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MeerKAT discovers mystery clouds



Dark cloud discovery: Overlay of MeerKAT 21cm neutral hydrogen gas on a deep optical image.

An international team of astronomers led by Professor Gyula Józsa, Professor Michelle Cluver and Professor Thomas Jarrett from the Department of Astronomy at the University of Cape Town (UCT), has utilised the South African MeerKAT telescope to discover a mysterious chain of hydrogen gas clouds the size of a massive galaxy.

The accumulation of so much elemental hydrogen without associated stellar components is the largest yet discovered. Appearing at the edge of a relatively massive group of galaxies, there is the possibility that the cloud chain is gas stripped from group-member galaxies, but it may also be primordial and gravitationally drawn into the group through a cosmic filament pathway. Whatever the case, MeerKAT is proving to be a ground-breaking telescope, and many such discoveries should soon follow this "dark" cloud discovery in the exciting days ahead.

The findings are published in the [*Astrophysical Journal*](#).

"It is very puzzling to see such a massive and large gas cloud without a "host" galaxy, or simply, where are the stars? The hydrogen is the fuel for star formation, and so where you have a lot of hydrogen, amassed into a dense object, you have stars (or better, a galaxy of stars). So, it is quite a discovery," said Jarrett.

"Other 'dark' clouds have been seen of course, going back decades, but nothing this large or concentrated like a big galaxy. What I think is that these things exist, perhaps in large numbers, but it required a new and amazing telescope — MeerKAT — to finally see them."

Jarrett said the project started 5 years ago, in 2016, with investigation of a particular region of the sky called G23 (GAMA Field 23), in which they have optical redshifts and infrared imaging.

"We have been working on understanding the galaxy distribution and evolution. We then proposed MeerKAT observations (in 2019) to go after a cosmic filament in our field, a very interesting large-scale object in its own right, worthy of additional study."

With regard to the discovery, Jarrett said, "One day I was looking at the data — the data cube that is — using our new VR system developed by the IDIA/UCT-Astro Visualisation Laboratory, and by golly, I noticed this strange-looking object in the hydrogen gas emission."

One thing led to another as they dived into deep imaging from the data repository arsenal, and realised the "fuzzy blob" or just "blobby", did not have a counterpart in the UV, optical and infrared. That is, no-host galaxy. It was free-floating.

"And then one day we were looking at another data archive, of a survey done 20 years ago using a single dish antenna (the famous "The Dish" telescope in Parkes, Australia), and we could see our fuzzy blob in their data (only a spectrum, not an object with structure). It's in our paper; this was a great thing because now we are 100% sure it is real."

Jarrett commented: "This discovery has huge implications because we found this thing relatively easily, and we think this must be more common. It may be a completely new type of object, and that always leads to a new understanding of nature, or it might be a new class of object, common but not seen until now, that will also lead to new insights with galaxy evolution."

"What is next for us is to figure out how this cloud came to be, and where it is going. It could be the detritus from a titanic collision between two galaxies, stripping and separating the gas from the stars. But we really don't see the progenitors, the two (or however many) galaxies that did this. They could be there, just hiding somehow," he said.

"Alternatively, it could be more pristine (primordial) gas that has been flowing through the filament of the cosmic web, into the "attractor" that it appears to be aimed. This gravitational attractor is a massive galaxy group (many galaxies, bound together to form a group). We need deeper MeerKAT observations, and a deeper optical imaging to dig down into the fainter stuff to see if we can discern any gas or star "trails" that point to a past tidal disturbance."

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