

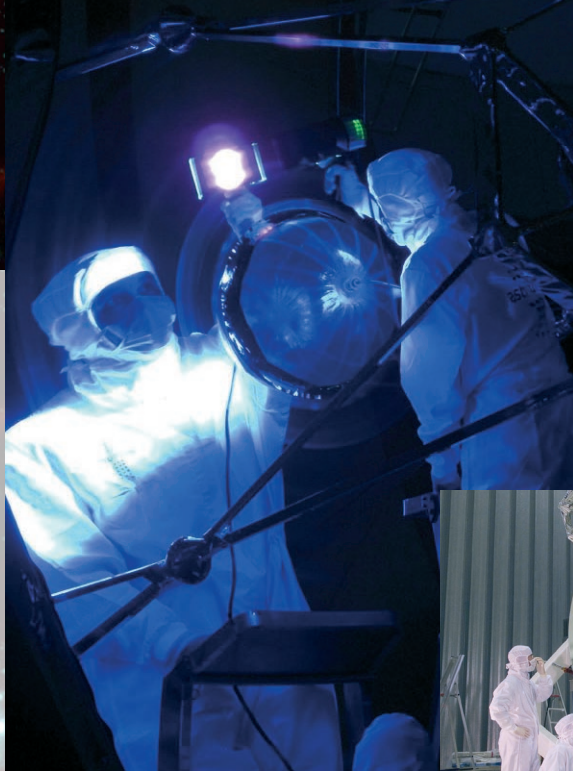
Herschel

Understanding how stars and galaxies are formed

If our eyes were sensitive to infrared light, the Universe would appear quite different. We would be able to see through the cocoons of gas and dust that surround nascent stars. We could witness the birth of galaxies, a few billion years after the Big Bang, and perhaps even earlier. And if our infrared eyes had built-in spectroscopes, we would be able to study the atmospheric composition of planets and comets, and the complex molecules of the interstellar medium. Seeing all these celestial bodies that are concealed from observation in visible light, either because they are surrounded by dust or because they are too cold to emit visible light, is the mission of the Herschel observatory.

This light spectrum range, which varies from infrared to submillimetric wavelengths, is still relatively unexplored as it cannot be accessed from Earth. Moreover, not only does any instrument used need to be cooled to cryogenic temperatures, but so does the telescope. There have been predecessors to Herschel, such as the European ISO¹ satellite, and more recently the American Spitzer Space Telescope. But Herschel's key innovation is its 3.5 m diameter telescope, which makes it the largest ever produced for a space application.

Using this large telescope, Herschel will be able to see much finer details than its predecessors. It will be able to study closely the molecular content of interstellar clouds where stars are formed, and thus determine whether the elements essential for the appearance of life are found everywhere



Cleanliness inspection of the HERSCHEL satellite at the Guiana Space Centre on 15 February 2009
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Integrating the telescope
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in the Universe. Some observation time will be devoted to studying the chemical composition of the atmosphere of gas giant planets in the solar system. Herschel will also be able to detect dimmer bodies, such as the first galaxies in the Universe, and observe how they evolved throughout the Universe's history.

Herschel is being launched in April 2009 on the same Ariane 5 flight as the satellite Planck, which will be studying relic radiation from the Big Bang. The two satellites will be placed in orbit at the 2nd Lagrange Point, at a distance of around 1.5 million kilometres from the Earth in the opposite direction to the Sun. From this position it will be easier to cool them and protect them from rays from the Sun, the Earth and the Moon which could disrupt their measurements.

Thales Alenia Space has been entrusted with Herschel's production, whereas the telescope is the responsibility of EADS Astrium in Toulouse. CNES is helping to finance the mission, via ESA, and the production of the PACS² and SPIRE³ instruments and the HIFI⁴ spectrometer.

¹ **Iso:** *Infrared Space Observatory*

² **Pacs:** *Photoconductor Array Camera and Spectrometer*

³ **Spire:** *Spectral and Photometric Imaging Receiver*

⁴ **HIFI instrument:** *Selon ESA (http://www.esa.int/esaSC/120390_index_0_m.html) cet instrument s'appelle "Heterodyne Instrument for the Far Infrared"*

Herschel	
Initiator	ESA
Participants	Member states of ESA and French organizations contributing to instruments (CNES, CNRS, CEA)
Objectives	<ul style="list-style-type: none"> To study the molecular content of interstellar clouds. To study the formation and evolution of stars and galaxies. To study the atmosphere and satellites of giant planets, as well as comets.
Mission's initial duration	3 years
Launch	April 2009 on Ariane 5

Key figures	
Dimensions	Height: 7 m Width: 4.3 m
Launch mass	3.25 tonnes
Payload	A 3.5 m diameter telescope. A superfluid helium cryostat (2K) containing the 3 instruments, PACS, SPIRE and HIFI
Orbit	L2 Lagrange Point
Distance from Earth	1.5 million km