



Welcome to the Planet Pavilion – here are some questions to answer!

The Jodrell Bank Orrery

This is a moving model of our Solar System (if it is not moving, **turn the handle**)

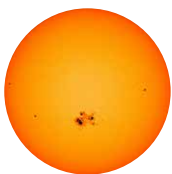
The **time** it takes for the planets to orbit the Sun is to scale.

1 minute for the Orrery = 1 Earth year

The sizes of the planets and the distances from the Sun are **not** to scale.

Real diameter of the Sun:
1,391,000 km

Real diameter of the Earth:
12,756 km



Real Earth-Sun distance: **150 million km**

The Sun in our Orrery has a diameter of **15 cm**.
For things to be to scale, the ratios of the sizes must be equal:

$$\frac{\text{Real Sun Diameter}}{\text{Model Sun Diameter}} = \frac{\text{Real Earth Diameter}}{\text{Model Earth Diameter}}$$

1. Find approximately what the diameter of the model Earth should be, if the Orrery were built to scale.

2. Write a similar equation to the one given, which can be used to calculate the Orrery's Earth-Sun distance. (Hint: you will still need to include the real diameter of the Sun or Earth)

3. Use your equation to calculate approximately what the Orrery's Earth-Sun distance should be, if the Orrery were built to scale.

Worksheet 2 / Planet Pavilion

Around the room are images of objects in deep-space taken by various space and ground-based telescopes, observing in different ranges of the electromagnetic spectrum.

- The Orion nebula is the closest star-forming region to our Solar System. How far away is it?

lightyears

(A light year is the distance a beam of light will travel in a year: about 10 trillion kilometres)

- Which nebula is the remnant of a star which was seen to explode in 1054 AD?

Nebula

- Our Solar System is part of the Milky Way galaxy. What is the name of our nearest large spiral galaxy?

How far away is it?

lightyears

- At the centre of our Milky Way galaxy is a supermassive black hole called Sagittarius A*. How many times heavier than the Sun is this black hole?

Notes:

Worksheet 3 / Space Pavilion



Welcome to the Space Pavilion – here are some questions to answer!

Start around the wooden model of the Lovell telescope

1. What part of the EM spectrum do the telescopes at Jodrell Bank observe?

2. What is the diameter of the Lovell telescope?

3. The dish of the Lovell telescope is a paraboloid shape. Why is this important?

4. What temperature is the receiver on the Lovell telescope? Why is this important?

5. List two potential sources of interference for the Jodrell Bank telescopes.

Check out: People of Jodrell Bank

Find out about some of the science and engineering careers available in astronomy.

Job map:		
Head of computing	Pulsar astrophysicist	Research engineer
Power engineer	Radio engineer	Telescope controller
Planetary nebulae astrophysicist	Telescope engineer	Cosmology astrophysicist
Signal transport engineer	Director of e-MERLIN network	Supernovae astrophysicist

Check out: the Infrared Camera

Try: Hold up the props in front of the screen. Which are opaque and transparent in infrared?

Try: Hold your hand against something room-temperature for a few seconds, then let go.

Worksheet 4 / Space Pavilion

Step inside the Big Bang Cone

Hit the button to hear the 'sound' of the expansion of space over the first 100 million years.

This is not really a sound – it has been created from observations of the cosmic microwave background radiation.

6. How long after the Big Bang were the following things formed?

a. Hydrogen and Helium nuclei.

b. Atoms.

c. The first stars.

Find the Plasma Ball. Stars are made of plasma.

Plasma is the 4th state of matter. Atomic nuclei and electrons are not bound together and move around freely.

7. Explain what happens in terms of a flow of charge when you touch the sphere.

Find the area about Pulsars

Pulsars are rapidly rotating neutron stars, sometimes left over after blue giant stars go supernova.

8. Which astronomer first discovered pulsars?

Find the dome showing two planets orbiting a star

This shows an exoplanet system. Exoplanets are planets outside our solar system, orbiting other stars.

9. This demonstrates the transit method of detecting exoplanets. The amount of light from the star is being measured by a camera (in the red circle) and being displayed on screen.

Explain how exoplanets can be discovered by this method.

10. Which planet (small or large) is easier to detect? Why?

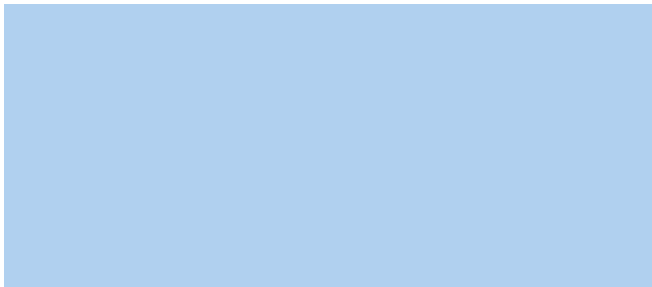
Worksheet 5 / Space Pavilion

Find the box on the floor with a pole sticking out of it

This is another way of discovering exoplanets. Stars and planets actually orbit around each other.

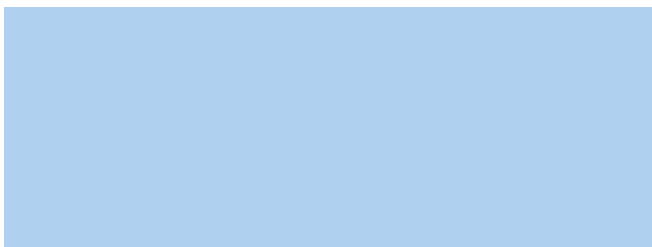
Stars (including the Sun) 'wobble' back and forth as their planets go around them.

11. How do astronomers measure the amount a star is wobbling?



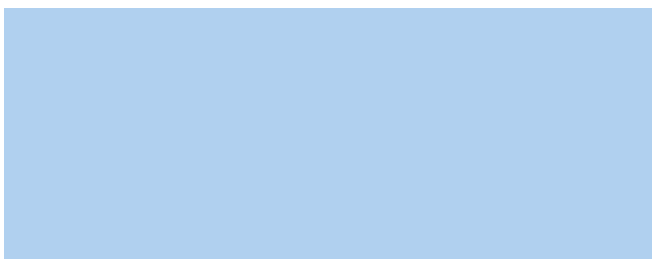
Go to the World Map of Big Telescopes

12. The Lovell telescope is the third largest steerable telescope in the world. The second and first largest are the Effelsberg telescope and the Robert C. Byrd Green Bank telescope, respectively. What is the (approximate) diameter of these?



13. Jodrell Bank is home to the project headquarters for the Square Kilometre Array, a radio telescope which will be a giant network of many smaller detectors.

On which two continents will the SKA detectors be based?



Check out: the see-through Reflecting Telescope

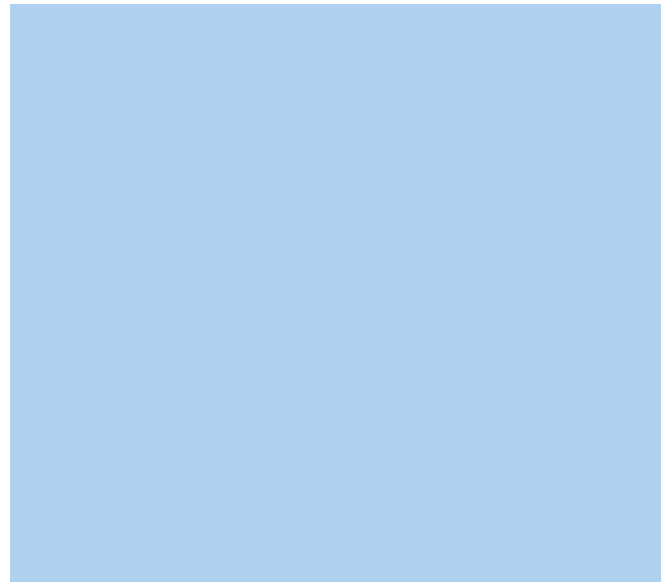
This is a Newtonian style optical telescope.

Sir Isaac Newton was the first to use curved mirrors to focus light, instead of lenses.

Find the eyepiece which allows you to see your own eye

Adjust the light level and observe the effect on your pupil.


14. How does this demonstrate one advantage of building big telescopes?



Find the wheely-truck exhibit

This exhibit tells the story of the early experiments at Jodrell Bank in the 1950s and 60s into building interferometer networks of radio telescopes. Spin the wheel to move the truck. Start at Jodrell Bank.

15. What were bright radio sources originally called, when first discovered in the 1940s?



16. Name the two brightest radio sources that are 'visible' from Jodrell Bank.



Worksheet 6 / Space Pavilion

17. As a result of the interferometry techniques, the Jodrell Bank astronomers realised some of these very bright radio sources were coming from extremely small point sources on the sky. What had they discovered?

18. What is the equivalent size of the UK's e-MERLIN network of radio telescopes?

Find the spiral-arm model of an interferometer

This is a model of a modern interferometer network of radio telescopes.

It shows how interferometers can vastly improve the resolving power of radio telescopes.

19. Describe/sketch the view of galaxy M82 with the following sections active.

a. Central core only

b. Some spiral arms only

c. Central core and all spiral arms