

A star is born? Herschel space observatory captures the birth of stars

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A three-colour composite of a region of star formation in the constellation of Aquila. Credit: ESA

(PhysOrg.com) -- The European Space Agency has released a preview of the first science results from the Herschel Space Observatory, including the UK-led SPIRE instrument. The new data which include images of previously invisible stardust - the stuff that all life is made from - will give us valuable new information about how stars and galaxies are made and reveal the life cycle of the cosmos.

Physicists from Imperial College London played a key role in conceiving, designing and developing the SPIRE instrument over the last 20 years, and more recently have been instrumental in developing the software to convert masses of raw data from space into the pictures

released by the European Space Agency today.

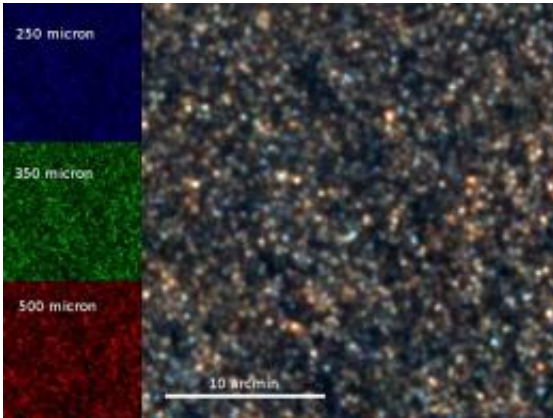
Professor Keith Mason, Chief Executive of the Science and Technology Facilities Council (STFC), which provides the UK funding for Herschel, said: "These results are extremely impressive and are an indication of the excellent science that Herschel, including SPIRE, will perform over the next few years. We're very proud of the technology and expertise that the UK has contributed to this groundbreaking mission."

Professor Matt Griffin, SPIRE Principle Investigator, said: "The Herschel Science Demonstration meeting is what the SPIRE team has been looking forward to since the start of the project more than a decade ago, and the results being presented are even better than we dared hope before launch. Not only are the observatory and the instrument working very well, but it is already clear that in this unexplored region of the spectrum, the Universe is even more interesting than we thought."

Figure one shows a three-colour composite of a region of [star formation](#) in the constellation of Aquila around 1000 light-years from Earth. In the image, the red shows light at 500 microns detected by SPIRE, while green and blue are light at 170 microns and 70 microns respectively, as measured by the PACS instrument. The size of the area imaged is around 60 light-years per side, and shows the large filaments of cold dust (seen as red and orange) threading through the region. The many blue regions are warmer, emitting more at shorter wavelengths, and show where the gas and dust is either collapsing under gravity to form stars, or where it has already collapsed and formed a protostar - the earliest stages of a star's life.

Professor Derek Ward-Thompson, of Cardiff University and a member of the Gould Belt Key Project, for which this image was taken, said: "The insight into the way stars are forming that is provided by this image is absolutely fantastic, and I can't wait to see the rest of the data we're

going to receive over the coming months."



Great Observatory Origins Deep Survey. Credit: ESA

There are hundreds such regions found in the image, and this confirms the connection between the large, cool filaments and the locations where stars form.

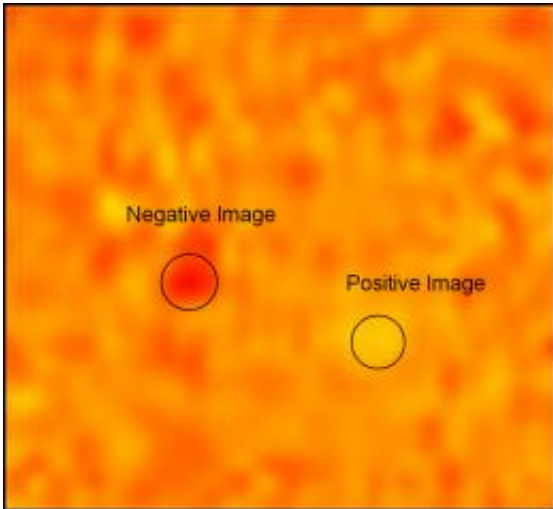
Figure two shows an area of sky called the "Great Observatory Origins Deep Survey" (GOODS), which has been observed by many telescopes at a range of wavelengths, and now by SPIRE in the far-infrared. It is an area of sky devoid of foreground objects, such as [stars](#) within our Galaxy, or any other nearby galaxies, and is a little larger than the area of the full moon as observed from Earth.

The image is made from the three SPIRE bands, with red, green and blue corresponding to 500mm, 350mm and 250mm respectively. Every fuzzy blob in this image is a very distant galaxy, seen as they were 3—10 billion years ago when the star formation was very widely spread throughout the Universe.

Dr Seb Oliver, of University of Sussex and PI of the HERMES survey for which this image was taken, said: "Seeing such stunning images after just 14 hours of observations gives us high expectations for the full length observations over much larger regions of the Universe. This will give us a much clearer idea of how star formation has progressed throughout the history of the Universe."

The redder objects are either more distant, as the expansion of the Universe has stretched, the light more since it was emitted by the galaxy, or much cooler than the bluer galaxies. This is the first time much of the Cosmic Infrared Background, discovered in the 1990s, has been resolved into the individual galaxies. Studying these galaxies at this early stage of the Universe will allow astronomers to test their models of star and galaxy formation.

Professor Michael Rowan-Robinson from Imperial College London, said: "Our pre-launch models of the submillimetre sky suggest most of these galaxies will be at high redshift, so are galaxies undergoing their main bursts of star formation. The challenge will be to disentangle the effects of the cosmological redshift from the natural tendency of cooler dust in the outer parts of [galaxies](#) to be prominent at submillimetre wavelengths."



MakeMake. Credit: ESA

Further results are being presented at the Science Demonstration Phase First Result meeting in Madrid, Spain.

Since launch on 14th May 2009, Herschel spent several months undergoing careful tests on the performance of the instruments and calibration. This was followed by the Science Demonstration Phase: the period when the instruments were tested to their full capabilities.

To date, the mission has gone almost perfectly. The performance of the spacecraft has been shown to be well within pre-launch expectations, and the SPIRE and PACS instruments are working extremely reliably and the first look at the data is exceedingly promising. A problem with the HIFI instrument in August 2009 led to it being turned off for several months while further checks were carried out. Earlier this month HIFI was powered up again for the first time since the problem occurred, using its backup power supply unit. HIFI should be fully operational from January, giving Herschel back its full complement of scientific instruments. The science demonstration will continue in early 2010,

while in the meantime routine scientific observations can begin.

In November 2009 Time Magazine voted Herschel the 7th best invention of 2009, ranking just above an AIDS vaccine and a chip which could give blind people partial eyesight.

Provided by Imperial College London

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