

Issued by:

Jan King
Communications Manager, University of Queensland
07-3365-1120 (office) 0413-601-248 (mob.)
j.king@uq.edu.au

Helen Sim
Public Relations and Media Liaison, Anglo-Australian Observatory
02-9372-4251 (office) 0419-635-905 (mob.)
hsim@aaoepp.aao.gov.au

Research contacts and image URLs at end

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Astronomers discover dozens of mini-galaxies

Astronomers using the Anglo-Australian Telescope (AAT) at Siding Spring Observatory in NSW have found more than forty previously unknown miniature galaxies.

Their finding will be announced at the Royal Astronomical Society National Astronomy Meeting at the Open University, Milton Keynes (UK), on Thursday 1 April.

The team of 12 scientists from five countries found the objects, so small they looked like stars, hidden in the nearby Fornax cluster of galaxies.

The Fornax cluster is 60 million light-years away – in astronomical terms, on Earth's doorstep.

Joint project team leader Dr Michael Drinkwater of The University of Queensland (UQ) said the galaxies belonged to a class dubbed "ultra-compact dwarfs" (UCDs), which was unknown before the same team of astronomers discovered six of them in the Fornax cluster in 2000.

Now the researchers say that UCDs outnumber the “conventional” elliptical and spiral galaxies in the central region of the Fornax cluster and they have found some in the Virgo galaxy cluster too.

“It’s likely that at least some are left-over examples of the primordial building blocks that formed large galaxies by merging together,” said Dr Drinkwater, of UQ’s School of Physical Sciences.

“It could be that they are very common but scientists have overlooked them because they resemble nearby stars at first sight.”

“Obviously, it is very important that we have a complete inventory of all galaxy types if we want to have an accurate knowledge of how much luminous (and even dark) matter is in the universe, as well as understand all the ways in which galaxies are formed.”

“This is very exciting – it will significantly advance our understanding of how galaxies form and evolve in environments where they are surrounded by swarms of other galaxies,” said Professor Joss Bland-Hawthorn of the Anglo-Australian Observatory.

“Computer simulations predict that there should be thousands of such small objects in the vicinity of our own Galaxy but we see only about twenty,” he said.

“The missing objects may be composed of dark matter and therefore presently invisible to us. Or the simulations could be profoundly flawed. This is an area of intense debate in astrophysics.”

UCDs were discovered by chance when Dr Drinkwater, Dr Stephen Phillipps of Bristol University and their colleagues undertook a large survey of all the moderately bright objects they could see in the direction of the Fornax cluster.

The UCDs were first discovered with the 3.9m Anglo-Australian Telescope (AAT) at Siding Spring Observatory, Coonabarabran.

The key to finding them was the AAT’s Two Degree Field (2dF) instrument, which can measure the redshifts (distances) of 400 objects simultaneously.

“We were able to measure the redshift of every object in the field of view, and so sort out which objects that looked like stars in our Galaxy were in fact in the Fornax cluster,” said team member Professor Warrick Couch of UNSW.

“The 2dF system makes the Anglo-Australian Telescope one of only a handful in the world where this kind of observation is possible.”

Follow-up observations with the Hubble Space Telescope and the European Southern Observatory’s Very Large Telescope (VLT) revealed just how strange the Ultra Compact

Dwarfs are. Although their masses are similar to those of previously known dwarf galaxies, they are amazingly small — only about 120 light years across.

Tens of millions of stars are squashed into what is a tiny volume by galaxy standards.

Favouring the idea that UCDs are the nuclei of galaxies that were originally larger and have been stripped of their outer stars, the team predicted that they would find them in other dense clusters where the stripping or "threshing" process could go on. They also calculated how many more they would expect to find if they searched for fainter ones.

When they put their predictions to the test, three nights of observations uncovered a further 46 UCDs in Fornax — even more than the team had expected — and in just four hours they found eight in the Virgo cluster, again around 60 million light years away.

"These results indicate that UCDs are indeed common and part of the standard population of galaxies we can expect in rich galaxy clusters," Dr Phillipps said.

The UCD collaboration is: Dr Steve Phillipps of the University of Bristol and Dr Michael Drinkwater of The University of Queensland (joint project leaders); Dr Bryn Jones of Queen Mary University, London; Dr Michael Gregg of the University of California, Davis; Professor Warrick Couch and Dr Kenji Bekki of the University of New South Wales; Dr Quentin Parker of Macquarie University, Sydney and the Anglo-Australian Observatory; Ms Anna Karick of the University of Melbourne; Mr Russell Jurek of The University of Queensland; Dr Terry Bridges of Queen's University, Ontario; Dr Harry Ferguson of the Space Telescope Science Institute, Baltimore; and Dr Michael Hilker of the University of Bonn.

The work has received Australian Research Council funding of \$180,000 for a two-year program.

For more information:

Dr Michael Drinkwater, University of Queensland
(Joint Project Leader, Australia)
+61 7 3365 3428, mjd@physics.uq.edu.au

Dr Steve Phillipps, University of Bristol
(Joint Project Leader, UK)
telephone +44 (0)117 954 6881, email: s.phillipps@Bristol.ac.uk

Prof. Joss Bland-Hawthorn, Anglo-Australian Telescope
telephone +61 2 9372 4251, email jbh@aaoepp.aao.gov.au

Prof. Warrick Couch, University of NSW
(team member)
telephone (02) 9385 4578, email w.couch@unsw.edu.au

Images

For a high resolution image of the latest discovery, please contact UQ photographic library coordinator Diana Lilley, d.lilley@uq.edu.au, +61 7 3365 2753.

Lower resolution images can be seen at the following websites:

<http://www.physics.uq.edu.au/people/mjd/media/>

Location of the new galaxies in the Fornax cluster.

This page also includes other background information and images.

<http://www.anzwers.org/free/universe/virgo.html>

Position of the Fornax cluster

Our Galaxy, the Milky Way, is at the centre of the map, at the point marked "Local Group".

<http://www.star.bris.ac.uk/sxp/take2.jpg>

How an ultra-compact dwarf might form.

A numerical computation of the removal of the outer layers of stars of a dE,N galaxy by tidal forces as it plunges past the central giant galaxy NGC 1399. The insets show a 'before and after' view of a normal dE,N galaxy (top) and a UCD (bottom) as observed with the Hubble Space Telescope. CREDIT: UQ Communications. Insets: Hubble Space Telescope; background: Michigan Curtis Schmidt Telescope and Arna Karick (University of Melbourne).