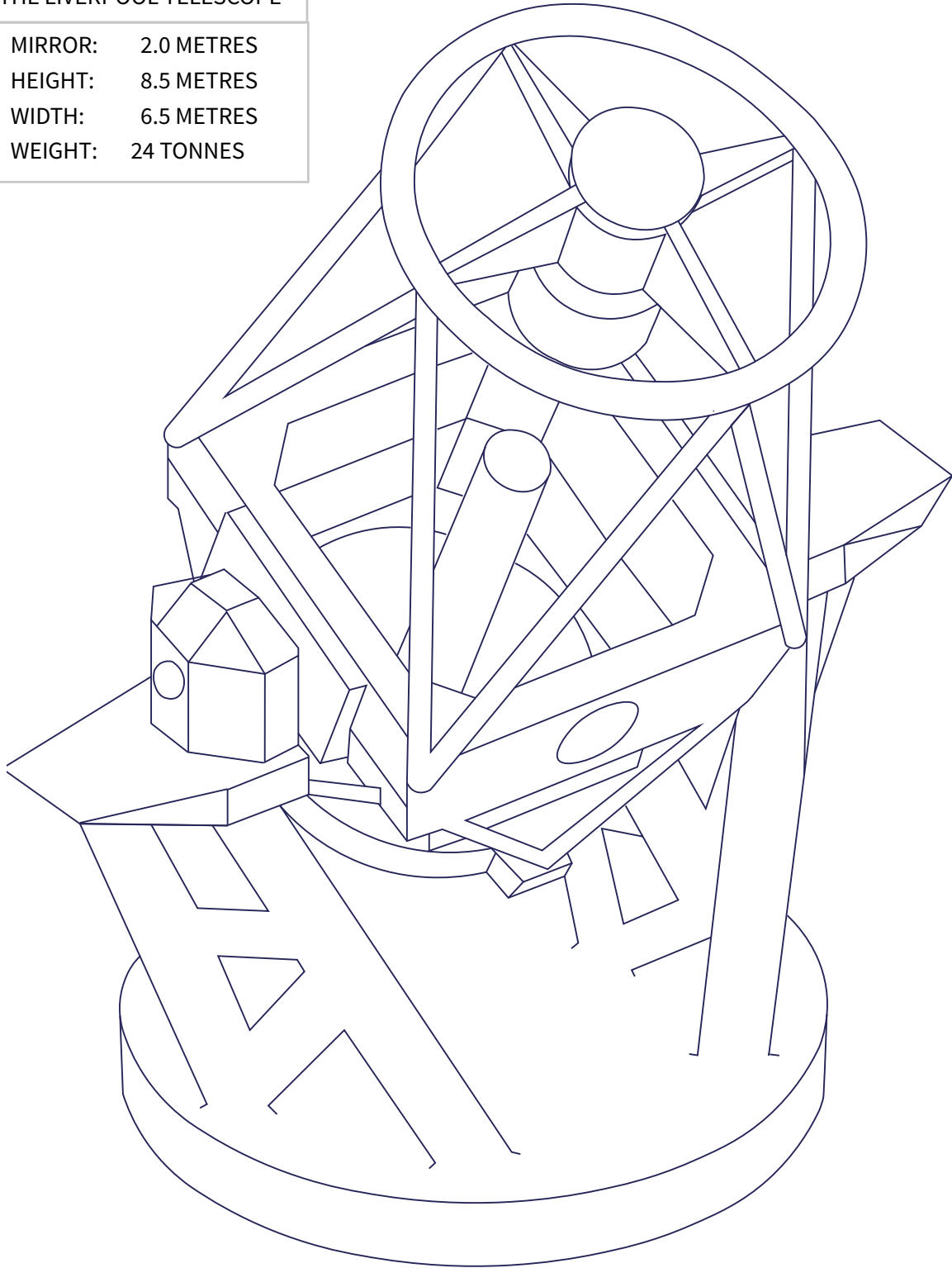


# TELESCOPES

We love our telescope but it is not very colourful. We thought you might like to colour in this drawing of it for us. Make it as bright and colourful as you want!

## THE LIVERPOOL TELESCOPE

MIRROR:	2.0 METRES
HEIGHT:	8.5 METRES
WIDTH:	6.5 METRES
WEIGHT:	24 TONNES

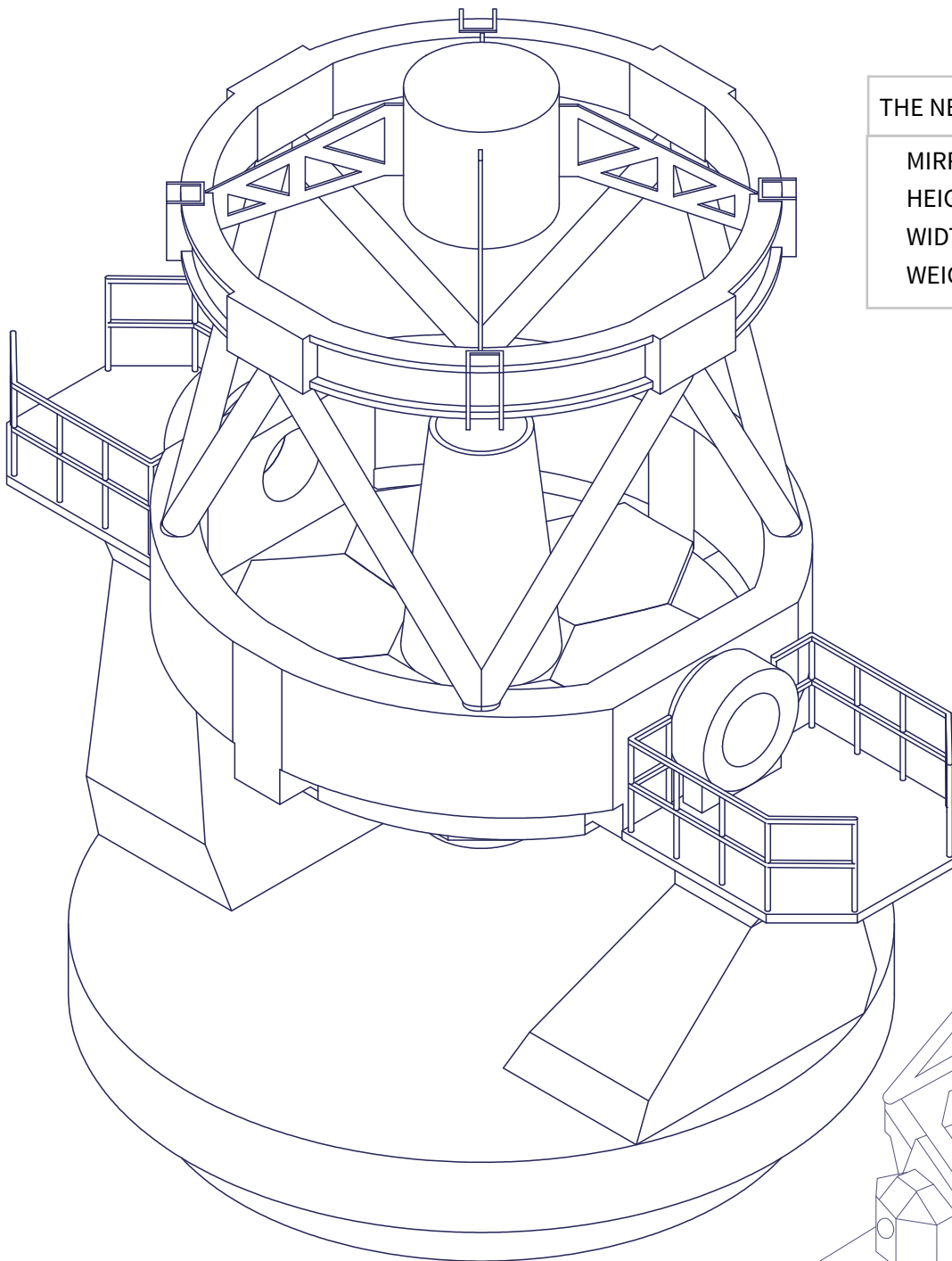




This is a drawing of what we hope will be our new telescope. At the moment its name is the New Robotic Telescope (NRT for short) but perhaps you can think of a better name?

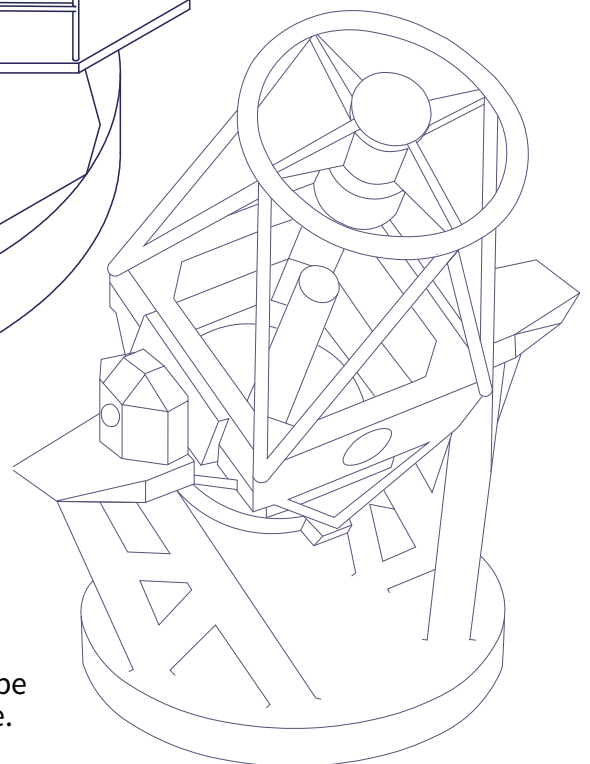
Name:

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**THE NEW ROBOTIC TELESCOPE**

MIRROR:	4 METRES
HEIGHT:	13 METRES
WIDTH:	11 METRES
WEIGHT:	75 TONNES



The Liverpool Telescope is shown here to scale.



## ABOUT THE SCHOOLS' OBSERVATORY

The Schools' Observatory (TSO) is proud to be part of Liverpool John Moores University (LJMU). We are part of LJMU's Astrophysics Research Institute (ARI). LJMU has a robotic telescope, called the Liverpool Telescope, which is located at the top of a very high mountain on La Palma in the Canary Islands. LJMU is one of the few UK Universities that owns and operates a professional telescope.

We were created to help young people across the UK and Ireland use the Liverpool Telescope. You can read all about our team here: [www.schoolsobservatory.org/about/team](http://www.schoolsobservatory.org/about/team)

Congratulations! You have now finished the Bronze STEM Club booklet! We hope you have enjoyed yourself and learnt a few things along the way.

If you want to know about other topics that are not already on our website, ask your Stem Club Leader to email us and let us know: [SchoolsObs@ljmu.ac.uk](mailto:SchoolsObs@ljmu.ac.uk)

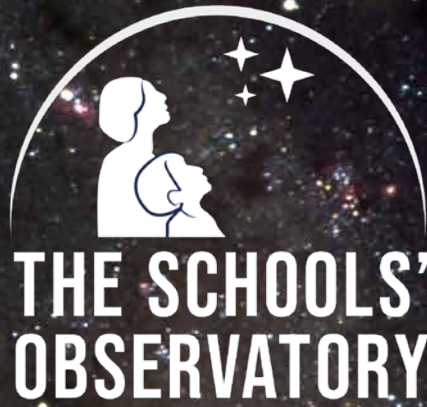
## WORD SEARCH ANSWERS

s j m a w t v **s t a r** l k a u  
o p e v w **g a l a x y** o e s d  
z g b i w n w w s **u r a n u s**  
f e m z s f k **j u p i t e r** k  
v q **m o o n** a t i o n a l l s  
n k c k **e x o p l a n e t** j r  
x s **m e r c u r y** x j z x o d  
v s f l **s c h o o l** s r y p r  
z f w **m a r s** a **p l a n e t** b  
**n e p t u n e** d r x **s p a c e**  
**s a t u r n** s c **v e n u s** i m  
n j j p y q g p x p p n g n g  
g f q n **t e l e s c o p e** c a  
b k b **o b s e r v a t o r y** a  
u b q u v h f y **e a r t h** h b



**[PLACE YOUR CERTIFICATE HERE]**





If you enjoyed the Bronze award ask your STEM Club Leader about our Silver award, six amazing sessions taking you to the next level in your space adventure.

**6 SILVER SESSIONS:**

*HUNTING FOR ASTEROIDS  
IN-DEPTH MOON INVESTIGATIONS  
SPACE ART  
AND MORE...*

***PROUD TO BE PART OF***



**WWW.SCHOOLSOBSERVATORY.ORG**

Triangulum galaxy by The Schools' Observatory

**STEM  
Club**

**PRIMARY EDITION**

