AN "EXTREMELY LARGE" WINDOW TO THE UNIVERSE

When complete, the Extremely Large Telescope (ELT) will be by far the largest visible to mid-infrared telescope ever built.

The telescope will be built by the European Southern Observatory on a 30-km peak at Cerro Armazones in Chile.

It will gather 27% more light than the Hubble Space Telescope and produce images 13 times clearer.

The ELT will dwarf the scientists that work with it.

The ELT is being built by the European Southern Observatory (ESO) with 13 member states, of which the UK is a major partner.

All around the UK, scientists, engineers, and companies are working together to help create this amazing telescope.

The ELT is the only telescope capable of directly imaging rocky planets beyond our Solar System that up to now have only been seen indirectly. We will measure the atmospheric composition and even search for possible biomarkers.

The ELT will also help us to understand the elusive "dark matter" that pervades the cosmos and even more mysterious "dark energy" that seems to be causing the Universe to expand at an ever-increasing rate.

Of course, the most exciting discoveries will be those that we can’t even predict yet.

The primary mirror

Spanning 33.3 metres across, the primary mirror of the ELT will be made up of 798 individual hexagonal mirror segments, each measuring 1.45 metres.

Each mirror segment can move independently to compensate for changes in the shape caused by temperature fluctuations and gravity.

How the mirrors work

The ELT has a unique system of five mirrors and an advanced adaptive optics system.

a. Mirror 1: The 3.93-metre primary mirror collects light and reflects it to the secondary mirror.

b. Mirror 2: A 1.8-metre mirror that reflects light back down to the third mirror.

c. Mirror 3: The 3.0-metre relay mirror reflects light to the adaptive mirror located directly above.

d. Mirror 4: The adaptive optics system uses data derived from monitoring real or laser guide stars to compensate for atmospheric distortions.

e. Mirror 5: The 2.642-metre mirror is mounted on a fast-moving stage that allows it to tip and tilt to stabilise the image.

f. Mirror 5 directs the light to instruments - cameras and spectrographs - on the stationary platforms.

Science instruments
Un-be-leaf-able!

The ELT will be much more powerful than any other telescope currently in existence. If it were placed at Land's End, it could see a bumblebee at John O'Groats... This power means it's going to be able to make some unimaginable discoveries!

From distant stars to small cells

The ELT's incredible adaptive optics allow astronomers to take really clear images of stars by stopping them from twinkling (there's more about how this works on the other side of the poster). Amazingly, this technology can also be used to look at very small things here on earth in un-be-leaf-able detail.

Biological and medical researchers have been working together with imaging experts to study the environment within cells.

A family of telescopes

The ELT will complement other major telescopes on the ground and in space. This includes the James Webb Space Telescope, which will be the largest observatory in space when it launches in 2019.

An industrial revolution

It is only possible to make the ELT to be the size it is because it has driven an 'industrial revolution' in telescope construction.

Unlike other large telescopes, the ELT will be made up of lots of smaller components that fit together, rather than a few one-off items.

The telescope's primary mirror is a great example of this – it will be 39 metres across, and made up of 798 hexagonal segments.

This has changed the way the telescope is made, and means that new types of businesses can be involved in its production.

UK involvement

Designing and building the ELT and its instruments is no small task. It's out of reach for any single country, but achievable thanks to many teams and countries around the world working together.

In the UK, experts are playing an important role in making the project happen. Teams in the UK, co-ordinated by the Science and Technology Facilities Council (STFC), are working together in collaboration with ESO to shape one of the biggest global science collaborations in history.

For the future

Current plans for the ELT see it operating for at least 30 years, and hopefully longer.

Once it is operational, many of the researchers using the ELT when it's built will not be the same researchers using existing telescopes today... They will be the next generation of astronomers, who are still in primary school or high school today.

If you are reading this, you might even be one of them!

Who knows what you might discover?