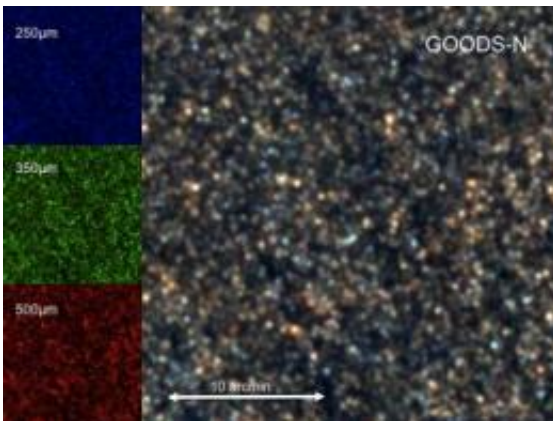


# Astronomers unveil images of 12-billion-year-old space nursery

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The SPIRE camera has three arrays operating at different wavelengths and the image from each of these is rendered in red, blue or green. Then the three images are combined to form a single false color image. Credit: Gaelen Marsden, University of British Columbia

A University of British Columbia astronomer has produced the most detailed images of deep space from 12 billion years ago, using data from the European Space Agency's Herschel Space Observatory.

Recently presented at the first International Herschel Science Meeting in Madrid, Spain, the images by UBC post-doctoral fellow Gaelen Marsden reveal tens of thousands of newly-discovered galaxies at the early stages of formation - just one billion years after the Big Bang, when the Universe was a thriving nursery of newly-formed stars.

"These images allow us to see 10 times more galaxies than ever before and with stunning clarity," says Marsden, who has spent the past few years working on similar but lower-resolution images from previously collected data.

"It is incredibly rewarding to see the high sensitivity and resolution that the new Herschel data have enabled. They allow us to take a close look at the stars during early and vital stages of formation, and could change the way we study formation in the future."

Herschel is the largest and most expensive [space telescope](#) ever built. It is equipped with three infrared cameras: SPIRE, PACS and HIFI. Herschel was successfully launched on May 14, 2009 aboard an Ariane-5 rocket from Europe's spaceport in French Guiana, for a two-month trip to its observation point, some 1.5 million kilometres above Earth.

Data collected by Herschel are being analysed by the programme's biggest research project, the Herschel Multi-tiered Extragalactic Survey (HerMES). The project consists of more than 100 astronomers from six countries, including UBC Astronomy Professors Mark Halpern and Douglas Scott and post-doctoral fellows Ed Chapin, Gaelen Marsden, Elisabetta Valiante and Don Wiebe.

The HerMES project aims to produce a map of the Universe as it was as far back as 12 billion years ago and is expected to discover hundreds of thousands of new galaxies at early stages of their formation. The first results from the HerMES survey come from the SPIRE camera, in which Canadians are involved through the support of the Canadian Space Agency (CSA).

The SPIRE [infrared camera](#) is capable of peering into the coldest dust clouds to see the most distant sites of star formation. Its three filters allow for a colour composite image to be made, where the colour

indicates the temperature of the region. This allows astronomers to learn about the physical conditions in some of the most distant sites of star formation and untangle the mysteries of how the first stars formed.

"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," says Seb Oliver, a U.K. lead in the project. "This will give us a much clearer idea of how star formation has progressed throughout the history of the Universe."

This survey was preceded by the successful BLAST project, the Antarctic balloon experiment that inspired a full-length documentary "BLAST! The Movie." BLAST used a replica of the SPIRE camera and provided a glimpse of what was to come.

"While BLAST provided exciting results, the ability to go into space for an extended period of time allows for much more ambitious surveys of the distant Universe," says UBC's Douglas Scott, part of the CSA-funded UBC BLAST team. "The Herschel telescope has the biggest mirror to be launched into space, and this provides images which are less blurred than those collected by BLAST."

A major goal of the Herschel mission is to discover how galaxies were formed and how they evolved to give rise to present-day galaxies like our own Milky Way Galaxy. Professors Halpern and Scott of UBC's Department of Physics & Astronomy are experts in understanding galaxy formation through using far-infrared, millimetre wavelength and microwave radiation and will actively participate in the HerMES project as it produces more results.

"We chose to feature these images first because they show what we believe is the most important result in the initial science release of this satellite - and the key to the early star formation history of the

Universe," says Halpern.

## **Background**

The Universe is estimated at 13.7 billion years old. Light observed from these images took 12 billion years to reach us at 300,000 kilometres per second.

SPIRE is one of three instruments on the Herschel [Space Observatory](#). The SPIRE camera operates across three wavelength bands centred on 0.25, 0.35 and 0.5 mm. SPIRE is a UK-led instrument, with an instrument consortium consisting of institutions in many countries, including the University of Lethbridge in Canada, and with a science team involving researchers at Lethbridge, and the Universities of British Columbia, Calgary, McMaster, Toronto and Victoria.

Herschel Multi-tiered Extragalactic Survey (HerMES) is the largest of Herschel's Key Programmes, with 900 hours of observation currently allocated, and is carried out by the SPIRE High-redshift Specialist Astronomy Group. HerMES will map large regions of the sky using cameras that are sensitive to infrared radiation, and is expected to discover over 100,000 galaxies. The light from most of these galaxies will have taken more than 10 billion years to reach us, which means we would see them as they were three or four billion years after the Big Bang. Since the cameras are detecting infrared radiation they see star formation that is hidden from conventional telescopes. It is expected that the SPIRE cameras will catch many of the galaxies at the moment they are forming most of their stars.

Provided by University of British Columbia

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