

Astronomers detect vast amounts of gas and dust around black hole in early universe

Press release from the Max-Planck-Institute for Astronomy (MPIA), the Royal Astronomical Society (RAS) and the Astronomische Gesellschaft (AG) on the occasion of the National Astronomy Meeting (NAM 2012) in Manchester.

Using the IRAM array of millimetre-wave telescopes in the French Alps, a team of European astronomers from Germany, the UK and France has discovered a large reservoir of gas and dust in a galaxy that surrounds the most distant supermassive black hole known. Light from the galaxy, called J1120+0641, has taken so long to reach us that the galaxy is seen as it was only 740 million years after the Big Bang, when the universe was only 1/18th of its current age.

Team leader Dr. Bram Venemans of the Max-Planck Institute for Astronomy in Heidelberg, Germany will present the new discovery on Wednesday 28th March at the RAS / AG National Astronomy Meeting in Manchester, United Kingdom.

The Institut de Radioastronomie Millimetrique (IRAM) array is made up of six 15-m size telescopes that detect emission at millimetre wavelengths (about a thousand times as long as visible light) sited on the 2550-m high Plateau de Bure in the French Alps. The IRAM telescopes work together to simulate a single much larger telescope in a so-called interferometer that can study objects in fine detail.

A recent upgrade to IRAM allowed the scientists to detect the newly discovered gas and dust that includes significant quantities of carbon. This is quite unexpected, as the chemical element carbon is created via nuclear fusion of helium in the centres of massive stars and ejected into the galaxy when these stars end their lives in dramatic supernova explosions.

Dr Venemans comments: "It's really puzzling that such an enormous amount of carbon-enriched gas could have formed at these early times in the universe. The presence of so much carbon confirms that massive star formation must have occurred in the short period between the Big Bang and the time we are now observing the galaxy."

From the emission from the dust, Venemans and his team were able to show that the galaxy is still forming stars at a rate that is 100 times higher than in our Milky Way.

The team give credit to the IRAM upgrade that made the new discovery possible. "Indeed, we would not have been able to detect this emission only a couple of years ago." says team member Dr Pierre Cox, director of IRAM.

The astronomers are excited about the fact that this source is also visible from the southern hemisphere where the Atacama Large Millimeter/submillimeter Array (ALMA), which will be the world's most advanced sub/millimeter telescope array, is currently

under construction in Chile. Observations with ALMA will enable a detailed study of the structure of this galaxy, including the way the gas and dust moves within it.

Dr Richard McMahon, a member of the team from the University of Cambridge in the UK is looking forward to when ALMA is fully operational later this year. "The current observations only provide a glimpse of what ALMA will be capable of when we use it to study the formation of the first generation of galaxies."

Figure 1: *This image shows the bright emission from carbon and dust in the galaxy surrounding the most distant supermassive black hole known. At a distance corresponding to 740 Million years after the Big Bang, the Carbon line, which is emitted by the galaxy at infrared wavelengths (that are unobservable from the ground), is redshifted, because of the expansion of the Universe, to millimeter wavelengths where it can be observed using facilities such as the IRAM Plateau de Bure Interferometer.*

Figure 2: *This image of J1120+0641 (red dot in the center) was created by combining Survey data in visible and infrared light of the Sloan Digital Sky Survey and the UKIRT Infrared Deep Sky Survey. (Credits: ESO/UKIDSS/SDSS)*

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Additional Information

The Team

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Weblinks

IRAM Plateau de Bure Interferometer <http://www.iram-institute.org>
 Atacama Large Millimeter/submillimeter Array (ALMA) <http://www.almascience.org>
 Max-Planck-Institute for Astronomy, Heidelberg <http://www.mpia.de>
 Institute of Astronomy, Cambridge <http://www.ast.cam.ac.uk/>
 Imperial College London <http://www3.imperial.ac.uk/>
 Liverpool John Moores University <http://www.ljmu.ac.uk/>

NAM 2012

Bringing together more than 900 astronomers and space scientists, the National Astronomy Meeting (NAM 2012) will take place from 27-30 March 2012 in the University Place conference centre at the University of Manchester in the UK. The conference is a joint meeting of the Royal Astronomical Society (RAS) and the German Astronomische Gesellschaft (AG) and is held in conjunction with the UK Solar Physics (UKSP: www.uksolphys.org) and Magnetosphere Ionosphere Solar Terrestrial (MIST: www.mist.ac.uk) meetings. NAM 2012 is principally sponsored by the RAS, AG, STFC and the University of Manchester.

The Royal Astronomical Society

... (RAS: www.ras.org.uk), founded in 1820, encourages and promotes the study of astronomy, solar-system science, geophysics and closely related branches of science. The RAS organises scientific meetings, publishes international research and review journals, recognizes outstanding achievements by the award of medals and prizes, maintains an extensive library, supports education through grants and outreach activities and represents UK astronomy nationally and internationally. Its more than 3500 members (Fellows), a third based overseas, include scientific researchers in universities, observatories and laboratories as well as historians of astronomy and others.

The Astronomische Gesellschaft

...(AG: www.astronomische-gesellschaft.de), founded in 1863, is a modern astronomical society with more than 800 members dedicated to the advancement of astronomy and astrophysics and the networking between astronomers. It represents German astronomers, organises scientific meetings, publishes journals, offers grants, recognises outstanding work through awards and places a high priority on the support of talented young scientists, public outreach and astronomy education in schools.

The Science and Technology Facilities Council

... (STFC: www.stfc.ac.uk) is keeping the UK at the forefront of international science and tackling some of the most significant challenges facing society such as meeting our future energy needs, monitoring and understanding climate change, and global security. The Council has a broad science portfolio and works with the academic and industrial communities to share its expertise in materials science, space and ground-based astronomy technologies, laser science, microelectronics, wafer scale manufacturing,

particle and nuclear physics, alternative energy production, radio communications and radar. It enables UK researchers to access leading international science facilities for example in the area of astronomy, the European Southern Observatory.

The Jodrell Bank Centre for Astrophysics

... (JBCA: www.jb.man.ac.uk/) is part of the School of Physics & Astronomy at the University of Manchester. JBCA is split over two main sites: the Alan Turing Building in Manchester and the Jodrell Bank Observatory in Cheshire. At Jodrell Bank Observatory, the new Jodrell Bank Discovery Centre is a key focus for our work in public engagement and education. Jodrell Bank is a world leader in radio astronomy-related research and technology development with a research programme extending across much of modern astrophysics. The group operates the e-MERLIN national radio astronomy facility and the iconic Lovell Telescope, hosts the UK ALMA Regional Centre Node and is home to the international office of the SKA Organisation. Funded by the University, the Science & Technology Facilities Council and the European Commission, it is one of the UK's largest astrophysics research groups.