

## **HIFI recovered from cosmic ray hit!**

**HIFI, one of the three scientific instruments on ESA's Herschel Space Observatory, has taken a hit by a cosmic ray particle in a critical area again. On Monday 28 February a particle presumably hit the electronics of the instrument, which brought HIFI observations to a full stop. However, after switching HIFI off and then on again the instrument came back online. HIFI will now be able to continue its highly successful quest for carbon and water in gas clouds, which sheds new light on the birth and early development of stars and planets.**

Because HIFI was offline the specialists from ESA and SRON can't be sure that the cause of the malfunction is a hit by a cosmic particle, but this is by far the most probable scenario. In the extreme conditions of space every instrument runs the risk of being damaged by hits of cosmic ray particles. This is the reality of space research. A few months after the successful launch in May 2009 HIFI (the Heterodyne Instrument for the Far-Infrared) was probably hit by a cosmic ray particle in its electronics.

This led to a series of events that eventually caused a malfunction of the prime electronics. It became clear that HIFI had to fall back on its back-up electronics. In the joint HIFI-ESA investigation that followed new procedures were devised that successfully minimized the risks of operating HIFI on its backup electronics. HIFI was switched on again and continued to observe its main targets in the first year with great success, showing a wealth of spectral detail that no other instrument could beat.

Since then HIFI has been hit tens of times by cosmic rays without any further damage, showing the new procedures to be resilient against particle impacts. However, the investigation of 2009 also indicated that there was one area in the electronics that remained vulnerable: the computer memory of the auxiliary computer in one of the electronic units (the LCU microprocessor). It is this computer memory which has most probably been hit by a particle again on Monday 28 February 2011, which put a full stop to HIFI. The only possible solution was power cycling (turning off and then on again) of the instrument from the Control Centre on Earth. This is what has been done after carefully choosing the right conditions to do so, like the temperature of the electronics.

As expected, HIFI came back online, showing that careful operation in space research is the key to success. The HIFI specialists from ESA and SRON expect to have to switch HIFI off and on at least one more time during the lifetime of Herschel, but this incident has given them the confidence that it can be done without affecting the health of the instrument. HIFI will now continue its observations alongside the two other Herschel instruments PACS and SPIRE.

Herschel is an ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA. HIFI has been designed and built by a consortium of institutes and university departments from across Europe, Canada and the United States under the leadership of SRON Netherlands Institute for Space Research and with major contributions from Germany, France and the US.

Membres of the consortium: Netherlands: SRON, TUD; Germany: KOSMA, MPIfR, MPS; USA: Caltech, JPL, NHSC; France: IRAP, LAB, LERMA, IRAM; Canada: CSA, U.Waterloo; Spain: Observatorio Astronómico Nacional (IGN), Centro de Astrobiología (CSIC-INTA); Ireland: NUI Maynooth; Italy: ASI, IFSI-INAF, Osservatorio Astrofisico di Arcetri-INAF; Poland: CAMK, CBK; Sweden: Chalmers University of Technology - MC2, RSS & GARD; Onsala Space Observatory; Swedish National SpaceBoard, Stockholm University - Stockholm Observatory; Switzerland: ETH Zurich, FHNW;