New Scientist

WEEKLY January 29 - February 4, 2022

COSMIC CONFUSION
We officially don't know how fast the universe is expanding

COVID BRAIN FOG
What causes it and can it be reversed?

INTO THE METAVERSE
Why virtual worlds are as real as any other

THE MIGRAINE MIND

A new understanding of the condition – and how to treat it

KNOW YOUR EXPOSOME
Your lifetime risk from harmful chemicals

PLUS SALIVA SHARING / **HISTORY OF TIMEKEEPING** / DEFINING EARTH'S NEW EPOCH / **EVOLUTION OF LIES**

Science and technology news **www.newscientist.com**

No3371 US$6.99 CAN$9.99

Cosmology

Clashing figures for universe's growth are starting to look more serious

Leah Crane

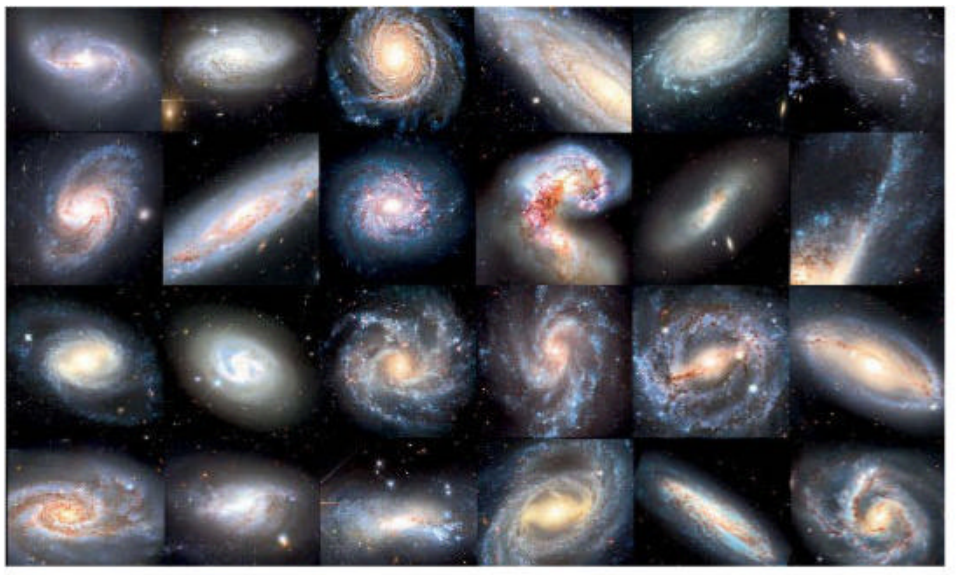
THE expansion of the universe is accelerating, but we don't know how quickly. With new observations, this issue has only become more severe, and now some astronomers are saying that it is officially a real problem – not one caused by uncertainties in the measurements.

There are two main ways we measure the Hubble constant, which describes the expansion of the universe. The first is to examine the cosmic microwave background – a relic of the first light to shine through the universe after the big bang – and use our standard model of cosmology to calculate from that what the expansion rate should be like today. This puts the acceleration rate at about 67 kilometres per second per megaparsec.

The other method, called the local method or the distance ladder, involves measuring the distances to stars called cepheids and then using those distances to extrapolate to supernovae in other galaxies. These distances allow us to calculate the Hubble constant, which the latest measurements from Adam Riess at Johns Hopkins University in Maryland and his colleagues have put at about 73 kilometres per second per megaparsec.

For decades, it has been plausible that these two methods would eventually converge on a single true value of the Hubble constant. Now, Riess and his team say that is extraordinarily unlikely – which would mean that something is wrong with our standard model of the universe.

Hubble Space Telescope galaxy images helped reveal the cosmic tension



ESA

Even after analysing the data in many different ways and including results from other teams, "it's really hard for us to get below about 72.5 or above about 73.5", says Riess. The disagreement between the two calculations is known as the Hubble tension.

By his team's calculations, the two methods of measurement disagree with one another at a statistical level referred to as "5 sigma", generally considered a gold standard in physics for demonstrating that measurements are a true discovery and not a statistical fluke. This means there is only about a 1 in 3.5 million chance that the Hubble tension is just a fluke (arxiv.org/abs/2112.04510).

However, other astronomers have pointed out that even a 5-sigma discrepancy doesn't rule out the possibility of errors or systematic uncertainty in our measurements of stars. "It doesn't matter how many sigma away you are, it's whether you have determined all of the potential errors out there that had led to that place," says Barry Madore at the Carnegie Institution for Science in California.

While the measurements may point towards the Hubble tension being a real problem, we cannot know for certain until it is confirmed by several methods of measurement, says Madore. Thankfully, the newly launched James Webb Space Telescope should be able to help with that, and researchers are also working on other methods, such as using gravitational waves. ▮

Neuroscience

Cash for low-income families improves babies' brain activity

GIVING low-income families in the US more money changes a child's brain activity.

Kimberly Noble at Columbia University in New York and her team are studying how exactly child poverty causes reduced grey matter volume in the hippocampus and frontal cortex, which are associated with the development of thinking and learning. These changes have been seen throughout childhood and adolescence.

They are tracking development in the brains of 1000 babies from low-income families in four US metropolitan areas: New York City, greater New Orleans, Minneapolis–Saint Paul and Omaha. Each family had an average annual income of just over $20,000.

The team gave half the babies' mothers a monthly stipend of $333 and the other half $20 a month. The first payment was received soon after their baby's birth. "They can spend the money however they want – no strings attached," says Noble. She says they chose to give $333 a month because that adds up to about $4000 a year, which studies suggest is an increase in wealth that has been linked with improvements in a child's school performance later in life.

By July 2020, the babies had reached their first birthday. Just before or soon after turning 1, 435 of the children had their brain activity recorded using EEG – about 40 per cent were in families receiving $333 a month and 60 per cent were in families given $20 a month. The team couldn't take recordings from all 1000 due to complications caused by the covid-19 pandemic.

"We're showing for the first time that poverty reduction has a causal impact on brain activity"

The researchers found that, on average, children from families that received $333 a month had more brain activity in higher frequencies than those in the $20 group (*PNAS*, doi.org/hdqj).

"We're showing for the first time that poverty reduction has a causal impact on brain activity," says Noble. ▮

Jason Arunn Murugesu