Cosmic Stocktake Reveals What's Left of Big Bang

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The Universe has guzzled its way through about 20 per cent of its normal matter, or original fuel reserves, according to findings from a survey of the nearby Universe by an international team of astronomers involving researchers at The Australian National University.

The survey, to be released at the General Assembly of the International Astronomical Union in Prague today, revealed that about 20 per cent of the normal matter or fuel that was produced by the Big Bang 14 billion years ago is now in stars, a further 0.1 per cent lies in dust expelled from massive stars (and from which solid structures like the Earth and humans are made), and about 0.01 per cent is in super-massive black holes.

The survey data, which forms a 21st century database called the Millennium Galaxy Catalogue, was gathered from over 100 nights of telescope time in Australia, the Canary Islands and Chile, and contains over ten thousand giant galaxies, each of these containing 10 million to 10 billion stars.

According to the survey leader Dr Simon Driver of St Andrews University, Scotland, the remaining material is almost completely in gaseous form lying both within and between the galaxies, forming a reservoir from which future generations of stars may develop.

“I guess the simplest prognosis is that the Universe will be able to form stars for a further 70 billion years or so after which it will start to go dark," said Dr Driver. “However, unlike our stewardship of the Earth the

Universe is definitely tightening its belt with a steady decline in the rate at which new stars are forming."

Dr Alister Graham, an astronomer at The Australian National University who worked on the survey, said that the team of researchers were able determine how much of matter is in the stars through a 'cosmic stocktake.'

"We needed to measure the stellar mass within a representative volume of the local Universe. This required accurate and complete distance information for all the galaxies of stars that we imaged. This is where the Australian telescopes played a key role," Dr Graham said.

One of the unique aspects of this program was the careful separation of a galaxy's stars into its central bulge component and surrounding disc-like structure. This allowed the researchers to determine that, on average, roughly half of the stars in galaxies reside in discs and the other half in bulges.

"Measuring the concentration of stars in each galaxy's bulge is what enabled us to determine their central super-massive black hole masses," said Dr Graham. "Some of these are up to one million billion times more massive than the Earth. Once we had these masses it was a simple task of summing them up to determine how much of the Universe's matter is locked away in black holes at the centres of galaxies."

Dr Graham said next-generation telescopes such as the Giant Magellan Telescope, currently in production, will enable astronomers to directly measure black hole masses in galaxies ten times further away and thus ten times further back in time. "In effect, we'll soon be able to observe how galaxies and their black holes evolved into what we see around us today."

Other members of the research team include Paul Allen and Ewan Cameron of The Australian National University, Jochen Liske of the European Southern Observatory, and Roberto De Propris of the Cerro Tololo Inter-American Observatory.

The Millennium Galaxy Catalogue consists of data from the Anglo-Australian Telescope, The Australian National University's 2.3 m telescope at Siding Spring Observatory, the Isaac Newton Telescope and the Telescopio Nazionale Galileo at the Spanish Observatorio del Roque de Los Muchachos of the Instituto de Astrofisica de Canarias, and also from the Gemini and ESO New Technology Telescopes in Chile.

Source: Australian National University