Black holes and warped space: New UK telescope shows off first images

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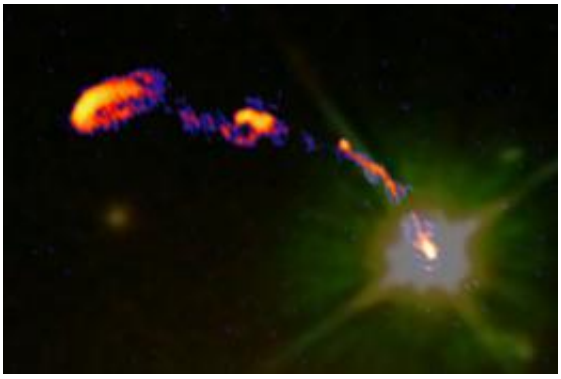

This is a composite of the new e-MERLIN radio image of the Double Quasar and an earlier Hubble Space Telescope (HST) optical image. One of the lensed quasar core images is visible at lower right. The radio emission generated by the black hole as seen with e-MERLIN is visible as the compact bright region superimposed on the (yellow-green) optical emission seen by HST. The radio jet, moving at speeds approaching that of light, is seen in the e-MERLIN image arcing away from the black hole towards the upper left. The jet shows several regions of enhanced brightness before it ends in a hotspot where it is ploughing through the tenuous matter filling the space around the quasar. The e-MERLIN image is shown in false-colour with a colour table ranging from blue through red to white, where the colours represent the brightness of the radio emission. The HST image is made from WFPC2 images through two filters: the F555W filter (V-band) is coloured green and the F814W filter (I-band) is coloured red. Credit: Jodrell Bank Centre for Astrophysics, University of Manchester

Spearheaded by the University of Manchester's Jodrell Bank

Observatory and funded by the Science and Technology Facilities Council, the e-MERLIN telescope will allow astronomers to address key questions relating to the origin and evolution of galaxies, stars and planets.

To demonstrate its capabilities, University of Manchester astronomers turned the new telescope array toward the "Double Quasar". This enigmatic object, first discovered by Jodrell Bank, is a famous example of Einstein's theory of gravity in action.

The new image shows how the light from a quasar billions of light years away is bent around a foreground galaxy by the curvature of space.

This light has been travelling for 9 billion years before it reached the Earth. The quasar is a galaxy powered by a super-massive black hole, leading to the ejection of jets of matter moving at almost the speed of light – one of which can be seen arcing to the left in this new e-MERLIN image.

The warping of space results in a 'gravitational lens' producing multiple images of the same quasar – the two brightest of these lensed images can be seen here as two bright objects, one below the other.

The foreground galaxy whose mass is responsible for the lensing effect is also visible just above the lower quasar image. The radio emission seen in the e-MERLIN image suggests that this galaxy also harbours a black hole, albeit somewhat smaller.

The UK's national facility for radio astronomy, e-MERLIN is now set to produce increasingly-detailed radio images of stars and galaxies using seven telescopes spread up to 220 km apart across the UK and working as one. This combination of widely-spread telescopes provides astronomers with a powerful 'zoom lens' with which they can study the

fine details of astronomical events out towards the edge of the observable universe.

The radio signals collected by the telescopes are brought back to Jodrell Bank using a new optical fibre network. These fibre links and advanced electronic receivers will allow astronomers to collect far more data and so see in a single day what would have previously taken them more than a year of observations.

In parallel with this successful demonstration of the new telescope system, work has begun on 'early science' observations intended to rigorously test its capabilities. The project has attracted astronomers from over 100 institutes across the world who will use e-MERLIN to study a huge range of astrophysics.

This includes star birth and death, black holes and galaxy evolution, pulsars (the collapsed cores of exploded stars) and young planets forming around nearby stars.

The e-MERLIN project has been funded by the Science and Technology Facilities Council (STFC), the Northwest Development Agency,

The University of Manchester, The University of Cambridge and Liverpool John Moores University. It is being operated by STFC and the University of Manchester.

Minister for Science and Universities, David Willetts said: "The image produced by the e-Merlin telescope is inspiring to all with an interest in the space sector.

"I am confident this impressive project will reap significant scientific rewards - it demonstrates how effective British universities are in this field."

Professor Simon Garrington, Director of e-MERLIN at the University of Manchester, says:

“This first image demonstrates the success of the complex new system of electronics and optical fibre links.

“It is also testament to the hard work put in by our engineers, scientists and technicians to turn our vision of a huge fibre-connected array of telescopes into a reality. We are very much looking forward to the new scientific results that will flow from the telescope over the coming years.”

Professor John Womersley of the Science and Technology Facilities Council said: “e-Merlin is a flagship project for the UK in radio astronomy, a scientific field where the UK has a rich legacy, a strong future, and is proud to be the home of some of the very best researchers in the world.

“The project has attracted more than 300 astronomers from over 100 institutes in more than 20 countries who will use the power of this ‘super telescope’ to conduct major scientific legacy projects.”

Professor Mike Garrett, General Director of ASTRON, the Netherlands Institute for Radio Astronomy, said: “e-MERLIN is going to be a transformational telescope – astronomers around the world can't wait to get their hands on it.

“As a pathfinder for the next-generation international radio telescope, the Square Kilometre Array, e-MERLIN represents another giant leap forward for the global radio astronomy community."

Provided by University of Manchester