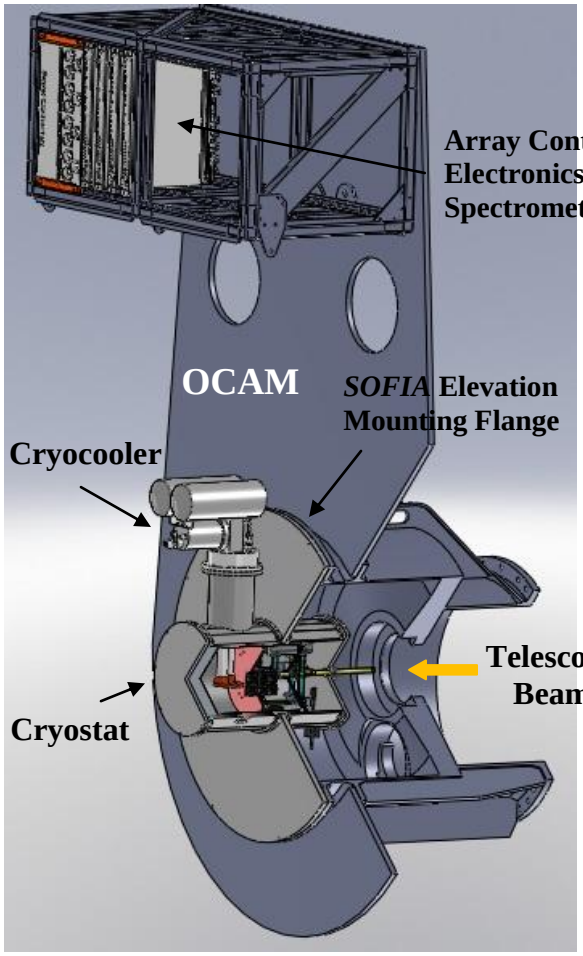
OCAM: Oxygen Heterodyne Camera for SOFIA

Science Objectives

The **Oxygen Heterodyne Camera (OCAM)** is a technology demonstration, 4 x 4, `Super'-THz heterodyne array instrument for SOFIA. It is optimized to observe the 63 µm [OI] fine-structure line. OCAM will be a new, powerful probe of the interaction of stars with their environment and serve as a pathfinder for future, large format, heterodyne arrays.

OCAM's receivers will provide the spectral and spatial resolution needed to untangle the complexities of the interstellar medium. OCAM directly addresses the **NASA Strategic Plan (2011) Goal 2.4:** *Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.*



Goal 1: Investigate the radiative interaction of massive stars with their natal clouds.

Goal 2: Investigate the interaction of protostellar winds and jets with their natal clouds.

Goal 3: Investigate the interaction of massive stars with their environment in the Galactic Center.

Goal 4: Uniquely probe conditions in the nuclei of nearby, face-on, normal & starburst galaxies.

Data Products

1. **Fully sampled, velocity-resolved, 25–250 square arc minute surveys of [OI] (63µm) line emission and/or absorption toward the Galactic Center, Orion, Cepheus, and M33 (see Fold-Out 1, Fig. 1.1-1.4).**
2. **Database of existing complementary line and continuum surveys.**

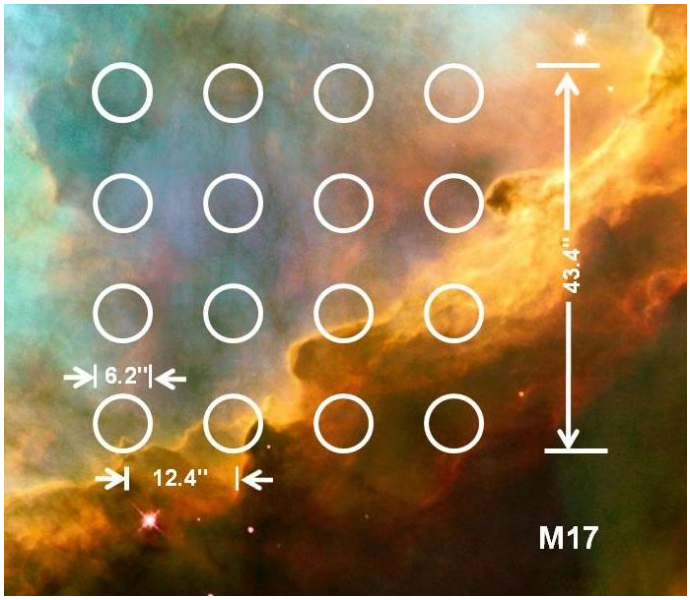
Major Mission Characteristics

Mission mode : SOFIA 2nd Generation Instrument
Mission duration: 3 Science Demonstration Flights
Flight constraints: Spring/Summer (preferred)

Key Instrument Characteristics

Heritage: Herschel, STO, ODIN, SWAS technology
Receiver type: 16 pixel heterodyne array
Receiver Sensitivity: ~1000K DSB
Spectrometer: digital correlators: <1 km/s resolution, ~350 km/s velocity coverage per pixel
Cryogenic system: Helium-free, closed-cycle cryostat
Instrument Power: 9 kW
Instrument CBE Mass: 90 kg Flange; 230 kg SI pallet, (uncertainty 25%)

OCAM's 16 pixel array will dramatically increase the ability of SOFIA to conduct the high spectral resolution [OI] surveys needed to untangle the complex interactions of stars with the ISM. OCAM will utilize On-The-Fly (OTF) mapping techniques to make fully sampled maps of Orion, Cepheus A, the Galactic Center, and M33. >1,000 [OI] lines of sight will be observed on each flight; orders of magnitude more than all previous observations ***combined!***



OCAM/*SOFIA* Beam Footprint

The [OI] 63 µm line is superior to the [CII] 158 µm line in probing regions of massive star formation and the centers of galaxies. It is a unique probe of PDRs, shock waves from stellar winds/jets, supernova explosions, and cloud-cloud collisions.

Mission Management

Christopher Walker, (University of Arizona) PI
STO PI, 28 years experience designing, building, and using THz instruments for astronomy.
Craig Kulesa (University of Arizona) DPI
STO DPI, HEAT PI, 15 years experience designing/building astronomical instruments.
Brian Duffy (University of Arizona) PM
25 years management of military, oceanographic, and astrophysics projects, 3 years STO PM
S.H. Bailey (University of Arizona) DPM
20 years of spaceflight project management experience on four instruments

Teaming Arrangements – Direct Expertise Applied

UofA – Overall Project Lead
Provided multiple space-based instruments for astrophysics and planetary science.
SRON – 4.7 THz Mixers (J. R. Gao)
Provided mixer expertise and I&T for Herschel
MIT/Sandia – 4.7 THz LO (Qing Hu, John Reno)
World leader in QCL's for THz receivers
CIT – Low-noise Cryogenic amplifiers (S. Weinreb)
Extensive experience in receivers, amplifiers, and radio astronomy instruments

Science Team – World-Class Experience (Foldout 1)

Alexander Tielens (U.Leiden) –*OCAM Project Scientist*

Cost (Real Year Dollars)			
	Phase B	**Phase C/D**	**Total**
Cost	$814 K	$6,212 K	$7,026 K
Reserve	$204 K	$1,553 K	$1,757 K
NASA Totals	**$1,018 K**	**$7,765 K**	**$8,783 K**
Contributed			
Reserve			
Total	**$1,018 K**	**$7,765 K**	**$8,783 K**
Reserve %	25%	25%	25%