

# Cool Cosmos



## SEEING IN A DIFFERENT LIGHT

### Objectives

- To learn about the Herschel Space Observatory and understand how it is able to see things that are seemingly invisible to normal vision
- To experiment with infrared light
- To build a cardboard model of the Herschel Space Observatory

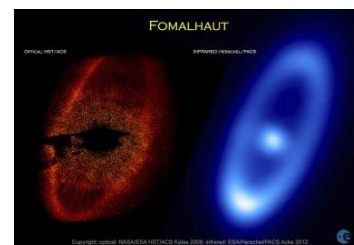
### Resources required

- Television
- Remote control for television
- Mirror
- 1 photocopy of the cut out Herschel telescope per pupil (on to card)
- Scissors (for each pupil)
- Glue (for each pupil)



### Teaching activities

### Background



The European Space Agency's Herschel Space Laboratory was the most powerful infrared telescope ever flown in space. Herschel ran out of liquid helium coolant in 2013 concluding more than 3 years of observing. Although Herschel is no longer working, it will continue to make many new discoveries over the next few years. Herschel produced so much data that it will take scientists and astronomers many years to go through it all!

(It is a similar story with Caroline and William Herschel whom this telescope is named after. They were great astronomers 250 years ago. As they observed and made new discoveries such as the planet Uranus and many comets and nebulae, Caroline diligently recorded every observation. Their catalogues have been used by astronomers ever since.)

The Herschel Space Laboratory telescope's huge mirror at 3.5-metres in diameter is the biggest ever space telescope mirror. Being so large it was able to collect infrared light from some of the coldest and dustiest and most distant objects in the Universe.

Infrared is a type of light that we cannot see with our eyes. Our eyes can only see what we call visible light.

## Cool Cosmos: SEEING IN A DIFFERENT LIGHT

Infrared light brings us special information that we do not get from visible light. It shows us how much heat something has and gives us information about an object's temperature. Everything has some heat and puts out infrared light. Even things that we think of as being very cold, like an ice cube, put out some heat. Cold objects just put out less heat than warm objects.

Cold things show up in infrared light as darker blue/purple colours and hot things are lighter orange, yellow and white.

### Activity 1 – Looking at infrared images (Great activity on an interactive board)

Look at the following infrared images and guess what they are. Put the mouse over the image to find the answer and more information.

<http://www.ipac.caltech.edu/outreach/Edu/Guess/>

### Activity 2 – Infrared light in our everyday lives

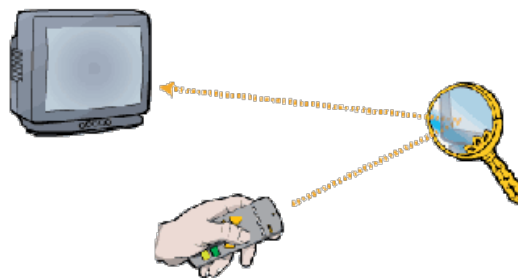
Television remote controls work by means of infrared radiation rather than visible light. That's why you can't see the beam when you change channels. Because infrared radiation has a longer wavelength than visible light, it behaves differently when it encounters objects that get in its way.

Just like the Herschel Space Observatory you can use a mirror to reflect infrared light. Make sure the TV is turned off. Turn your back to the TV and hold up the mirror so that you can see the TV in the mirror. Aim the remote at the image of the TV in the mirror and push the "on" button. Can you turn the TV on?

Turn the TV off and go into the corridor so that you can't see the TV. Set up the mirror so that you can see the reflection of the TV in the mirror. Point the remote at the reflection. Can you turn the TV on? You might have to fiddle with the position of the mirror and the remote.

Now try turning on the TV with the remote with different objects, such as a piece of paper or a person in the way. What does the infrared signal pass through?

The remote control system won't work if someone walks between it and the TV because the infrared signal is absorbed by the person.



### Activity 3 – Build your own Herschel Space Observatory

Follow the instructions on the pdf sheet to create your own Herschel Space Observatory.

[http://herschel.cf.ac.uk/files/HerschelCutoutModel\\_v2.pdf](http://herschel.cf.ac.uk/files/HerschelCutoutModel_v2.pdf)

### Web links

For more information on Herschel see:

<http://herschel.cf.ac.uk/>



www.spacefund.co.uk



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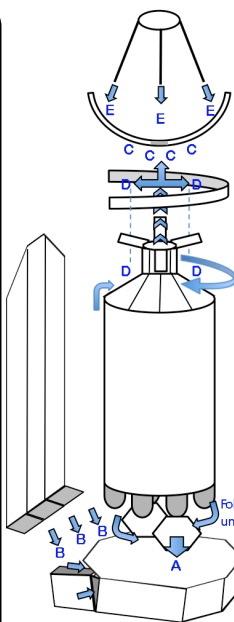
# Instructions:

- 1) Bus Module: fold bottom flaps under top section. Cut and fold side panel triangles.
- 2) Roll cryostat body into a cylinder and stick
- 3) Fold **A** triangle flaps onto grey **A** heptagon on cryostat bottom, then to white **A** heptagon
- 4) Stick Cryostat-mirror collar
- 5) Thread top of cryostat body through collar sticking **D** tabs to inside of collar
- 6) Fold secondary mirror arms down
- 7) Stick primary mirror so it is concave
- 8) Stick secondary to primary mirror with **E** tabs
- 9) Stick cryostat body **C** tabs to bottom on primary mirror
- 10) Stick sunshield **B** tabs to Bus module
- 11) Stick white **A** heptagon to Bus module



herschel

Sun Shield

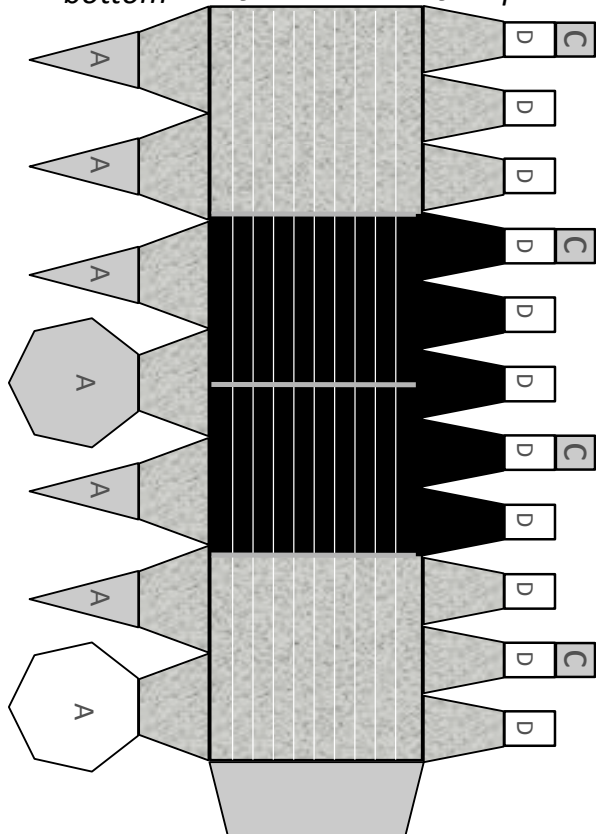


Secondary Mirror

Cryostat-mirror collar

(thread D tabs through inside)

bottom Cryostat body top



Primary Mirror

top Bus Module bottom

