German instrument GREAT begins its scientific observations on board SOFIA

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On 6 April 2011, German scientists carried out their first astronomical observations on board the Stratospheric Observatory for Infrared Astronomy, SOFIA. A joint project between NASA and the German Aerospace Center (DLR), SOFIA is the world's only operational airborne observatory. The first observations with the German Receiver for Astronomy at Terahertz Frequencies, GREAT, included spectra of the Omega Nebula (M17) an active star-forming region in the Milky Way, and the galaxy IC 342, located a few million light years away.

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At 06:40 local time (15:40 CEST) on 6 April, with SOFIA touching down once again at its home base, the Dryden Aircraft Operations Facility in Palmdale, California, Rolf Güsten and his team successfully concluded their first science flight with GREAT. The instrument had been pointed at, among other objects, IC 342, a prominent intermediate spiral galaxy in the constellation Camelopardalis, and M17, an active massive star-forming region 5000 light years away. For both sources, the radiation from ionised carbon at 1.9 terahertz (158 microns) and the high rotational transitions of warm carbon monoxide were measured, providing a tool to probe the interstellar medium in the environments around newly-formed massive stars.

Rolf Güsten, the Principal Investigator for GREAT, was delighted by the success: “These very first spectra are the reward for many long years investing in cutting edge technology developments and they showcase the scientific potential of airborne far-infrared spectroscopy. Thanks to the large collecting area of the 2.7-metre diameter telescope, together with enormous progress in terahertz technology, the collection of data is 100 times faster compared to earlier experiments, opening a new pathway for unique scientific experiments.” The GREAT instrument was developed by a team from the Max Planck Institute for Radio Astronomy (MPIfR) and the University of Cologne, led by Rolf Güsten, in collaboration with the Max Planck Institute for Solar System Research and the DLR Institute of Planetary Research.

“GREAT’s first science flight is the beginning of German-American scientific collaboration on SOFIA. We are confidently looking forward to the upcoming routine operations,” said Alois Himmes, SOFIA Project Manager at DLR. After these first observing flights with GREAT, the observatory will be open to astronomers outside the project. “Astronomers from all German institutes have been able to apply for scientific observation time with SOFIA during the summer of 2011. They will use either GREAT or the US Faint Object InfraRed-CAmera for the SOFIA Telescope, FORCAST,” explained Alfred Krabbe, Head of the German SOFIA Institute (Deutsches SOFIA Institut; DSI) at the University of Stuttgart."

About GREAT
GREAT, the German Receiver for Astronomy at Terahertz Frequencies, is a receiver for spectroscopic observations in the far-infrared spectral regime at frequencies between 1.2 and 5 terahertz (60–220 microns), which are not accessible from the ground due to absorption by

water vapour. GREAT is one of two first generation German instruments for SOFIA developed by the Max Planck Institute for Radio Astronomy (MPIfR) and the University of Cologne, in collaboration with the Max Planck Institute for Solar System Research and the DLR Institute of Planetary Research. Rolf Güsten (MPIfR) is the project manager for GREAT. The development of the instrument was financed by the participating institutes, the Max Planck Society, the German Research Foundation (Deutsche Forschungsgemeinschaft; DFG) and DLR.

About SOFIA

SOFIA is a joint project of the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and the National Aeronautics and Space Administration (NASA). The project is being carried out under the auspices of DLR, with funds provided by the German Federal Ministry of Economics and Technology (Bundesministerium für Wirtschaft und Technologie; BMWi) under a resolution passed by the German Federal Parliament, and with funding from the State of Baden-Württemberg and the University of Stuttgart. Scientific operations are coordinated by the German SOFIA Institute (DSI) at the University of Stuttgart and the Universities Space Research Association (USRA).

M17SW	**IC342**
M17SW is a molecular cloud containing about 10,000 solar masses of gas that is illuminated by a cluster of young stars with a total radiation output of more than one million solar luminosities. The radiation from the cluster ionises and heats the molecular gas, possibly compressing it into a state where more stars form. The SOFIA observations allow researchers to distinguish the effect of this radiative compression from the heating effect that would instead lead to expansion. In this way, the future of the molecular cloud with regard to its star formation activity can be predicted.	IC 342 is the nearest gas-rich spiral with active star formation in its nucleus. Within its central 30 arcseconds, two molecular arms end in a lumpy central ring of dense gas surrounding a young star cluster. The young stars heating the surrounding gas and dust are responsible for the rich chemistry and intense emission of these regions, known as Photon Dominated Regions (PDRs). The strong emission from these PDRs allows an in-depth study of the chemical and physical conditions in these distant massive star-forming regions.

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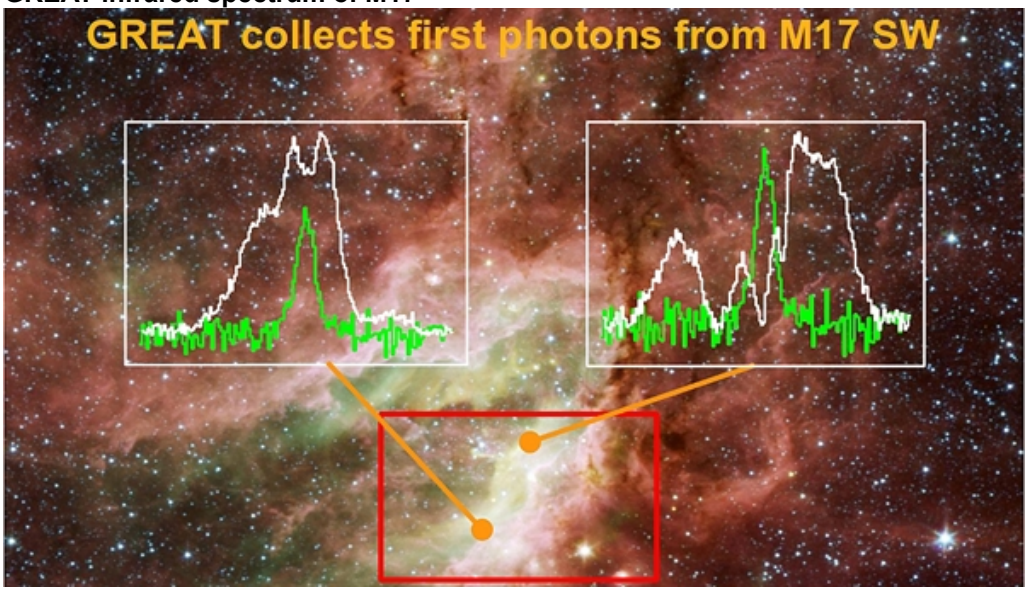
GREAT infrared spectrum of M17



GREAT collected its first terahertz photons from the M17SW star forming cloud on 6 April 2011. Superposed on a near-infrared false-colour image obtained with the Spitzer Space Telescope (NASA/JPL-Caltech/M. Povich, Univ. Wisc.), you will see selected spectra of ionized carbon ([CII], white line) and warm carbon monoxide (CO, green line). The high spectral resolution of GREAT is necessary to study the velocity structure across the cloud, as unveiled by the different line profiles. The field studied in the sky is overlaid on the infrared image, and the velocity integrated distribution of [CII] and CO is displayed in the inserts at the bottom. The data obtained with GREAT shows the warm interface of the M17 molecular cloud exposed to the ionizing radiation of nearby massive stars.

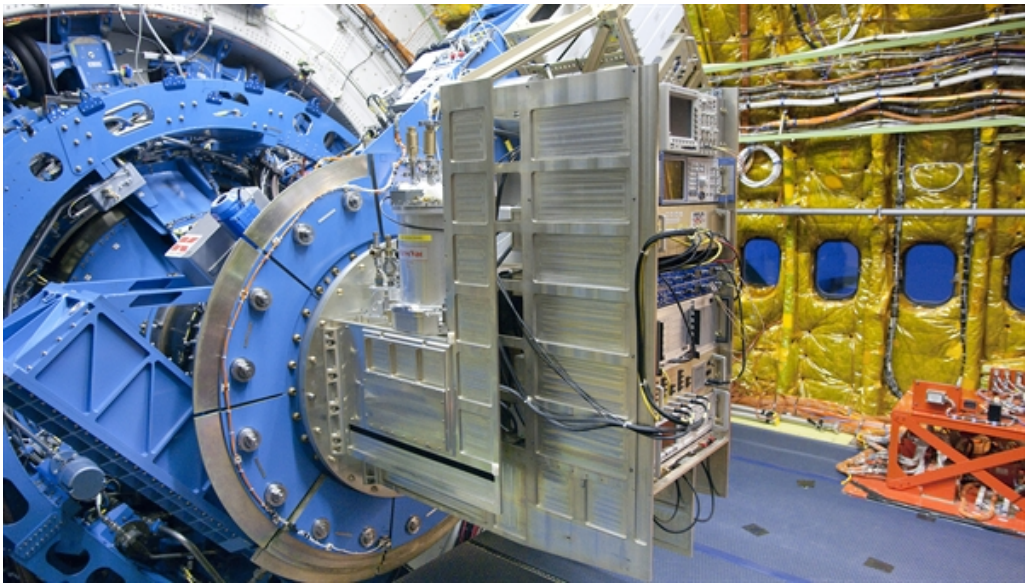
Credit: GREAT team / NASA/DLR/SOFIA/USRA/DSI. Spitzer image (background): NASA/JPL-Caltech/M. Povich, Univ. Wisconsin.

SOFIA, the Stratospheric Observatory For Infrared Astronomy

The Stratospheric Observatory For Infrared Astronomy (SOFIA) on its maiden test flight with a completely opened telescope hatch on 18 December 2009 over the Californian Mojave Desert. The 2.7 metre telescope, built in Germany, is visible through the opening in the fuselage of this Boeing 747SP. The test flight with an open hatch enabled engineers to examine the movement of air in and around telescope and door under experimental conditions for the first time.

Credit: NASA/C. Thomas.

The German instrument GREAT in SOFIA



The GREAT receiver (metallic silver) mounted on the telescope (in blue) on the SOFIA airborne observatory.

Credit: NASA/Tom Tschida.

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