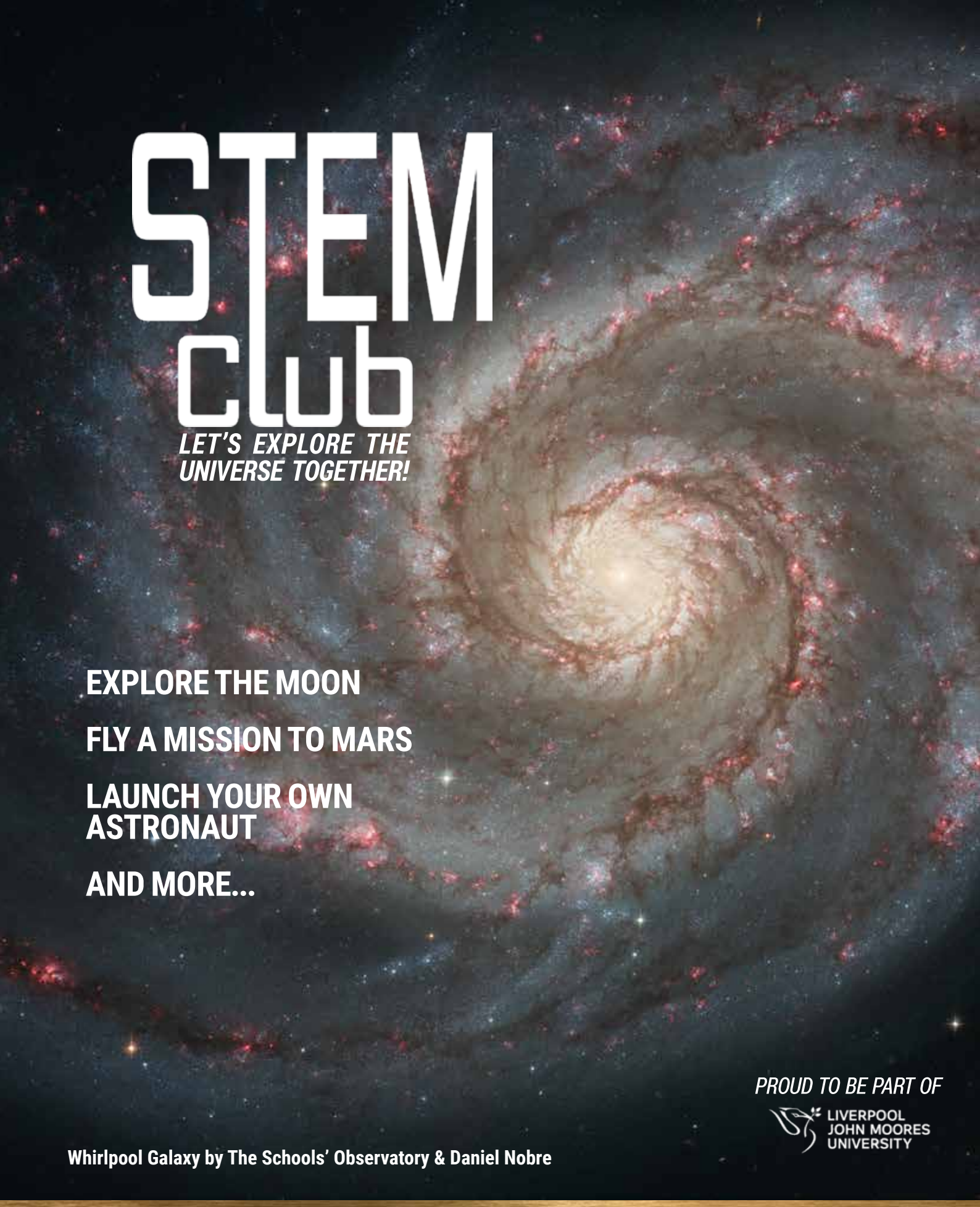
STEM Club

LET'S EXPLORE THE UNIVERSE TOGETHER!



EXPLORE THE MOON

FLY A MISSION TO MARS

LAUNCH YOUR OWN ASTRONAUT

AND MORE...

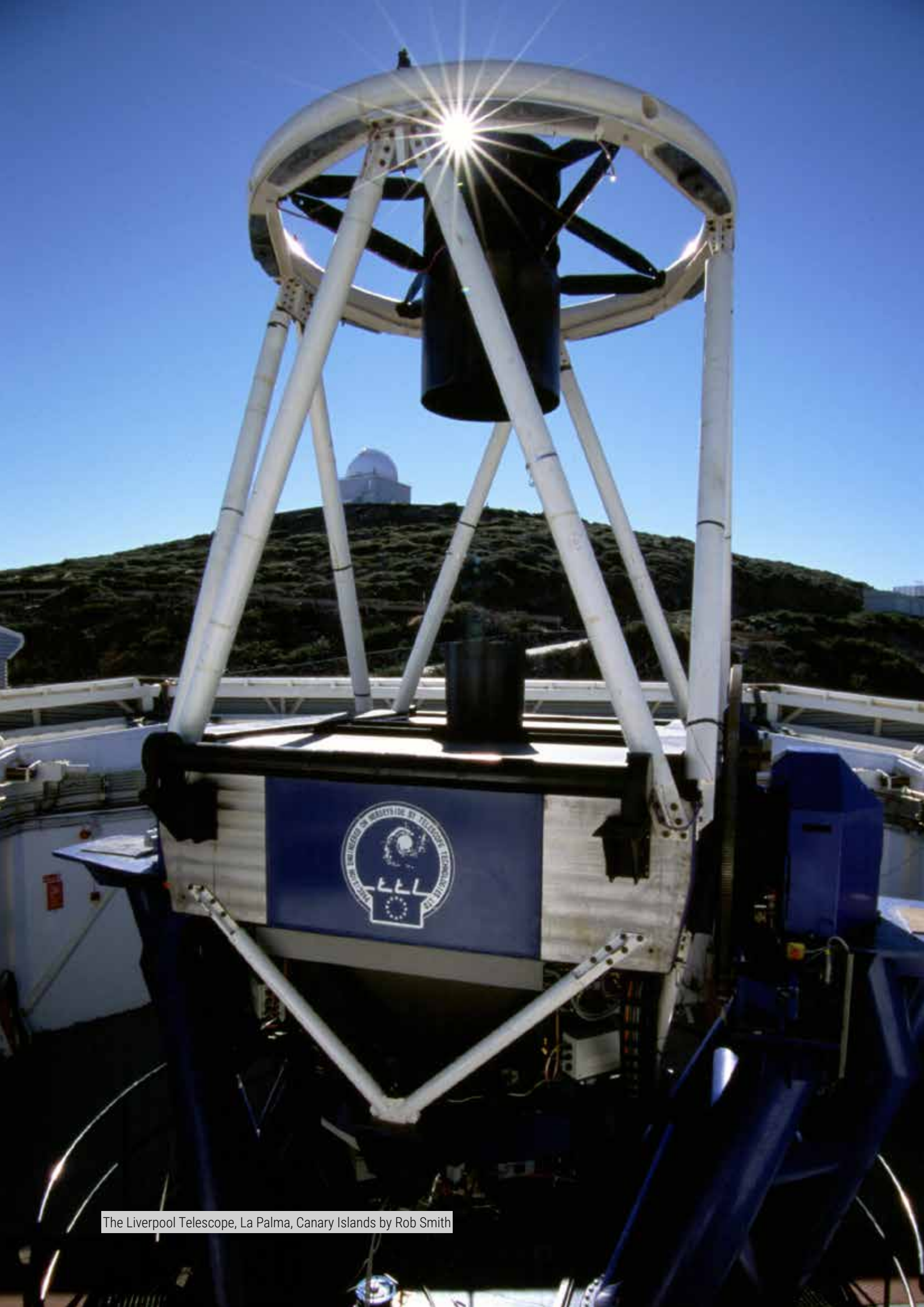
PROUD TO BE PART OF

LIVERPOOL JOHN MOORES UNIVERSITY

Whirlpool Galaxy by The Schools' Observatory & Daniel Nobre

BRONZE
SECONDARY EDITION

THE SCHOOLS' OBSERVATORY



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

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Secondary STEM Club - Bronze Award

Your Name: _____ Age: _____

SESSION 1: ASTEROID HUNT

Asteroids are large rocks orbiting the Sun that are too small to be called planets. Using images from the Liverpool Telescope (shown on the inside cover of this booklet) you can join the hunt for asteroids. By looking at two images taken by the telescope a short time apart, you might be able to spot an asteroid moving. This is because asteroids appear to move across the sky relative to the far away objects and stars that look fixed.

Asteroid taken day 1
By The Schools' Observatory

Asteroid taken day 3
By The Schools' Observatory

You will now hunt for asteroids using a pecial piece of astronomical software . Once you find it, add a drawing or photo below, circle the asteroid. Your STEM Club Leader will give you instructions to:

1. Log in to our Website
2. Download the images
3. Open the images in our free software
4. Hunt the Asteroid

There is also a bonus section to help track asteroids close to planet Earth.

Happy Hunting!

Your asteroid:

SESSION 2: EGGNAUT

Your mission, should you choose to accept it, is to design and build a vehicle that will protect your Eggnaut from the perils of re-entry. The objective is to have your Eggnaut survive the fall without a crack.

RESOURCES (PER ROCKET)

- ☆ 2 sheets of A4 paper
- ☆ 20 drinking straws of any width but at least 13 cm long
- ☆ 20 craft sticks/wood splints
- ☆ 100 cm string of any size
- ☆ 100 cm masking tape of any size
- ☆ 5 rubber bands of any size
- ☆ 1 plastic bag
- ☆ 1 raw egg
- ☆ 1 pair of scissors

IMPORTANT

Be careful using the scissors.

THE RULES

1. The re-entry system must fit inside a space of 20 cm x 20 cm x 20 cm.
2. Parachutes or helicopters are allowed.
3. A plumb line can be used to target the re-entry vehicle onto the recovery zone.
4. All parts of the re-entry system must be above the re-entry orbital height of 3 to 5 metres.
5. The re-entry system's mass must not exceed 400 grams.
6. Your Eggnaut must land as close as possible to the centre of the re-entry zone.
7. You do not have to use all of the materials listed.

This activity is adapted from Spaceweek International by EESA.Education.

QUESTIONS TO CONSIDER

1. How can I design my re-entry system (capsule) to protect the Eggnaut?
2. What can I design into my re-entry system to make sure it lands in the centre of the target area?
3. How am I going to slow it down?
4. Which of Newton's Laws of Motion are at work on the capsule and Eggnaut?

5. Draw a plan of your system and explain how it is going to work and why:

6. Report your test results and why you think they occurred and what you could do to improve your design:

SESSION 3: MISSION TO MARS

When humans go to Mars they will need somewhere protected to live where there is oxygen to breathe, food to eat, places to sleep and places to work!

We'll need somewhere comfortable to relax after a long day working – and something to help us explore the surface of Mars when we venture outside.

- ☆ How can we get oxygen to breathe?
- ☆ What will we eat and how will we prepare it?
- ☆ Where will we get water from?
- ☆ What can we do to relax?
- ☆ Where will we carry out experiments?
- ☆ How can we explore the surface?
- ☆ How can we communicate with people back on Earth?

Think about everything we need here on Earth to survive day to day – and see if you can create a base camp on Mars, which would allow people to live there for a long time. Remember to label everything in your base camp.

Write notes about your base camp here:

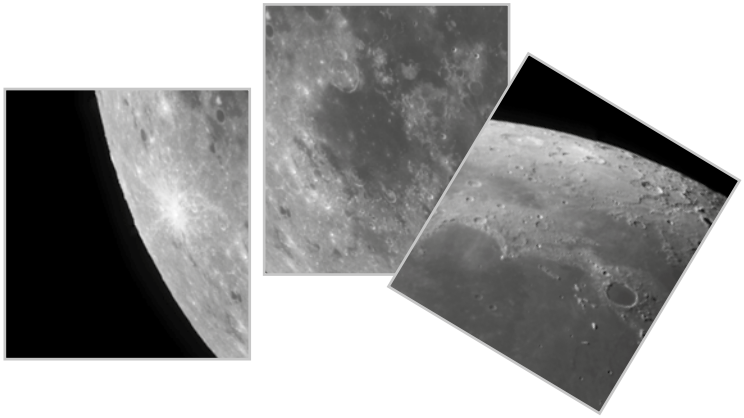
Draw your Martian base camp here:

SESSION 4: THE MOON

You are going to investigate the lunar surface by first completing a jigsaw of the Moon (Moonsaic). This is an image of the Moon during its gibbous phase. Then explore the features on the surface through researching various astronomical terms. You will then find and label them on the Moonsaic you've put together.

1. Cut out the individual segments from the "Moonsaic - Last Quarter" print outs.

   Available here: www.schoolsobservatory.org/things-to-do/moonsaic



RESOURCES

- ☆ Moonsaic segment print outs
- ☆ Sticky tape
- ☆ Scissors
- ☆ Arrow labels

2. Complete the Moonsaic. Use this map as guidance – note that each of the sections overlap a little to make things easier.

3. Once you are happy with the completed Moonsaic stick the pieces together using sticky tape or glue.

Moonsaic by The Schools' Observatory

4. Your STEM Club Leader will give you some arrow labels. Cut out the labels and place on the right features on the lunar surface. Some examples are below.

5. Research the following terms to see what they mean and what they might look like on the lunar surface.

Terminator:
Mare/Sea:
Lacus/Lake:
Vallis/Valley:
Mon/Mountain:
Crater:
Lunar rays:

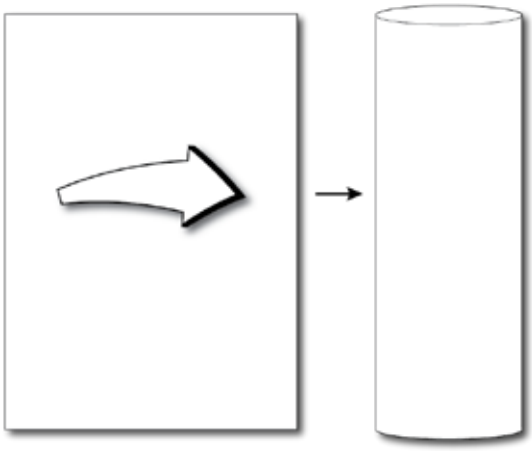
6. Once you are confident about these features, use the arrow labels to indicate where you can see them on the completed Moonsaic.

SESSION 5: 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 less stars than if you were out in the countryside.

In this session you will count the stars you can see in a small patch of sky. You will use that number to work out how many are in the whole visible sky.

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



RESOURCES

- ☆ One A4 sheet of paper
- ☆ Sticky tape
- ☆ One pencil
- ☆ Calculator
- ☆ Clear night sky!

2. Secure your paper tube with sticky tape.

3. Take your tube outside and allow your eyes to adjust to the dark. This can take up to 20 minutes. 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 and 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. Be very careful not to move the tube.

5. Record your count as 'Result 1' in the table below:

Postcode	Result 1 n_1	Result 2 n_2	Result 3 n_3	Result 4 n_4	Result 5 n_5

6. Repeat steps 4 and 5 for four more different parts of the sky. Each time being careful to select a part of the sky that is free of clouds and to keep the tube as still as you can. This will give you 5 results in total.

7. Work out the average number of stars you can see through your tube.

Notes	Equation	Your Answer
Add your results to give a total number, N	$N = n_1 + n_2 + n_3 + n_4 + n_5$	
Average number, n_{av}	$n_{av} = \frac{N}{5}$	

8. Counting all the stars in the sky would take a very long time! You can use the average number of stars in your 5 areas $n_{av} = \frac{N}{5}$ to approximate how many stars are in your night sky.

Follow the steps in the box below.

Notes	Equation	Your Answer
Diameter, d, of your tube (in mm)		
Length, l, of your tube (in mm)		
Calculate the total number of stars visible in your sky (one hemisphere), N_{sky}	$N_{sky} = n_{av} \times 8 \times \left(\frac{l}{d}\right)^2$	

9. As the Earth is a sphere, you can only see one half of the sky at any time. Each half is called a hemisphere. The UK is in the Northern hemisphere.

Calculate the number of stars visible in the whole sky (for both the Northern and Southern hemisphere) in the box below.

Notes	Equation	Your Answer
Number of stars visible in the whole sky (both hemispheres) $N_{whole\ sky}$	$N_{whole\ sky} = 2 \times N_{sky}$	

10. You can check your answers by going to:
www.schoolsobservatory.org/things-to-do/count-stars

You need to enter the total number of stars you counted through your tube over the 5 positions:

N

Then click 'Calculate'. This will reveal the number of stars in your night sky.

Do your answers match? Yes/No

11. Enter the postcode of your location then click 'Add to our map'. This will add your results to our collection and help us build our light pollution map.

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

What factors might affect the accuracy of your result? How could you improve this?

SESSION 6: ASTRO-PICS

Early astronomers didn't have computers, cameras or even electricity to help them study the night sky. They had to record their findings by drawing what they saw. In this session you will be taking your own 'picture' of the night sky. This can be a photograph or you might want to get more creative and draw or create your own artwork. Whatever you decide you will also need to write a little description of your picture, and what you like about it.

Top Tips!

When taking photographs in the dark, it is important to be steady. If you have a tripod, then use it, but if you don't it can be helpful to lean against a wall to keep yourself from wobbling, or (carefully) prop your camera up.

If you breathe out just before taking a picture and do not breathe in again until after you have taken it, you are less likely to wobble.

Smartphone cameras usually have apps available for helping with night-time photographs, some of which may even be free. It is worth experimenting with them.

Don't forget that you can use digital photography software (like Photoshop or less complicated packages like Photos) to adjust your photographs afterwards – cropping them, or changing the contrast or colours a bit.

Most importantly – be creative!

Here are some example pictures to give you a starting point, but do not be limited by these – let your imagination and creativity go and see what you can come up with!

The Moon and Jupiter over the Liverpool Skyline by Andy Newsam

The bright Moon with the fainter speck of Jupiter just near to it. I like this picture because the reflections in the water help to show the different colours of both the natural and artificial lights.

The crescent Moon pointing towards the colours of sunset are made more interesting by the shapes of the trees.

Moon and Sunset by Andy Newsam

Surrounded Moon by Andy Newsam

Three street lights on a staircase appear to be surrounding the Moon.

If you prefer to draw rather than photograph, then anything goes. This is just one example of a sketch of some imaginary extra-solar planets.

By Marion Leibl

Title:

write here a little bit about your picture and why you like it:

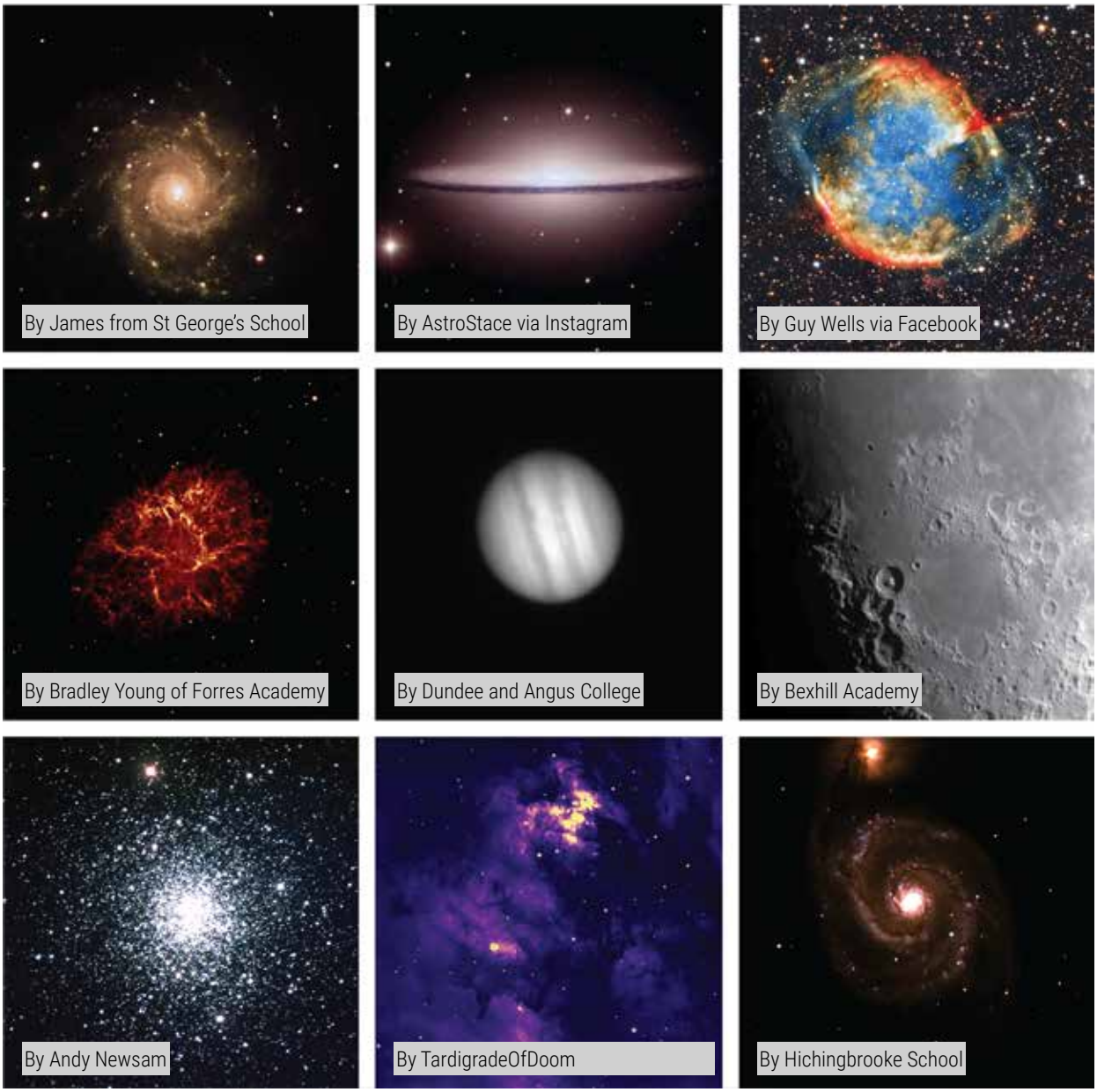
JUST FOR FUN!

SHARE YOUR IMAGES WITH US

We love to see the images you have created from your observations! Share your images with us.

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.

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

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

NOTES AND PICTURES

Use this page to write any notes or stick any pictures from your Bronze STEM Club sessions.

[PLACE YOUR CERTIFICATE HERE]

THE SCHOOLS' OBSERVATORY

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:

MEASURE THE SPEED OF LIGHT
CREATE COLOUR ASTRONOMY IMAGES
LEARN ABOUT STELLAR FORENSICS
AND MORE...

PROUD TO BE PART OF

LIVERPOOL JOHN MOORES UNIVERSITY

WWW.SCHOOLSOBSERVATORY.ORG

Triangulum galaxy by The Schools' Observatory

STEM Club

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