

Astronomy Across the Spectrum: Student Worksheet

You are going to investigate the world beyond your senses.

Check that you have the following equipment (see Picture 1):

- 1 Computer with Infrared Universe App
- 2 Pair of cameras
- 3 Telescope
- 4 Remote Control
- 5 Compass
- 6 Bottle of Coca Cola (not potable)
- 7 Fabric of different colours

If you have all of the equipment, now follow the instructions below.

Starter Activity: Prepare yourself to go beyond your senses

Be sure that you have a clear view towards the projection screen.

In this experience you will hear a note that tone pitch will increase with time. At the same time you will see a stopwatch on the projection screen starting when the first note sounds.

Pay attention and keep silent during the activity! Once you are no longer able to hear the note write down the time of this moment.

I stopped hearing the note _____ seconds after the start.

Remain silent until the educator stops the activity.

The educator presents a slide that shows the variation of the tone pitch with time of the performed experiment. Find out the maximum frequency you are able to hear.

My auditory threshold (maximum frequency):

Testing your eyes

After testing your ears you now are going to test your visual threshold.

Have a look at the Spectrino model - the rainbow colours and corresponding colourful light emitting diodes (LEDs) below.

a) Comment on what you perceive when looking at the LEDs with the naked eye.

b) Turn both cameras towards the spectrino, focus the cameras have a look at the computer screen. Comment on what you see and on possible differences between Camera 1 and Camera 2.

c) Use your mobile phone camera and point it towards the Spectrino model. Use both, the front and back side camera. Comment on what you notice.

You now are an astronomer investigating different astronomical objects with two different detectors - the cameras. Use the compass to find the objects in the room. You don't have to pay attention to the order of the astronomical objects on the worksheet. Choose the objects in a way that only 1-2 groups are doing each object at a time.

Object 1 (Constellation)

Location:

clockwise from North

degrees from horizontal

Questions:

1a) What colours of stars can you see?

Blue, red, white, orange

1b) Which are likely to be the hottest stars?

blue

1c) Which are likely to be the coldest stars?

red

1d) Which do you think are the youngest and oldest stars?

Blue - young, red - oldest

1e) Do you know the name of this constellation?

Taurus

1f) Do you notice anything different when you look with the infrared camera? Any suggestions why?

1g) Do you notice anything else interesting about or near this constellation?

Object 2 (Constellation)

Location:

67 degrees clockwise from North

+5 degrees from horizontal

Questions:

- a) What colours of stars can you see?
- b) Which are the hottest stars and which are the coldest?
- c) Describe what you see in the infrared camera?
- d) What do you think the infrared emission might be?
- e) Do you know the name of this constellation?

Orion

Object 3 (Dark Cloud - Barnard 68)

Location:

90 degrees clockwise from North

-20 degrees from horizontal

Questions:

- a) Describe what you see with the naked eye:
- b) Describe what you see with the visible camera:

c) Describe what you see with the infrared camera:

d) What do you think is causing the differences between the visible and infrared images?

Object 4 (Horsehead Nebula)

Location:

250 degrees clockwise from North

+35 degrees from horizontal

Questions:

a) Describe what you see with your naked eye?

b) What do you think creates the apparent "horsehead" shape?

c) How many stars appear brighter in the infrared?

d) Why do you think we can see some stars better in the infrared image?

Object 5 - (Nebula)

Location:

300 degrees clockwise from North

+50 degrees up from horizontal

Questions:

a) How many stars are only visible in the IR?

b) Do you think that they are new or old stars?

...

If you have finished, collect the extra sheet of activities to try with your infrared camera.

Other activities with the cameras

Remote control

Point the remote into the two cameras and press one of the keys.

- 1) What do you notice in the infrared camera?
- 2) Can you see anything change with your eye?
- 3) What about your mobile phone camera?
- 4) What have you learnt?

Coke Bottle

What do you notice when you look at the coke bottle in the infrared camera?

Transmission and Reflection

Infrared radiation can be emitted (produced) and reflected by different objects.

If an object is reflecting infrared radiation, it will look white through the camera.

Use the infrared camera to look at objects in the room and fill in the table

<u>Object</u>	<u>Emitted or reflection of infrared?</u>
Your bare arm	
Your eyes	

Exoplanets

- Search for 3 planetary systems located around the room.
- Use your telescope so that you can see them more clearly clearly.
- Take a screenshot for both cameras by pressing the Stop button

Extrasolar planet system 1

- a. Degrees clockwise from North:
- b. Degrees up from horizontal:
- c. How many planets do you see?
- d. Draw a sketch of the solar system:

Extrasolar planet system 2

- a. Degrees clockwise from North:
- b. Degrees up from horizontal:
- c. How many planets do you see?
- d. Draw a sketch of the solar system:

Extrasolar planet system 3

- a. Degrees clockwise from North:
- b. Degrees up from horizontal:
- c. How many planets do you see?
- d. Draw a sketch of the solar system:

(Advanced)

Use your screenshot and a ruler to work out if there are any exoplanets in the three solar systems that might harbour life using the following steps:

	Solar System 1	Solar System 2	Solar System 3
Temp			
Luminosity			

1. Calculate the brightness of the star
2. Calculate how far away from the star it is too cold
3. Calculate how far each of the exoplanets are away
4. Work out the temperature for each planet)

Summary

As our visiting astronomers, you have used an IR telescope to count how many stars are hidden behind dust clouds, located some of our cold stars and discover if we can find some exoplanets in nearby solar systems. (Advanced, and you have worked out if any of those exoplanets are worth studying further to see if we can find life!)