

SCIENCE INSTRUMENT DEVELOPMENT

Presented by:
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SUG – JUN 2017

SOFIA

*Stratospheric Observatory
for Infrared Astronomy*

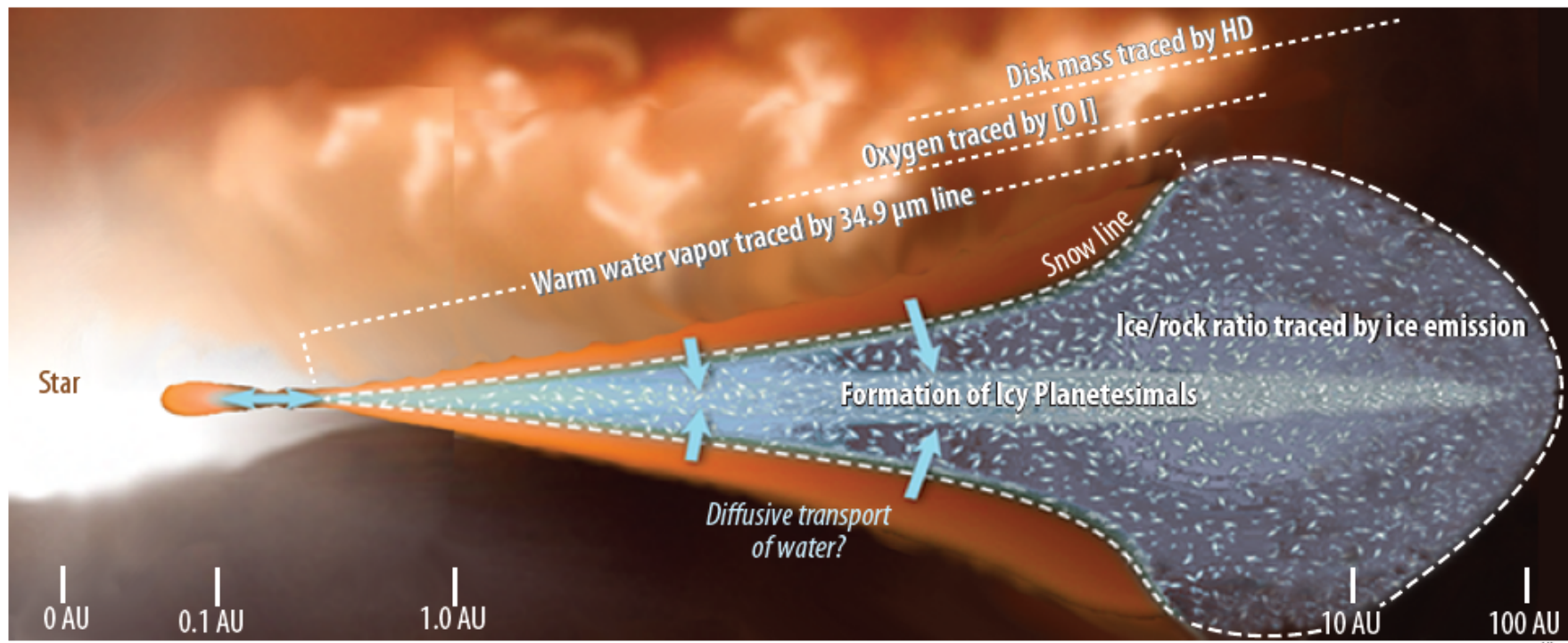


What is HIRMES?

- High Resolution Mid-infrared Spectrometer (HIRMES)
- HIRMES is the 3rd generation facility-class instrument that will fly on SOFIA in 2019
- HIRMES primary science is to investigate protoplanetary disk physics and addresses the questions:
 - How does the disk mass evolve during planetary formation?
 - What is the distribution of oxygen, water ice, and water vapor in different phases of planet formation?
 - What are the kinematics of water vapor and oxygen in protoplanetary disks?

Over riding theme is to discover how protoplanetary systems evolve

Protoplanetary Disks

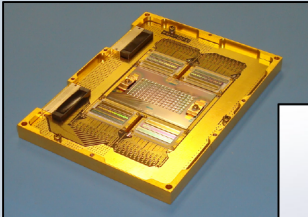
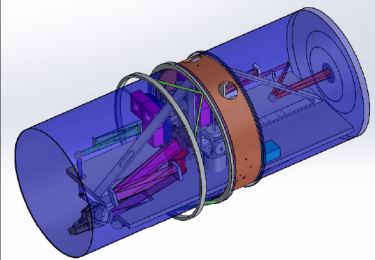

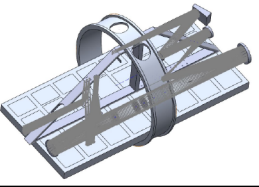
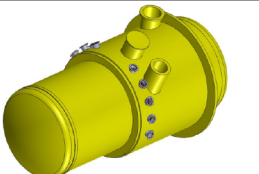


Water line measurements locate the transition region between warm water vapor and ice

Instrument Overview

- HIRMES is a direct detection spectrometer covering the spectral range from 25 to 122 μm
- There are four spectroscopic modes to HIRMES
 - High-res mode $R \sim 100,000$
 - Mid-res mode $R \sim 10,000$
 - Low-res mode $R \sim 600$
 - Imaging spectroscopy mode: $R \sim 2000$
- The modes are optimized to deliver the maximum sensitivity achievable with SOFIA. HIRMES uses:
 - Background limited bolometers (TES)
 - Combination of Fabry-Perot Interferometers and gratings
- Utilizes an adiabatic demagnetization refrigerator (ADR)
- More Detailed Project Information:
https://www.sofia.usra.edu/sites/default/files/12-21-16_Moseley.pdf

Roles & Responsibilities

GSFC	<ul style="list-style-type: none">• Science/PI• Instrument Management• Instrument Systems Engineering• HIRMES Overall Instrument<ul style="list-style-type: none">-Design & Build-Integration & Test-Key technology: Detector system• Airworthiness Safety• System Integration & Test, commissioning• Science Data Products		
Cornell University	<ul style="list-style-type: none">• Science Investigation• Low resolution imaging Fabry-Perot Interferometer• Mid & High Resolution FPI's		
Space Dynamics Laboratory	<ul style="list-style-type: none">• Optical Imaging Assembly<ul style="list-style-type: none">-Optical Bench-Optical components & mechanical components-Gratings-Optical alignment & verifying the imaging performance		
Precision Cryogenic Systems	<ul style="list-style-type: none">• Cryostat<ul style="list-style-type: none">-Cryostat fabrication and vacuum testing-Material certs, tracking reports and inspection reports.		

HIRMES Project Milestones

- Selected on December 2015 for Concept Study
- Systems Requirement Review (SRR) held during the competitive process on April 27, 2016
- Awarded on September 1, 2016 as a GSFC PI led instrument (PI: Harvey Moseley)
- Delta-PDR: March 8, 2017
- CDR: August 30, 2017
- Pre-Ship Review: February 22, 2019
- Deliver Instrument: March 2019

HIRMES Details and Update

- Lessons learned on the solicitation for the third generation SI have been discussed with the HIRMES team during the 28 APR 2017 weekly meeting with the HIRMES team
 - Effort to document is underway
 - CDR efforts are high priority at this time
- The following Engineering Peer Reviews will be held concerning the HIRMES Project

– ADR/Eddy Current Damper	Complete
– Opto-Mechanical CAD Model	Complete
– Cryostat	Complete
– GSE Lab and Installation Carts	TBD
– PI/Counterweight/Power Distribution	Week of Jun 15, 2017
– Mechanisms	Week of Jul 17, 2017
– Focal Plane Array / Detectors	Week of Jul 24, 2017

- **Next-generation instrument call for proposals will occur 2017, with a schedule to infuse new capabilities on SOFIA no later than 2021.**
- **NASA will complete the selection of the next generation science instrument in the first quarter of FY 2018 (Phase 1)**
- **Whether or not NASA moves forward with development of the instrument is contingent on the result of the 2019 Senior Review**
- **Working across the NASA team to develop the details, employ lessons learned, an optimal set the schedule for this effort**