New Scientist

WEEKLY July 1 - 7, 2023

FETAL THERAPY
Groundbreaking treatments save lives before birth

DARK MATTER HUNTER
Euclid space telescope will find what's missing in the cosmos

POWERING UP
Inside the factory making the world's greenest batteries

SPECIAL ISSUE

CIVILISATION

The new evidence rewriting the origin story of our modern world

THE EASY WAY TO GET FIT
Scientific shortcuts to turbocharge exercise

PLUS
DOLPHIN BABY TALK / IS MATHS REAL? / UNEXPECTED UPSIDES OF WORKING OUTSIDE / **ZOMBIE WORMS** / INTERGALACTIC VISITORS

No3445 US$7.99 CAN$9.99

Astronomy

Euclid ready to probe dark cosmos

Space telescope set to launch on 1 July to study the effects of dark energy and dark matter

Leah Crane

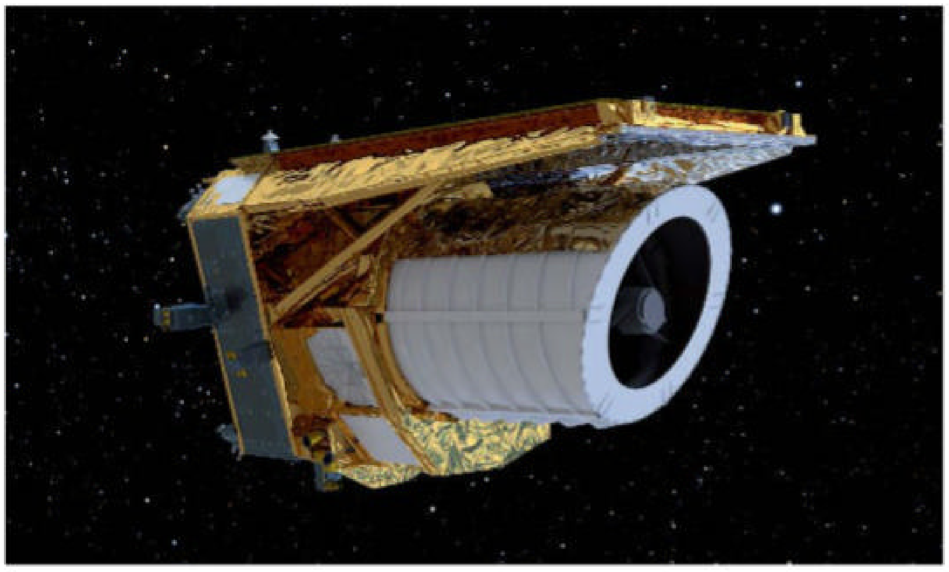
THE European Space Agency (ESA) is gearing up to launch its newest space telescope, Euclid. As *New Scientist* went to press, it was scheduled to blast off from Cape Canaveral in Florida on 1 July. Euclid is designed to help solve two of the biggest mysteries in the universe: dark energy and dark matter.

These two "dark" components make up more than 95 per cent of the cosmos, but we can't see them – hence their names – and know very little about what they could be made of. Astronomers infer the existence of dark matter from the behaviour of the matter that we can see, which acts as if there is some extra source of gravity holding everything together. Dark energy has the opposite effect, causing the accelerating expansion of the universe as a whole.

Euclid has two scientific instruments: a visible light camera to measure the shape of galaxies and a near-infrared detector to measure their brightness and distance. It isn't the first space telescope to use either type of instrument, but it is intended to observe a huge swathe of space, cataloguing more than a billion galaxies across a third of the sky.

"With Hubble and the James Webb Space Telescope, those are great observatories for looking at very small regions with very high sensitivity, extraordinary detail – but it's a bit like looking at the sky through a tiny straw," says Mike Seiffert at NASA's Jet Propulsion Laboratory in California, a project scientist for Euclid. "With Euclid, we're less interested in the properties of individual galaxies and objects than we are in measuring a few properties of many, many galaxies."

An artist's impression of the European Space Agency's Euclid telescope



ESA

Researchers will use these properties to build two types of maps of the universe. The first will use a phenomenon called gravitational lensing, in which relatively nearby matter warps and magnifies the light of objects behind it. The way this bends the apparent shapes of distant objects can tell us about the distribution of the matter acting as the lens.

The distortions are usually tiny, but the huge amount of data Euclid is expected to collect during its six-year mission should allow people to use gravitational lensing to map out the distribution of matter – including dark matter, which we can't see any other way – in the universe. This may help us figure out how dark matter behaves and what it is made of.

The other type of map uses ripples in the matter distribution of the universe called baryon acoustic oscillations. These ripples first formed as sound waves soon after the big bang, when the cosmos was a hot, roiling soup of particles and radiation. Eventually, that soup cooled and the waves froze in place, remaining as slightly more dense regions where more galaxies tended to form as the universe expanded. "Seeing how those wrinkles in the early universe propagated forward and how dark energy affected that will help us understand the evolution of the universe and, really, how the universe works," says Seiffert. ▮

Medicine

3D-printed human heart chamber beats for three months

MINIATURE-sized heart chambers called ventricles have been 3D printed using live human heart muscle cells and shown to beat on their own for at least three months.

Artificial heart tissue can be made by growing heart cells in moulds or on scaffolds, but this typically only enables the construction of simple shapes like sheets or rings.

3D printing allows the creation of more complex structures. In 2019, for example, Nadav Noor at Tel Aviv University in Israel and his colleagues 3D printed a whole heart; however, it couldn't beat.

Now, Tilman Esser at the Friedrich-Alexander University of Erlangen-Nuremberg in Germany and his colleagues have used 3D printing to fabrihcate beating ventricles, the chambers at the bottom of the heart that pump blood to other parts of the body.

They made an "ink" containing live heart muscle cells mixed with collagen protein and hyaluronic acid, which give heart tissue its structure. This was then inserted via a nozzle into a supportive gel that held it in the desired shape during printing, then was melted away to leave the printed structure.

The researchers created ventricle-like structures that were 14 millimetres high and 8mm in diameter, about a sixth the size of human ventricles.

These mini chambers started to beat a week after they were printed and were still beating after 100 days. Like real hearts, they beat faster when treated with a stimulant drug (bioRxiv, doi.org/kgkb).

"The ventricles were still beating after 100 days and, like real hearts, beat faster when stimulated"

The team hopes to print a whole beating heart with all four chambers, but "there are many challenges in the field that come with scaling up organ models to the size of a native organ", says Esser.

For example, real-sized hearts require blood vessels to supply oxygen and nutrients. The researchers want to add a second printing ink containing vascular cells, which they hope will grow into blood vessels in the printed heart. ▮

Alice Klein