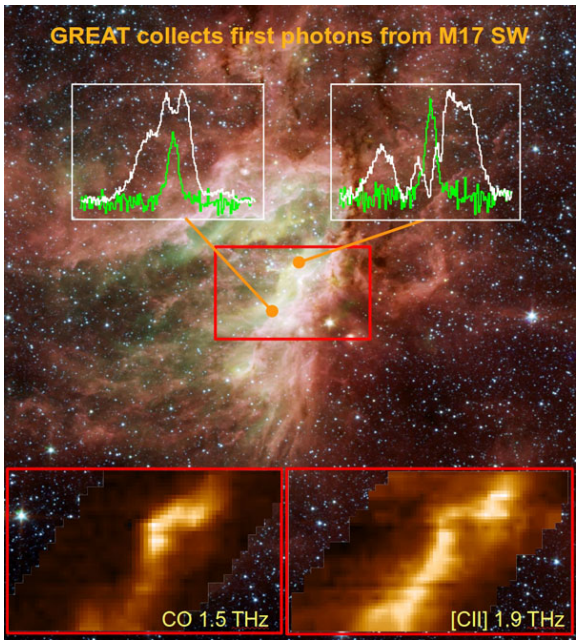
SOFIA

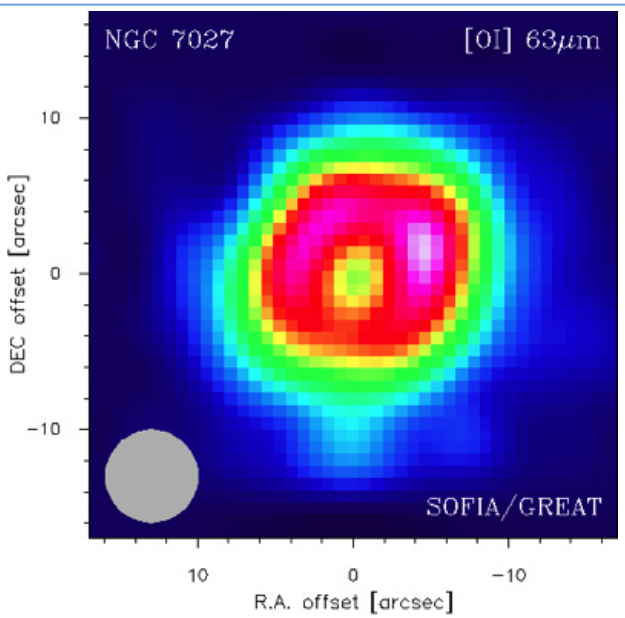
Stratospheric Observatory for Infrared Astronomy

German REceiver for Astronomy at Terahertz Frequencies

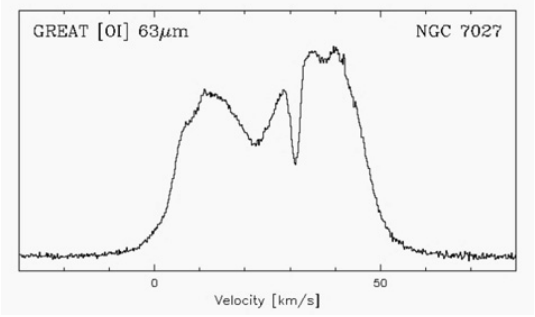
GREAT is a dual channel, Principal Investigator-class heterodyne instrument for far-infrared spectroscopy on board SOFIA. Its high spectral resolution in the Terahertz regime enables detailed studies of far-ranging topics in astrophysics, from planetary atmospheres and the Galactic interstellar medium, to extragalactic and early Universe processes.



Messier 17 data obtained with SOFIA/GREAT superimposed on a Spitzer near-infrared image. The white spectra are C II (singly-ionized carbon) and the green spectra are CO (carbon monoxide). The bottom panels show maps of C II and CO emission intensity within the red box in the upper panel. (C II and CO data: GREAT Team/NASA/DLR/USRA/DSI; Background image: NASA/JPL-Caltech/Spitzer)



SOFIA/GREAT data of planetary nebula NGC 7027 in the neutral oxygen emission line at 63 microns. *Left*: a map constructed from spatial scans made by the GREAT spectrometer's H-channel receiver. The effective angular resolution is indicated by the gray circle at lower left. *Right*: a high-resolution spectrum displaying the characteristic shape for an expanding, optically thin shell. The complex line structure shows that the expanding nebula has multiple components moving at different velocities. The narrow absorption at v~30 km/s likely corresponds to foreground ISM and illustrates the high spectral resolution achieved with GREAT. (GREAT Consortium)



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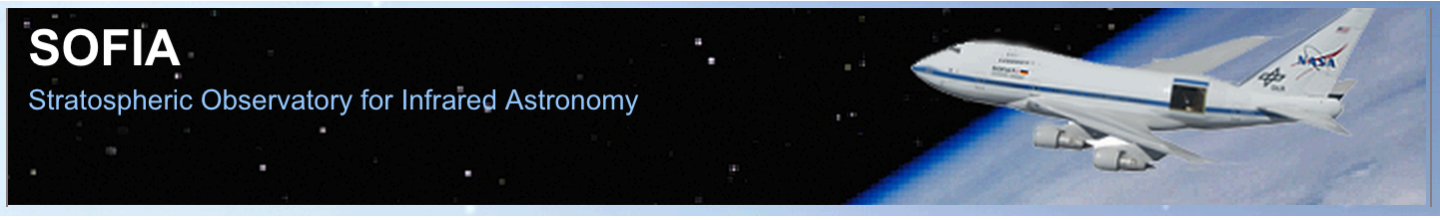


GREAT Specifications

Principal Investigator: Dr. Rolf Güsten, MPifR, Bonn

Project Management: Dr. Stefan Heyminck, MPIfR, Bonn

SOFIA Instrument pages - http://www.sofia.usra.edu/Science/instruments
GREAT Team page - http://www3.mpifr-bonn.mpg.de/div/submmtech/great.html

Channels	Frequency Range [THz]	T_{rec} [K], DSB*	Astronomical Lines of Interest
Low-frequency L1	1.25 – 1.39	600	CO(12-11), OD, SH, H_2D^+, HCN, HCO^+
	1.42 – 1.52	600	CO(13-12), [NII]
Low-frequency L2	1.80 – 1.90	700	NH_3(3-2), OH($^2\Pi_{1/2}$), CO(16-15), [CII]
Mid-frequency Ma	2.49 – 2.56	1500	$^{(18)}$OH($^2\Pi_{3/2}$)
Mid-frequency Mb	2.67 – 2.68	3100	HD(1-0)
High-frequency H	4.745	1000	[OI]

*Double Sideband

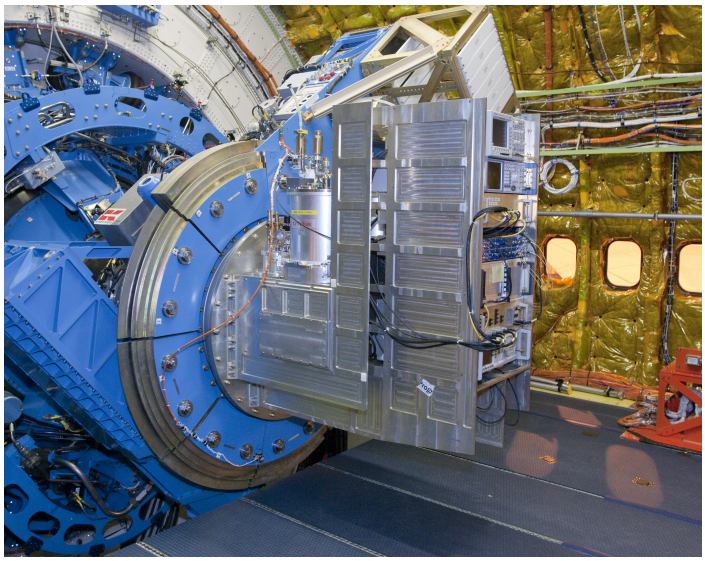
Four observing modes are currently supported by GREAT:

Position switching (PSW): The telescope moves between a target and a nearby emission-free reference position.

Beam switching (BMSW): The secondary mirror chops between the source and a reference position less than 10' away at a rate of about 1 – 2 Hz. The telescope nods between these positions at a slower rate.

Raster mapping: The telescope makes a collection of pointed observations (PSW or BMSW) to cover a small mapping area.

On-the-fly mapping (OTF): The telescope scans along a column or row while the backends continuously integrate the incoming signal and periodically write out the data. At the end of the row, the telescope moves to a reference position. Then, the telescope starts the next row. This process continues until a map of the desired size has been observed.



The GREAT instrument installed on SOFIA
(NASA Photo / Tom Tschida)

Backends: Fast Fourier Transform Spectrometers	Bandwidth [GHz]	Resolution [MHz]
AFFTS	1.5	0.212
XFFTS	2.5	0.044
FFTS4G	4.0	0.244