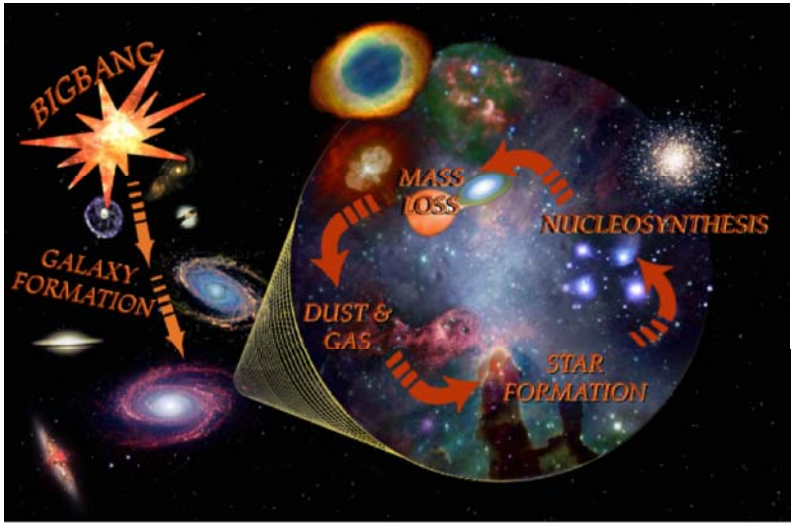
The Stratospheric Observatory for Infrared Astronomy (SOFIA)



R. D. Gehrz[a] and E. E. Becklin[b]

[a]University of Minnesota

[b]Universities Space Research Association

This talk is at: *http://www.sofia.usra.edu/Science/speakers/index.html*

Outline

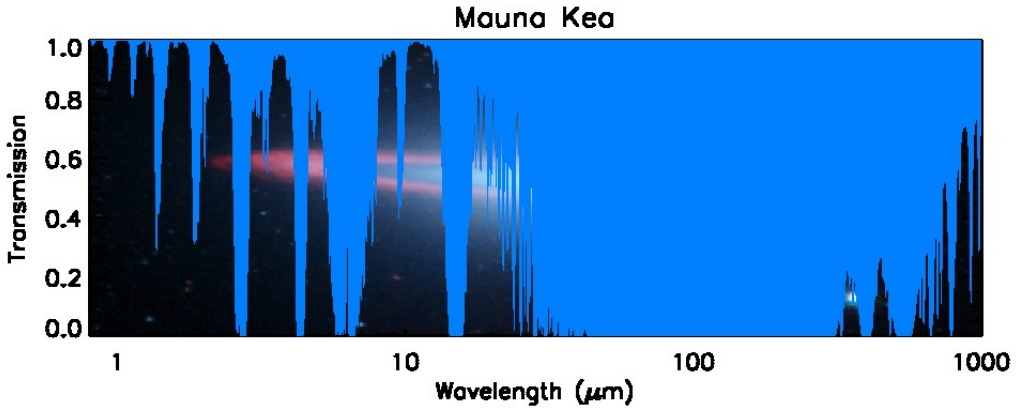
- *The SOFIA Facility and its Status*
- *SOFIA Performance Specifications*
- *SOFIA Basic Science Results*
- *SOFIA Schedule and General Investigator (GI) Opportunities*
- *Summary*

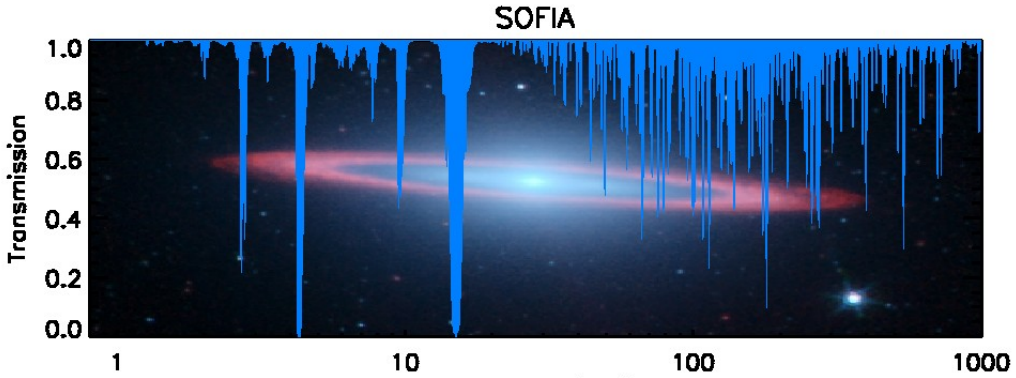
SOFIA Overview

- *2.5 m telescope in a modified Boeing 747SP aircraft*
  - *Imaging and spectroscopy from 0.3 μm to 1.6 mm*
  - *Emphasizes the obscured IR (30-300 μm)*
- *Operational Altitude*
  - *39,000 to 45,000 feet (12 to 14 km)*
  - *Above > 99.8% of obscuring water vapor*
- *Joint Program between the US (80%) and Germany (20%)*
  - *First Light images were obtained on May 26, 2010*
  - *20 year design lifetime –can respond to changing technology*
  - *Ops: Science at NASA-Ames; Flight at Dryden FRC (Palmdale- Site 9)*
  - *Deployments to the Southern Hemisphere and elsewhere*
  - *>120 8-10 hour flights per year*

The SOFIA Observing Environment

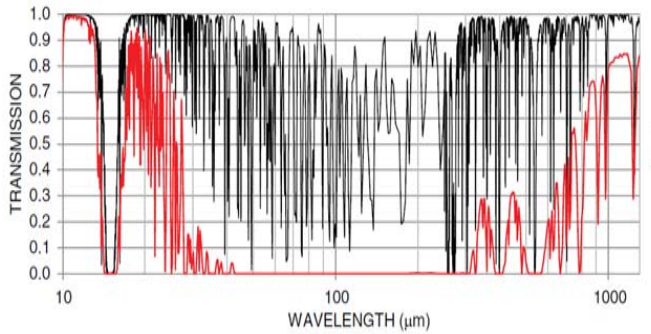
- *Above 99.8% of the water vapor*
- *Transmission at 14 km >80% from 1 to 800 μm*
- *Emphasis is on the obscured IR regions from 30 to 300 μm*





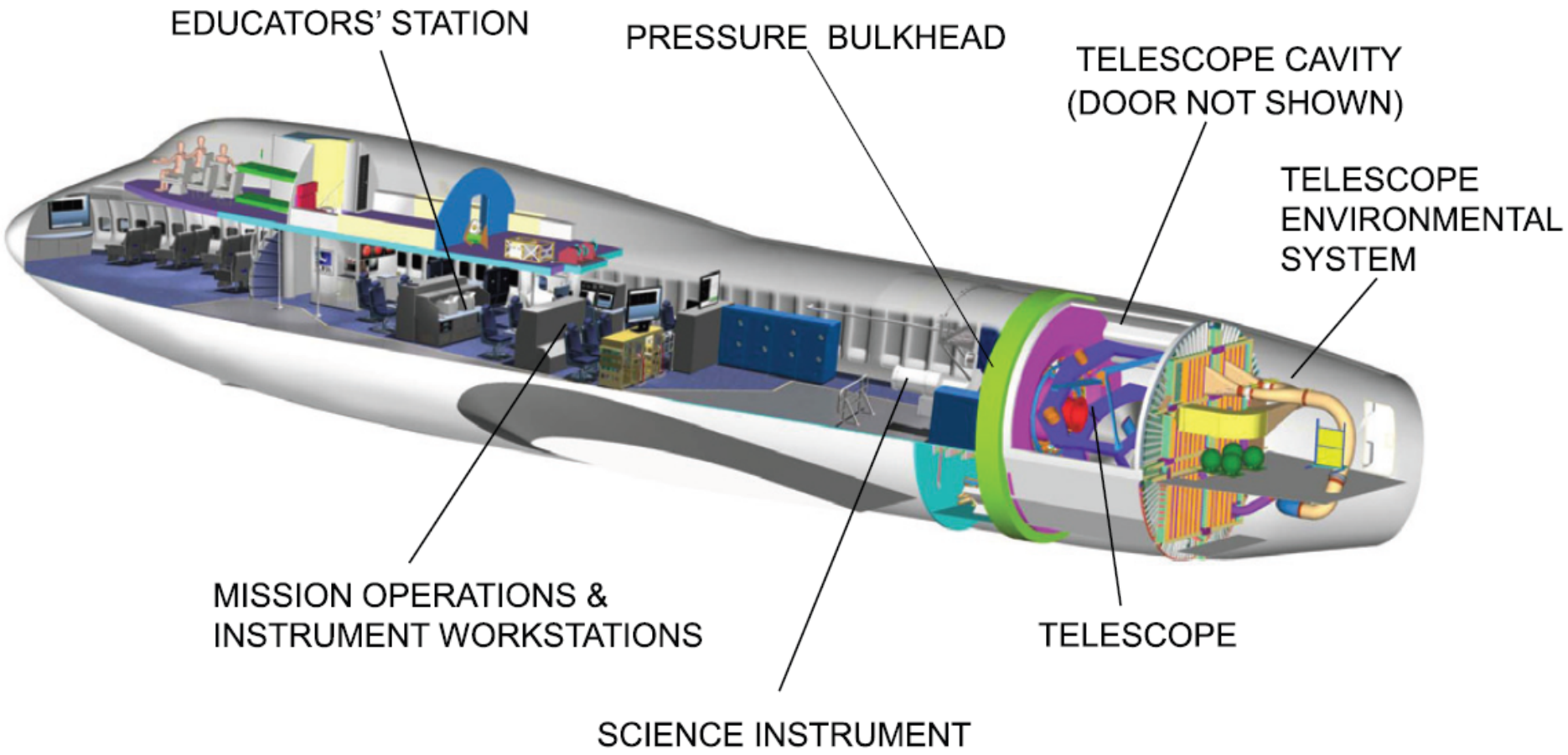
SOFIA , 10μm Precipitable Water Vapor ——

Cerro Chajnantor, 700μm Precipitable Water Vapor ——



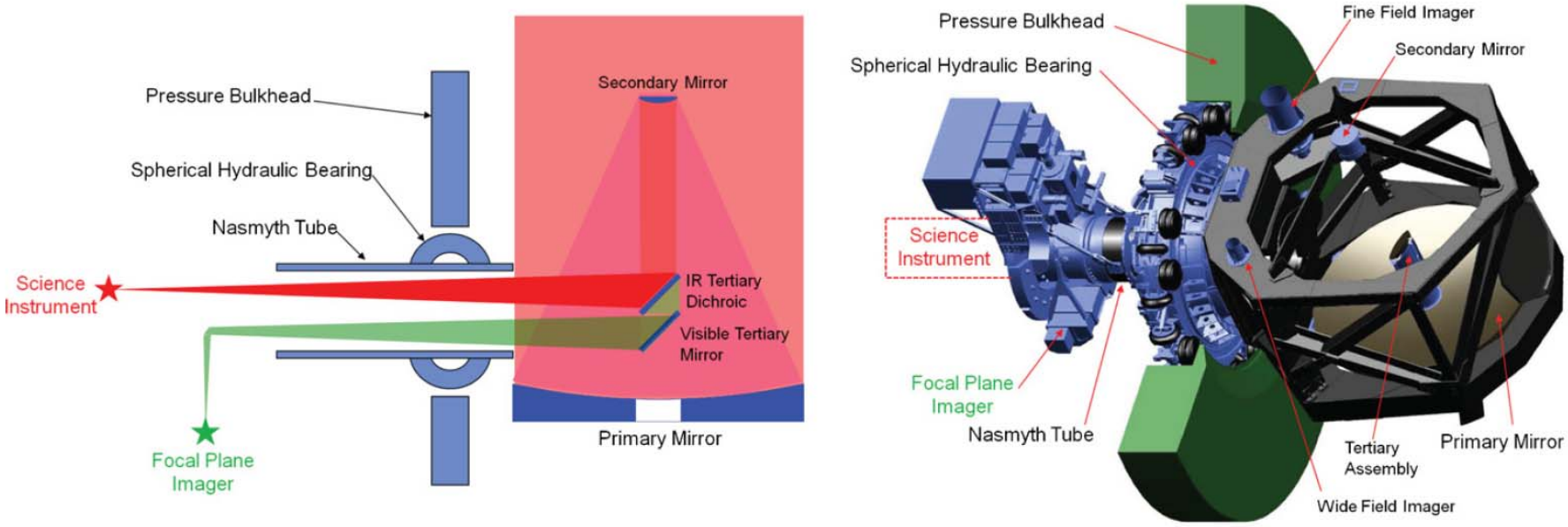
E.T Young et al. 2012, ApJ, 749, L17

The SOFIA Observatory



E.T Young et al. 2012, ApJ, 749, L17

Telescope and Optical Layout



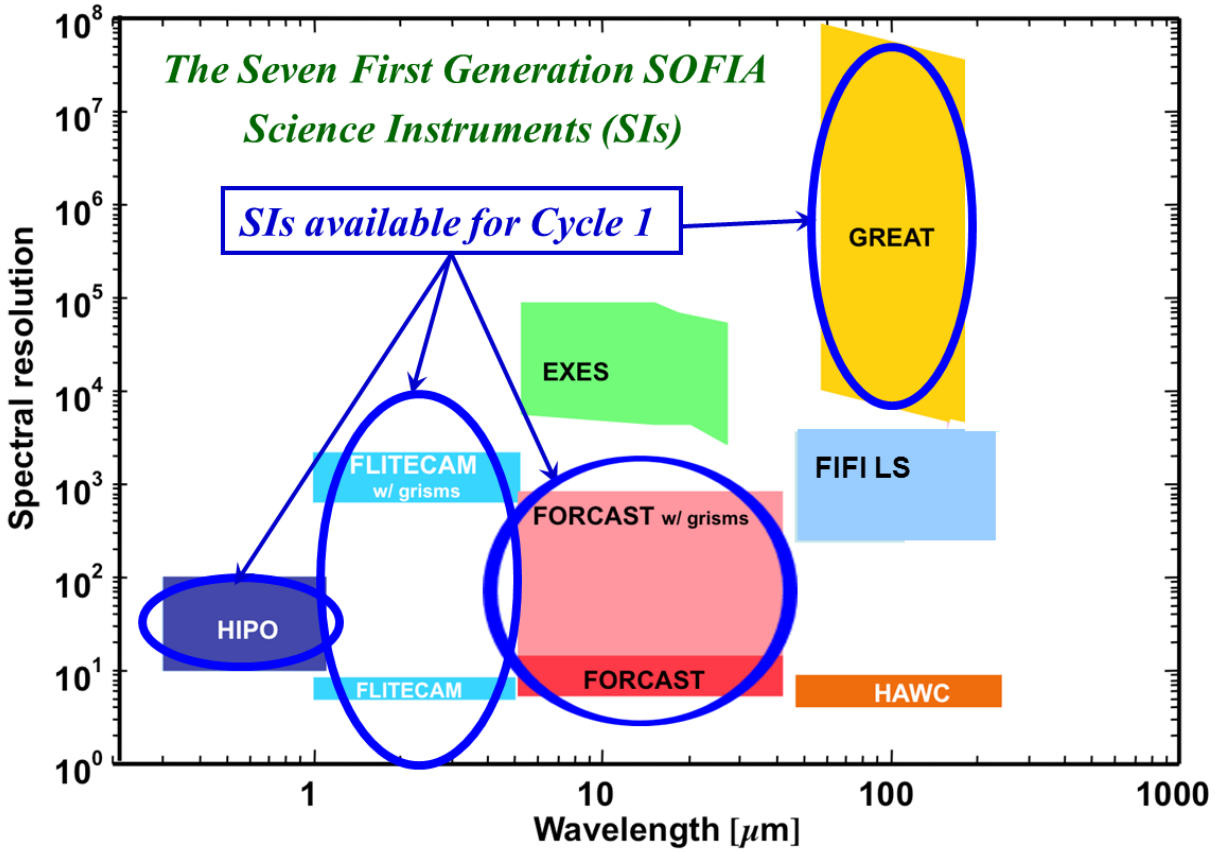
E.T Young et al. 2012, ApJ, 749, L17

SOFIA Airborne on July 13, 2010

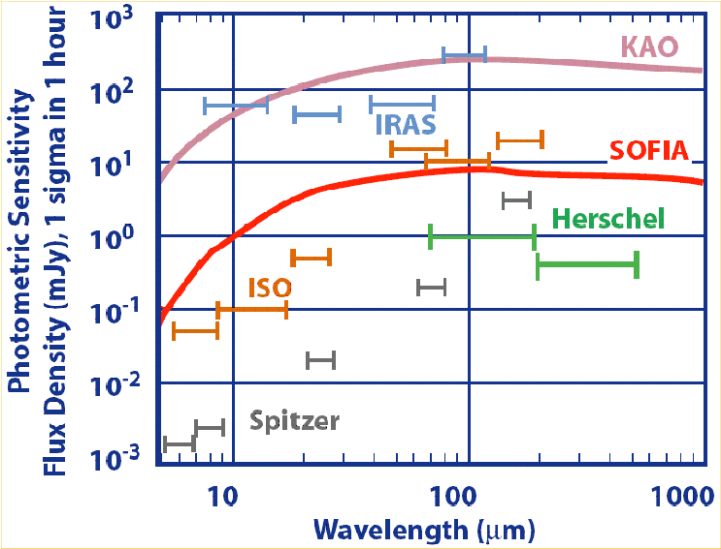
SOFIA Science Instruments

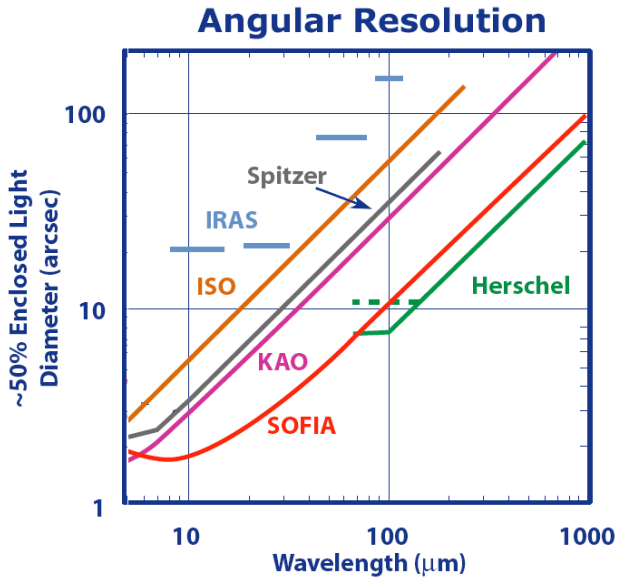
SOFIA supports a unique, expandable suite of Science Instruments (SIs)

- *SIs cover the full IR range with imagers and low to high resolution spectrographs*
- *4 SIs at Initial Operations; 7 SIs at Full Operations.*
- *SOFIA will take advantage of improvements in instrument technology.*
- *Will support both Facility Instruments and PI Class Instruments*



Photometric Sensitivity and Angular resolution





SOFIA is as sensitive as ISO

SOFIA is diffraction limited beyond 25 μm (θmin ~ λ/10 in arcseconds) and can produce images three times sharper than those made by Spitzer

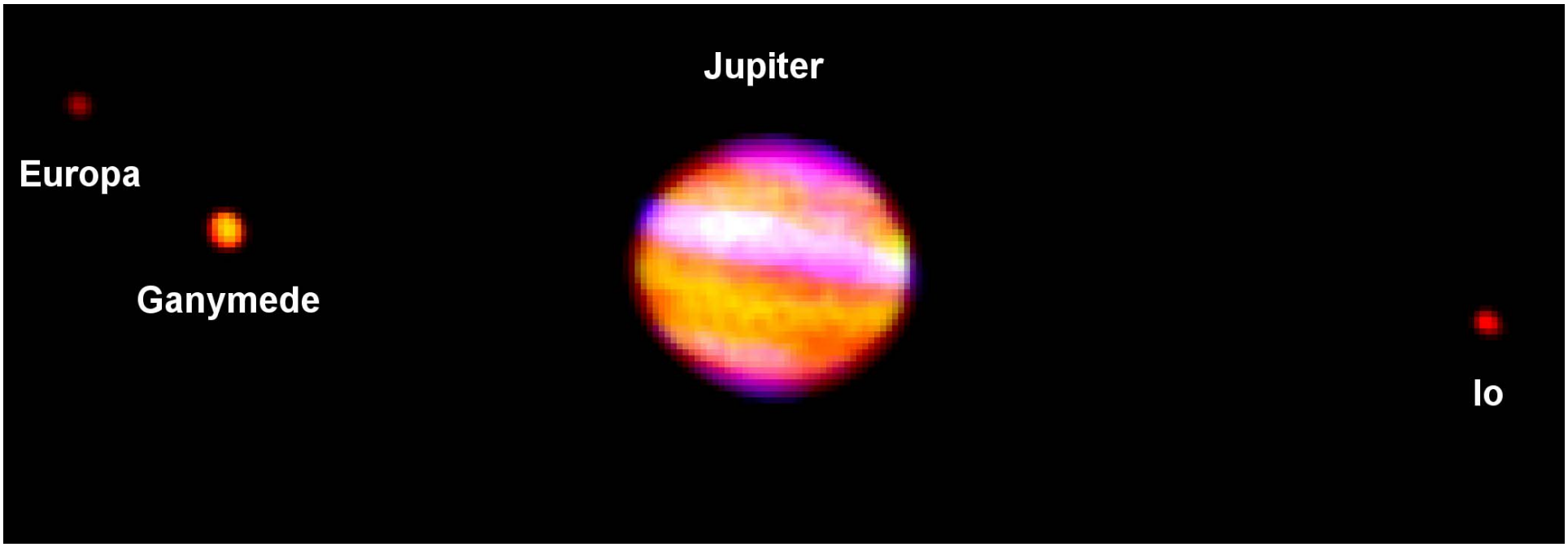
Results from the First Round of SOFIA Flights

Early Science with FORCAST

The FORCAST Team

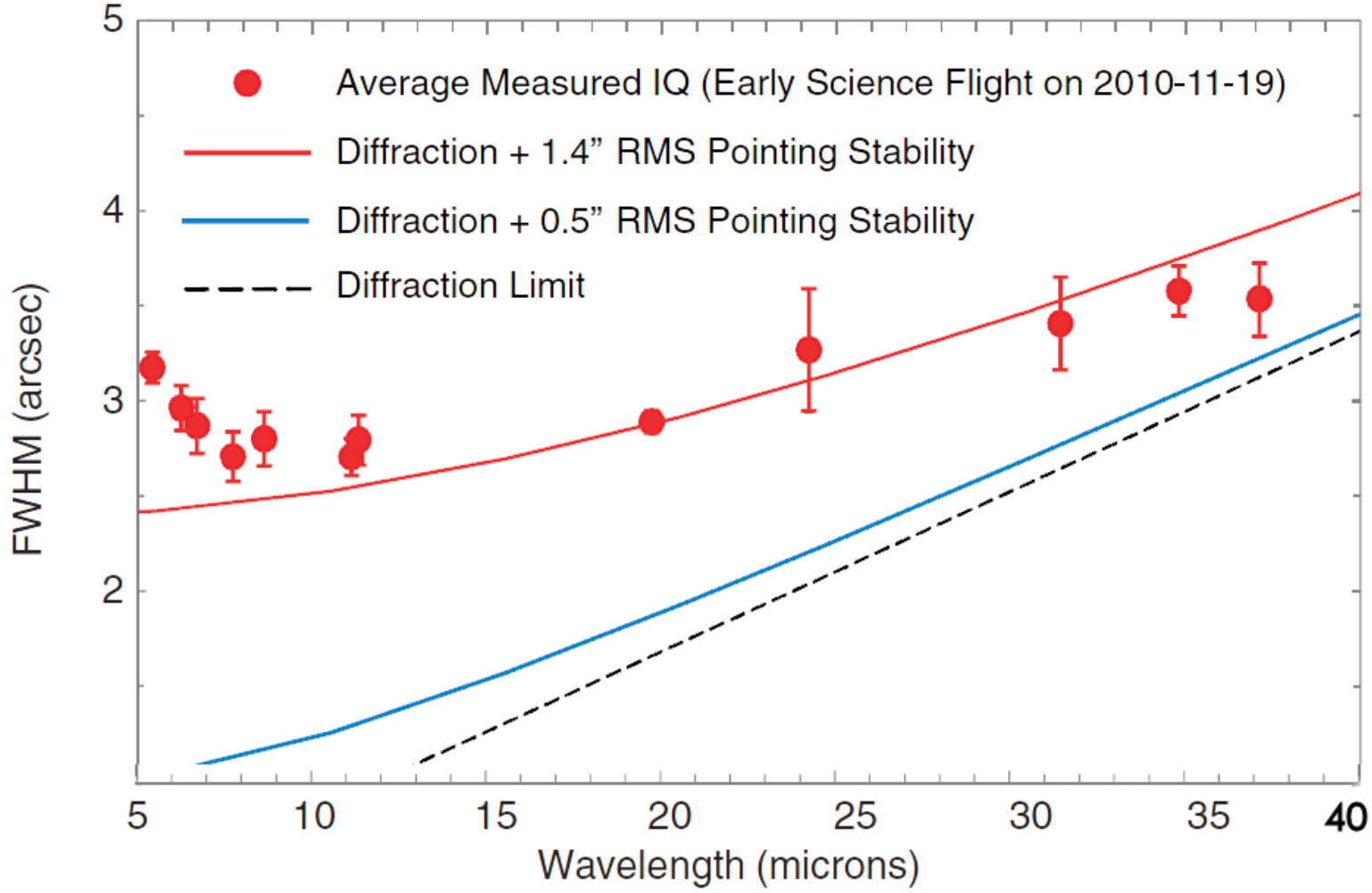
The DSI Telescope Assembly and Mission Operations Team in action during the First Light Flight

First Light on May 26, 2010 UT: We demonstrated diffraction limited imaging capability at 30 microns

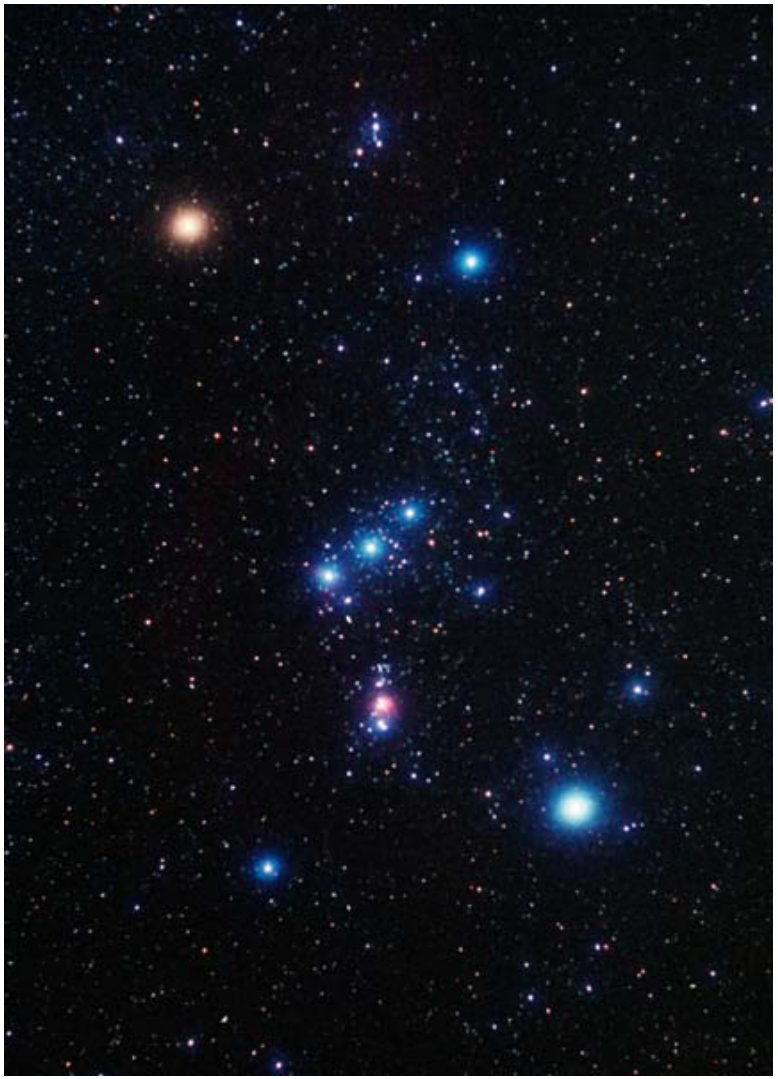


Red = 37.1 μm, Green = 24.2 μm, Blue = 5.4 μm

SOFIA Image Quality During Early Science



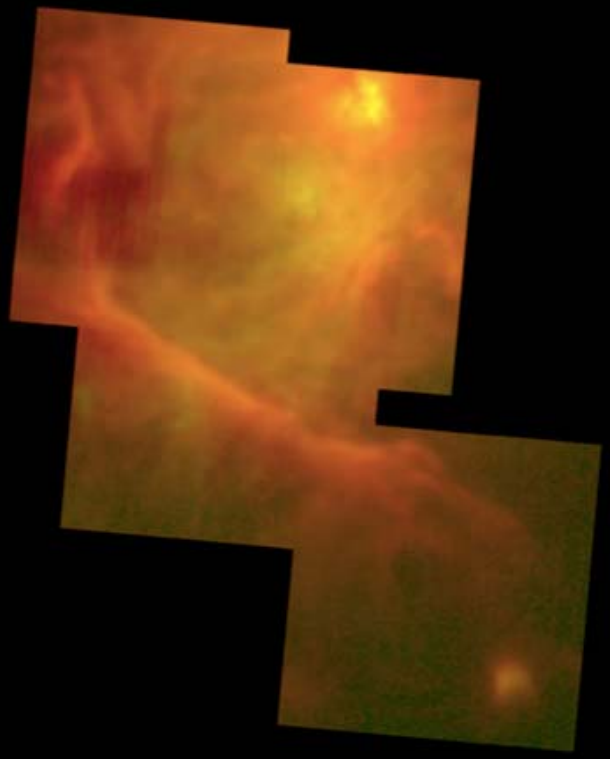
SOFIA Early Science: Star Formation in Orion



20 (Green) and 37 (Red) Micron Data of Orion Nebula

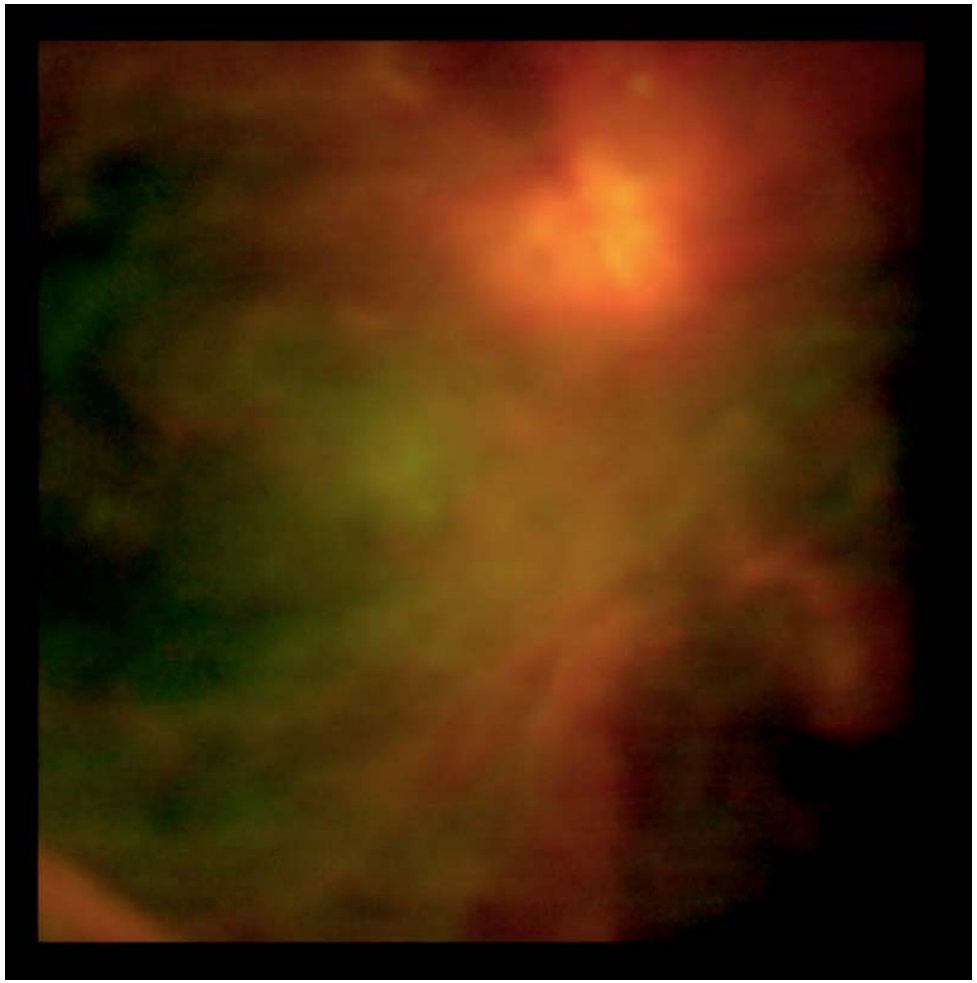
Visible light
(HST, C. O'Dell and S. Wong)

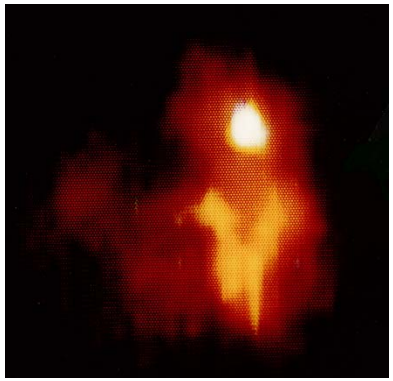
Near infrared
(ESO, M. McCaughrean)



SOFIA mid infrared
(SS02)

SOFIA Early Science Images





Red = 20 μm

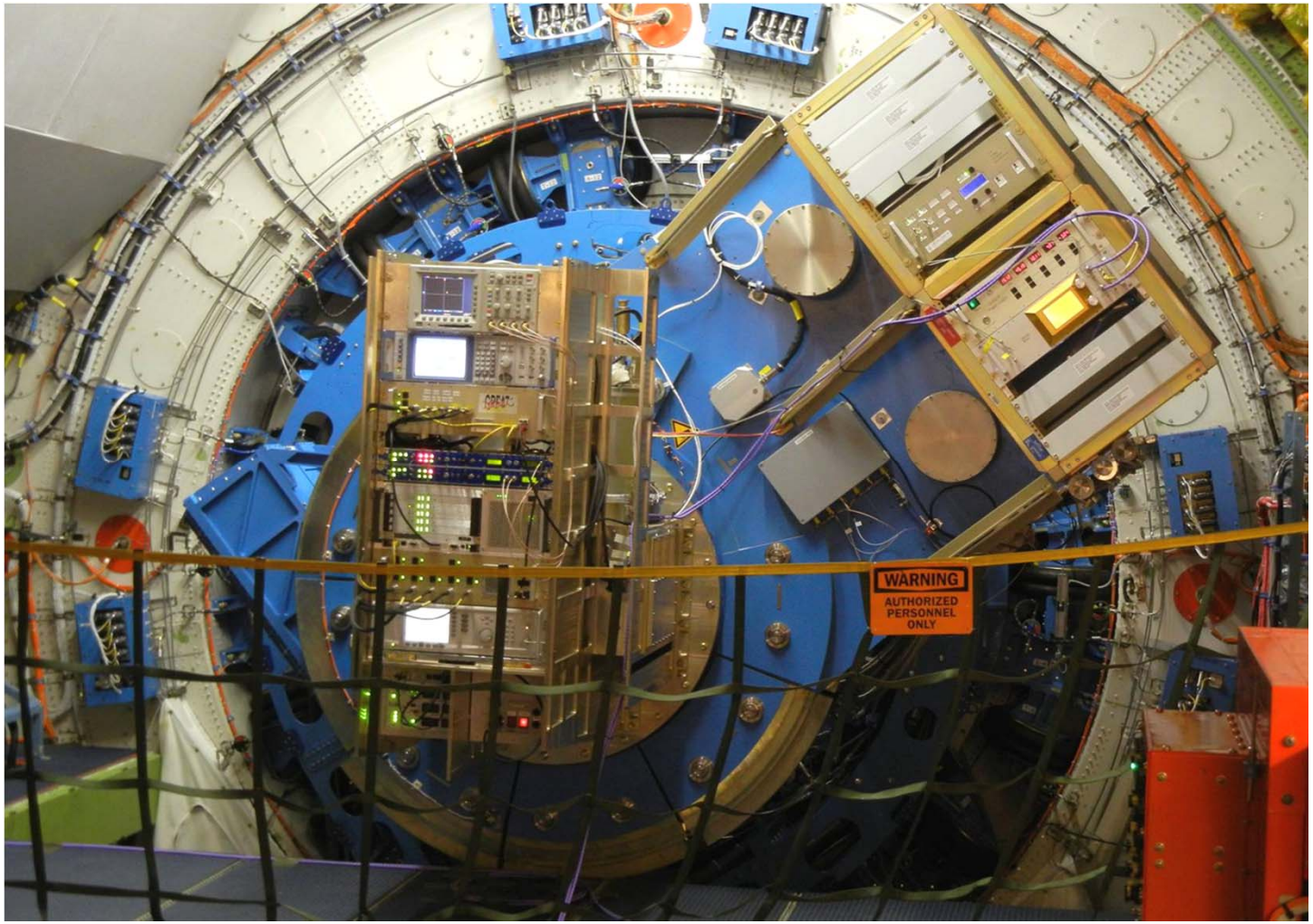
Green = 12 μm

Blue = 11 μm

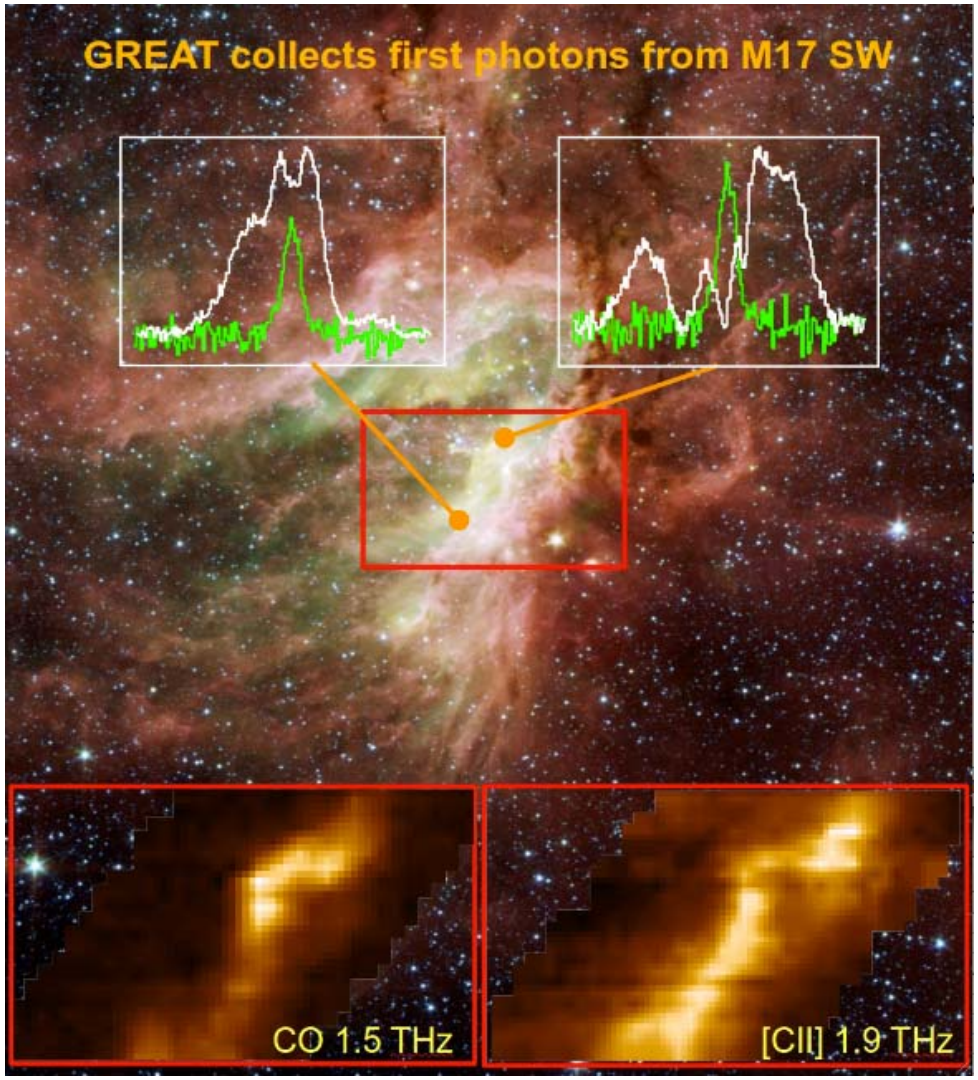
Wyoming Infrared Image from
Herzog et al., 1980, Sky and Telescope, 59, 18

Red = 37.1 μm, Green = 24.2 μm

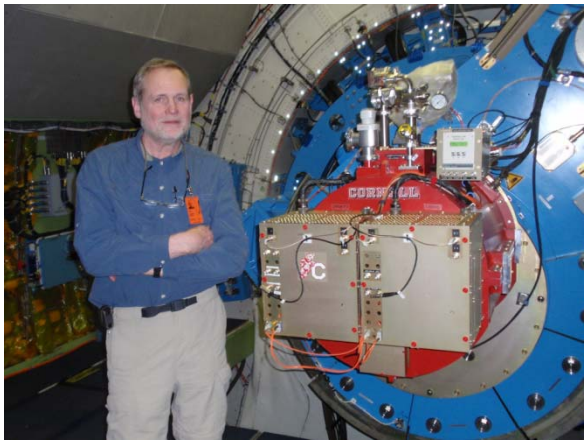
Early Science with GREAT installed on SOFIA

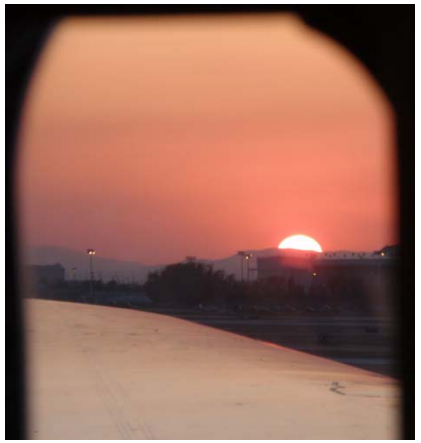


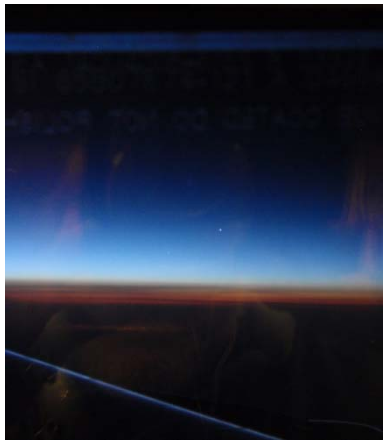
Early Science with GREAT (White CII, Green CO)



May 5, 2011: First Basic Science Flight







Spectroscopic science results from the Basic Science Flights will be described in the next talk

Science Results from SOFIA

- ***The Basic Science flight series was concluded on November 9, 2011***

- ***Thirty papers from the Early and Basic Science program have been published***

  - ***Eight papers on FORCAST science have appeared in a special edition of the Astrophysical Journal Letters (2012, Volume 749)***

  - ***Twenty two papers on GREAT science have appeared in a special edition of Astronomy and Astrophysics Letters (2012, Volume 542)***

Science Schedule

- *Aircraft and telescope control improvements are underway. Test flights will resume in September, 2012*
- *Cycle 1 proposals were ingested on January 27, 2012*
- *172 unique proposals were received (133 US; 39 German)*
- *Proposal selections will be announced in July, 2012*
- *Cycle 1 observations will begin with GREAT observations in November, 2012*
- *Cycle 2 proposals will be called for in December, 2012 or January, 2013 will be due in April, 2013*

Future Instrumentation Development

- *A call for SOFIA second generations SIs was released on July 17, 2011*
- *Eleven proposals were ingested on October 7, 2011*
- *The selection of two proposals for upgrades to HAWC was announced on April 17, 2012.*
  - *A new detector will increase the number of pixels from 380 to 2400*
  - *A wide-field polarimetric capability will be added*
- *NASA plans to issue another SI AO in 2014*

Summary

- *The Program is making progress!*
  - *Early and Basic Science flights have been concluded*
  - *Performance expectations are being met*
  - *The aircraft is being upgraded*
  - *Cycle 1 observations will begin in 6 months*
- *SOFIA will be one of the primary observational facilities for far-IR and submillimeter astronomy for many years*

Our Web site: *http://www.sofia.usra.edu//*

This talk: *http://www.sofia.usra.edu/Science/speakers/index.html*