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ANIMATION SCRIPT

BUILDING A CAMERA TO SEE THE FIRST GALAXIES

THE MUSCAT TEAM

TO MAKE THE MOST OUT OF THIS SCRIPT, YOU COULD:

- Stick it in your book as a record of watching the MUSCAT team's animation
- Pause the animation and make notes as you go
- Add your own illustrations to the sheet
- Create your own animation to accompany it
- Add notes from classroom discussions
- Make notes of areas you will investigate further
- Make notes of key words and definitions
- Add questions you would like answered – you can message Sam, Víctor and Marcial through the comments box at the bottom of their article: **www.futurumcareers.com/building-a-camera-to-see-the-first-galaxies**

SCRIPT:

Have you ever tried to imagine seeing colours that you have never seen before? Have you wished you could see with x-ray vision or spot things at night with infrared eyes?

Astronomers do not have to imagine what it is like to see beyond the visible spectrum. They have long been finding new perspectives on stars and galaxies by tuning into different wavelengths of the electromagnetic spectrum.

However, there are still some wavelengths that have been invisible to astronomers until recently. One of these 'blind spots' is in the millimetre range, around the boundary between infrared and microwaves.

That is why an international team of scientists and engineers, including Dr Sam Rowe at Cardiff University in the UK and Dr Víctor Gómez and Marcial Tapia at the National Institute of Astrophysics, Optics and Electronics in Mexico have been working on the Mexico UK Submillimetre Camera for AsTronomy, or MUSCAT.

MUSCAT is an astronomical camera, designed and built from scratch by this collaborative team.

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The camera is about to be installed at the Large Millimeter Telescope in Mexico. This telescope collects electromagnetic radiation from space, and MUSCAT will measure the millimetre wavelengths.

Optical components guide incoming millimetre wavelengths of radiation onto the focal plane which contains kinetic inductance detectors, or KIDs. These are sensitive detectors that measure the very faint light signals that arrive from space. Víctor was responsible for designing the KIDs for MUSCAT.

A significant challenge was that KIDs only work at extremely low temperatures, so a complex cooling system had to be designed to cool the camera to 0.1 Kelvin, or -273.05 °C!

The signals captured by the detectors are turned into digital data by the readout system. Sam and Marcial have been developing the electronics and software to do this, allowing astronomers to analyse the new millimetre information being received from space.

Historically, very few astronomical observations have been from millimetre waves. What have we been missing out on?

For a start, MUSCAT will enable astronomers to see into cold clouds of interstellar dust that absorb the ultraviolet, visible and infrared wavelengths emitted by stars. Being able to see the millimetre wavelength radiation re-emitted by these clouds will help us to understand more about how very large stars form.

In the years to come, hopefully MUSCAT will allow astronomers to answer many of the unanswered questions about the universe in which we live.

What could you achieve in the field of astronomy technology?

What new discoveries about our Universe would you make?