UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

6 July 2021

MEDIA RELEASE

UP researcher uses MeerKAT to discover large gas-rich galaxy group hiding in plain sight

PRETORIA – A study led by a University of Pretoria (UP) master's student using South Africa's MeerKAT telescope has led to the discovery of a group of 20 galaxies.

This large galaxy group is likely the most neutral hydrogen gas-rich group ever discovered. It is the first time this group has been identified, despite residing in a very well-studied area of the sky.

The research was led by Shilpa Ranchod, an MSc student at UP's Department of Physics, supervised by Professor Roger Deane, founder of the UP Radio Astronomy Research Group, and now Extraordinary Professor. "The distribution of neutral hydrogen gas in these galaxies has revealed interesting, disturbed morphologies suggesting that these galaxies are group members and are being influenced by their cosmic neighbours in the group," Ranchod said. "For example, we found an interacting pair of galaxies that will potentially merge to form a new galaxy with a completely transformed appearance."

Ranchod added that the MeerKAT observations show a galaxy group in its early stages of formation, which is extremely rare. "Through this, we are able to understand how galaxy groups are assembled and evolve. This group inhabits an area of sky that has been studied by many other telescopes, but the group structure has been revealed for the first time due to MeerKAT's excellent sensitivity."

Most star-forming galaxies are embedded within a cloud of cold neutral hydrogen gas, which acts as the raw fuel from which stars can eventually form. This gas is extremely faint and can only be detected in radio wavelengths. It is diffuse and extends beyond the visible part of the galaxy. By observing this hydrogen gas, astronomers are able to understand the evolutionary processes that take place in galaxies.

The majority of galaxies in the Universe reside in groups. However, it is rare to detect a group with such a large number of members with so much neutral hydrogen. This suggests that the group is still in the process of assembly, as it has not undergone evolutionary processes that would remove this gas from the galaxies.

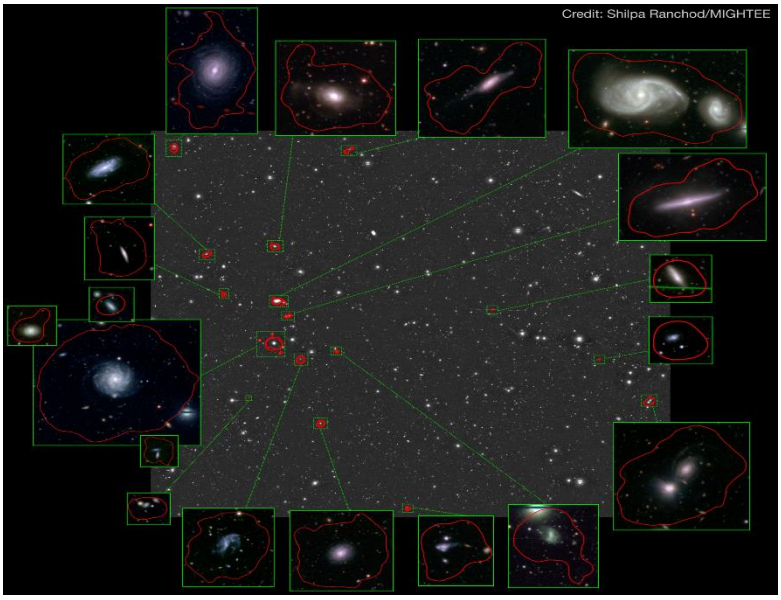
This galaxy group was discovered by the MeerKAT International Gigahertz Tiered Extragalactic Exploration (MIGHTEE) survey. It is one of the large survey projects in progress using South Africa's MeerKAT telescope and involves a team of South African and international astronomers. The MeerKAT radio telescope in the Northern Cape, South Africa's precursor to the Square Kilometre Array (SKA), aims to answer fundamental questions about the formation and evolution of galaxies. Its exceptional sensitivity provides astronomers with further insight into the drivers of galaxy evolution.

"MeerKAT continues to impress us with new discoveries, thanks to some brilliant South African engineers who have delivered a world-leading instrument," said Prof Deane. "To see our bright young students take hold of the scientific opportunities this presents and carry out internationally acclaimed research is both a rewarding and essential step as we plan ahead toward the Square Kilometre Array era."

Ranchod's galaxy group was found in a survey that produces hundreds of terabytes of data, which are processed via the cloud computing facility hosted by the inter-university Institute of Data-Intensive Astronomy (IDIA), a partnership between the universities of Pretoria, Cape Town and the Western Cape.

Professor Chris Theron, Head of UP's Department of Physics, noted that, "By equipping smart and inquisitive students with the hardware and software tools required to carry out big data research, we open enormous discovery potential. In the Department of Physics, we endeavour to do exactly that."

Prof Theron represents UP on the inter-university Institute for Data-Intensive Astronomy management team. An article on this discovery will be published in the Monthly Notices of the Royal Astronomical Society. Publicly available pre-print: https://arxiv.org/abs/2107.01237



Caption: Optical image of the galaxy group with three-colour optical images of each member galaxy. The red outline indicates the extent of the neutral hydrogen gas around each galaxy. The central image, also showing the many thousands of background galaxies, is one degree on each side, large enough to fit four full moons. (Shilpa Ranchod/MIGHTEE/HSC project)

Caption: A three-colour optical image of two of the group galaxies. The diffuse red structure is the neutral hydrogen gas, which envelops both galaxies, and indicates they are in the process of merging

(MIGHTEE/HSC Project)

Caption: South Africa's MeerKAT telescope (South African Radio Astronomy Observatory)

Images are attached

Media enquiries:

Please email Prim Gower at Primarashni.gower@up.ac.za or call 083 229 9011.

ABOUT THE UNIVERSITY OF PRETORIA

The University of Pretoria (UP) is one of the largest contact and residential universities in South Africa, with its administration offices located on the Hatfield Campus, Pretoria. This 113-year-old institution is also the largest producer of research in South Africa.

Spread over seven campuses, it has nine faculties and a business school, the Gordon Institute of Business Science (GIBS). It is the only university in the country that has a Faculty of Veterinary Science which is ranked top in Africa, and overall has 120 academic departments, as well as 92 centres and institutes, accommodating more than 55 000 students and offering about 1 100 study programmes.

UP is one of the top five universities in South Africa, according to the 2019-2020 rankings by the Center for World University Rankings. It is also ranked among the top 100 universities worldwide in three fields of study (veterinary science, theology and law), and among the top 1% in eight fields of study (agricultural sciences, clinical medicine, engineering, environment/ecology, immunology, microbiology, plant and animal sciences and social sciences).

In May 2020, the annual UK Financial Times Executive Education Rankings once again ranked GIBS as the top South African and African business school. The University also has an extensive community engagement programme with approximately 33 000 students involved in community upliftment. Furthermore, UP is building considerable capacities and strengths for the Fourth Industrial Revolution by preparing students for the world beyond university and offering work-readiness and entrepreneurship training to its students.

As one of South Africa's research-intensive universities, UP launched the Future Africa Campus in March 2019 as a hub for inter- and transdisciplinary research networks within UP and the global research community to maximise 4IR innovation and address the challenges and stresses our continent and world is facing. In addition UP also launched the Javett Art Centre in September 2019 as a driver of transdisciplinary research development between the Humanities and other faculties. In November 2020 UP launched Engineering 4.0. as a hub not only for Smart Cities and Transport, but also to link the vast resources in technology and data sciences to other faculties via Future Africa. These initiatives are stimulating new thinking at the frontier of 'science for transformation'.

For more information, go to www.up.ac.za