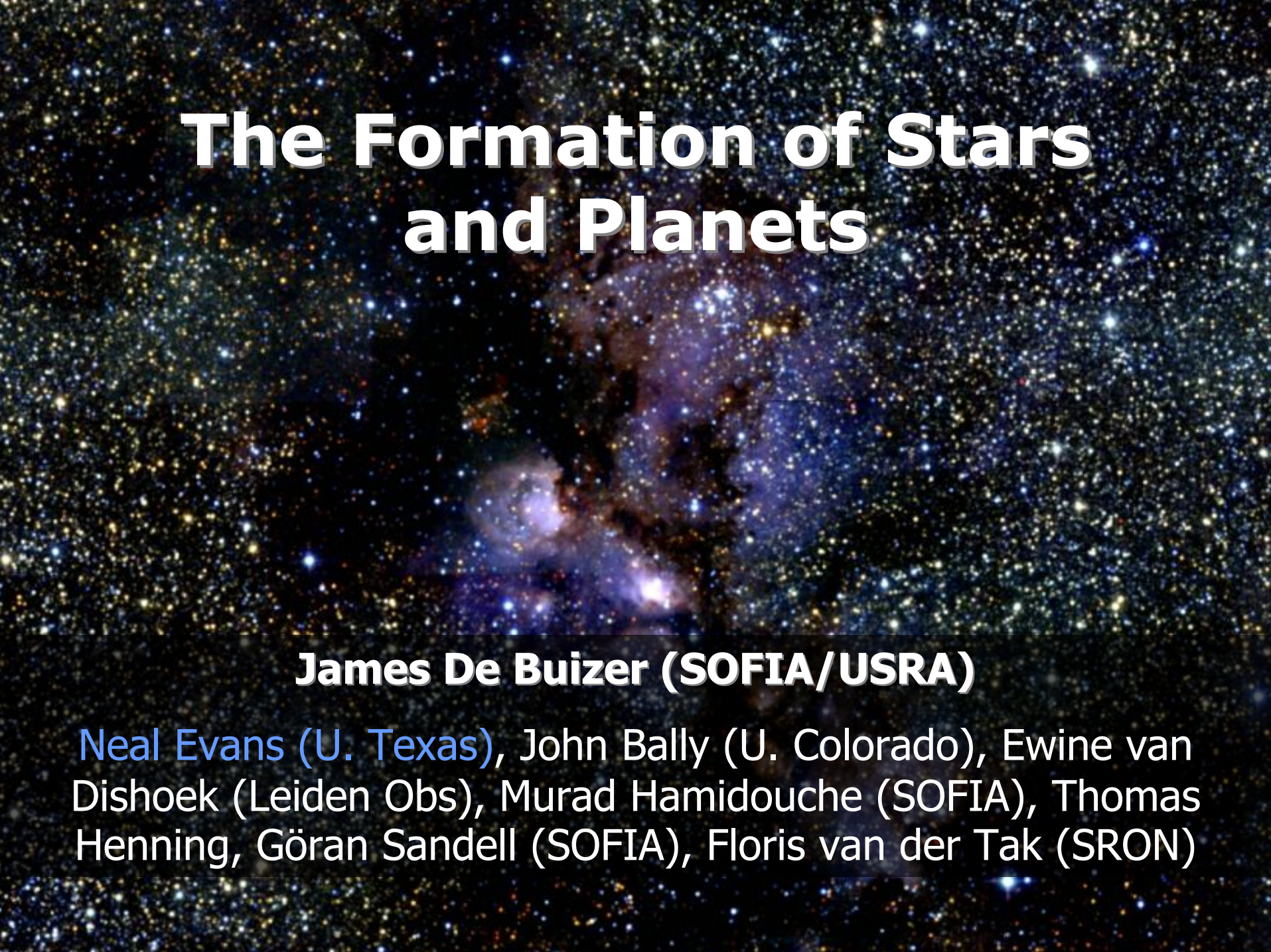


The Formation of Stars and Planets

James De Buizer (SOFIA/USRA)

Neal Evans (U. Texas), John Bally (U. Colorado), Ewine van Dishoek (Leiden Obs), Murad Hamidouche (SOFIA), Thomas Henning, Göran Sandell (SOFIA), Floris van der Tak (SRON)

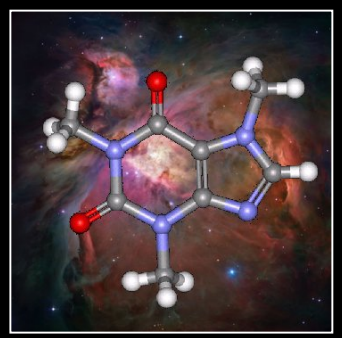
Three major themes were chosen within the general star and planet formation topic

1) Understanding Circumstellar Disks

- **Chemistry and Evolution of the Disk**
- **Understanding Disk Luminosities**

2) Massive Star Formation

- **Disentangling the Luminosity**
- **Probing the Interiors of Massive Star Forming Cores**
- **Polarization in Massive Star Forming Regions**



3) The Astrochemistry of Star Formation

- **The Oxygen Deficit Problem**
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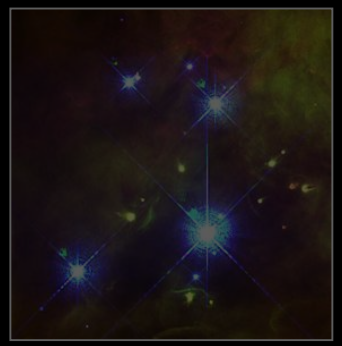

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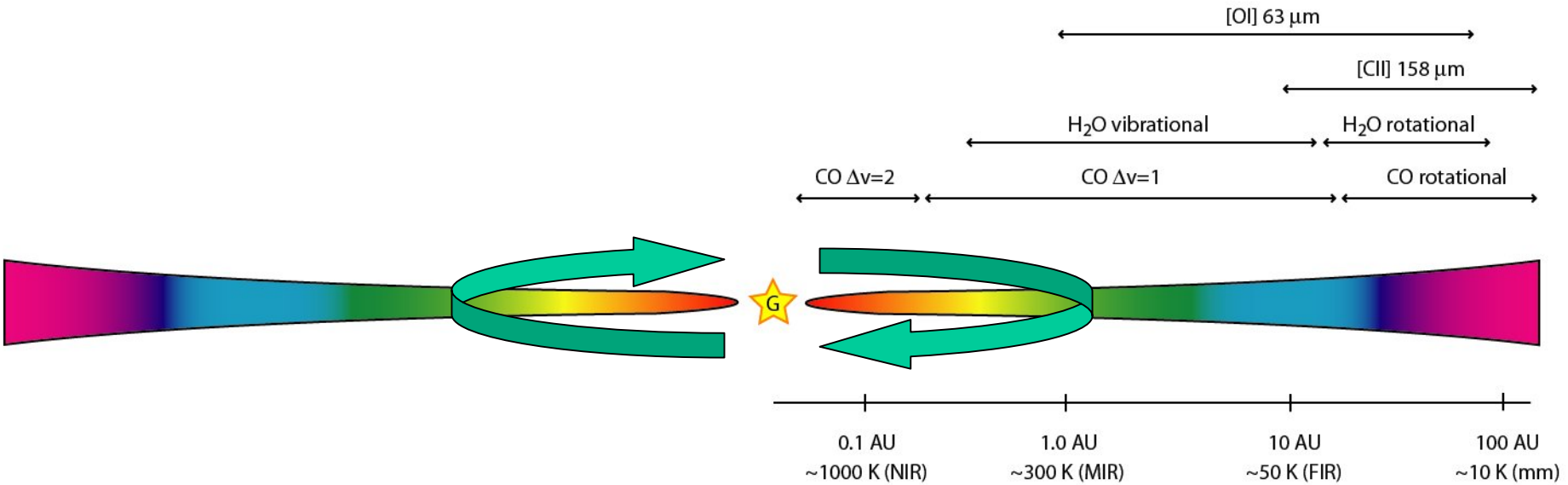
SOFIA will determine the chemistry of disks as a function of radius



- The cartoon of a rotating disk above is color-coded as a function of r
- We have only a general idea of where species may be located in disks

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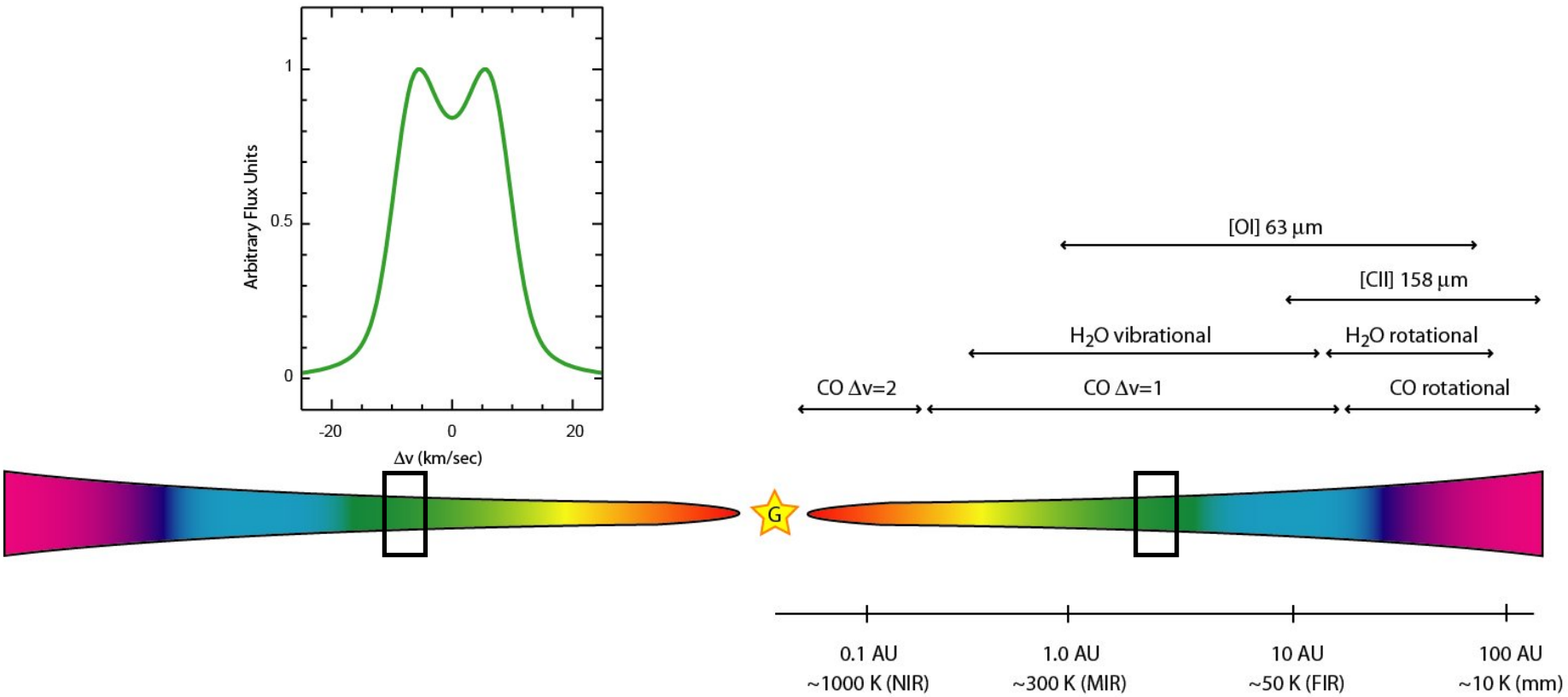

- High spectral resolution ($R>10^5$) can determine where species reside in the disk by velocity-resolving their lines

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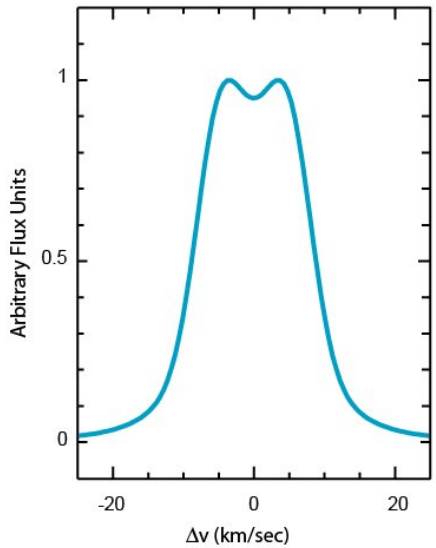

- Material at small radii produce double-peaked, wider lines.
- With Kepler's Law one can deduce the radius
- Spatially resolving the disk is not necessary

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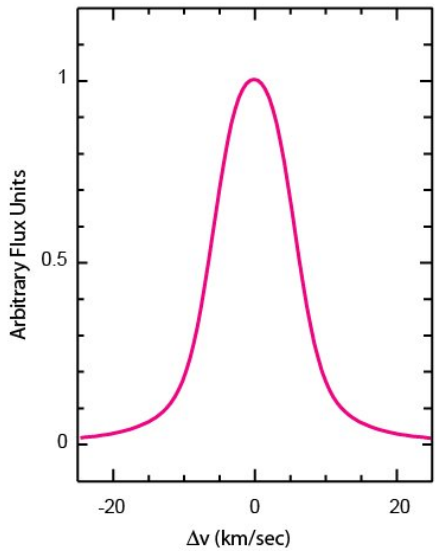

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- With Kepler's Law one can deduce the radius
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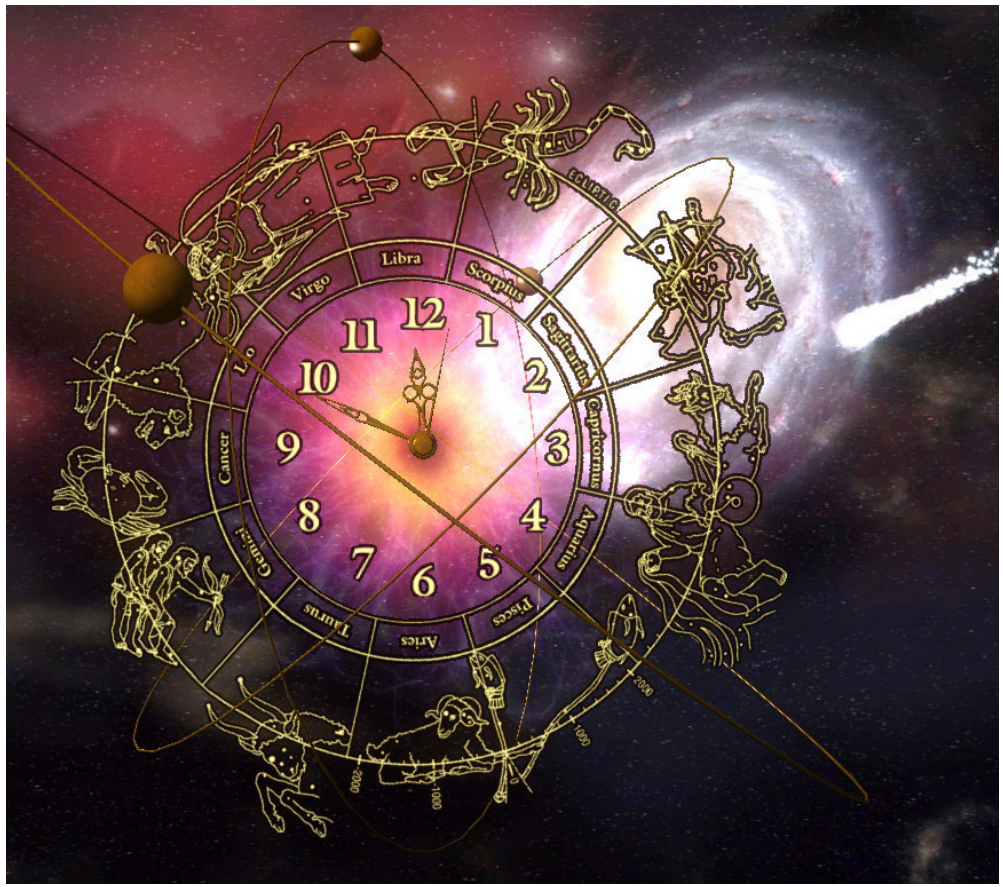
SOFIA will study how the chemistry of disks evolves with time

- SOFIA can be used to study lines of [OI] at 63μm, OH at 119μm, [CII] at 158μm and determine where they form

- By studying a variety of disks at different ages, one can study chemical evolution

- The H_2O at 6μm (gas) can probe the inner disk where there are migrating icy bodies and 45μm can probe beyond the "snow line" where icy bodies form



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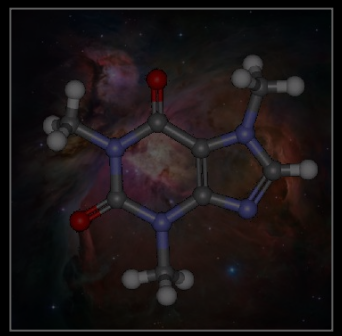

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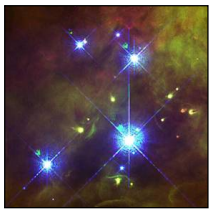
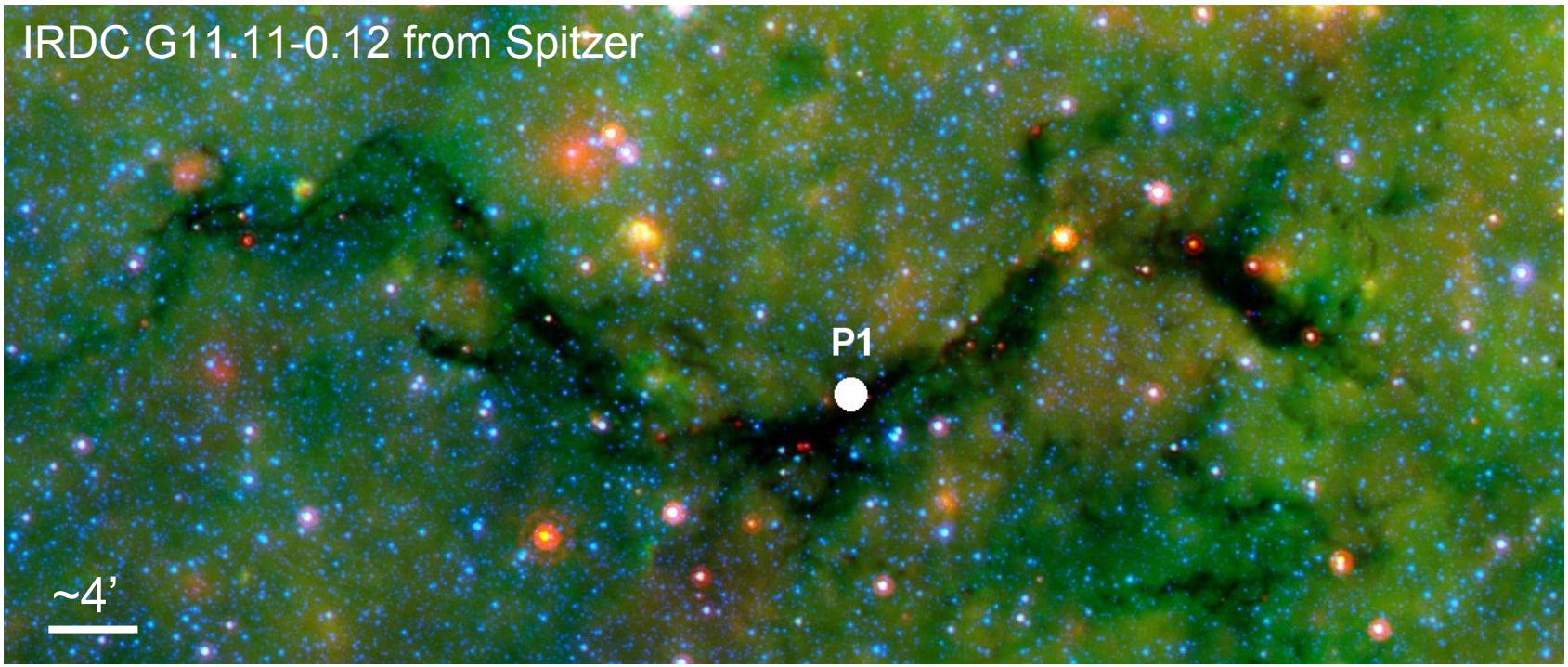
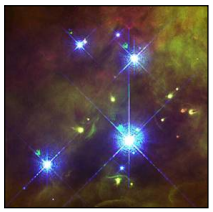


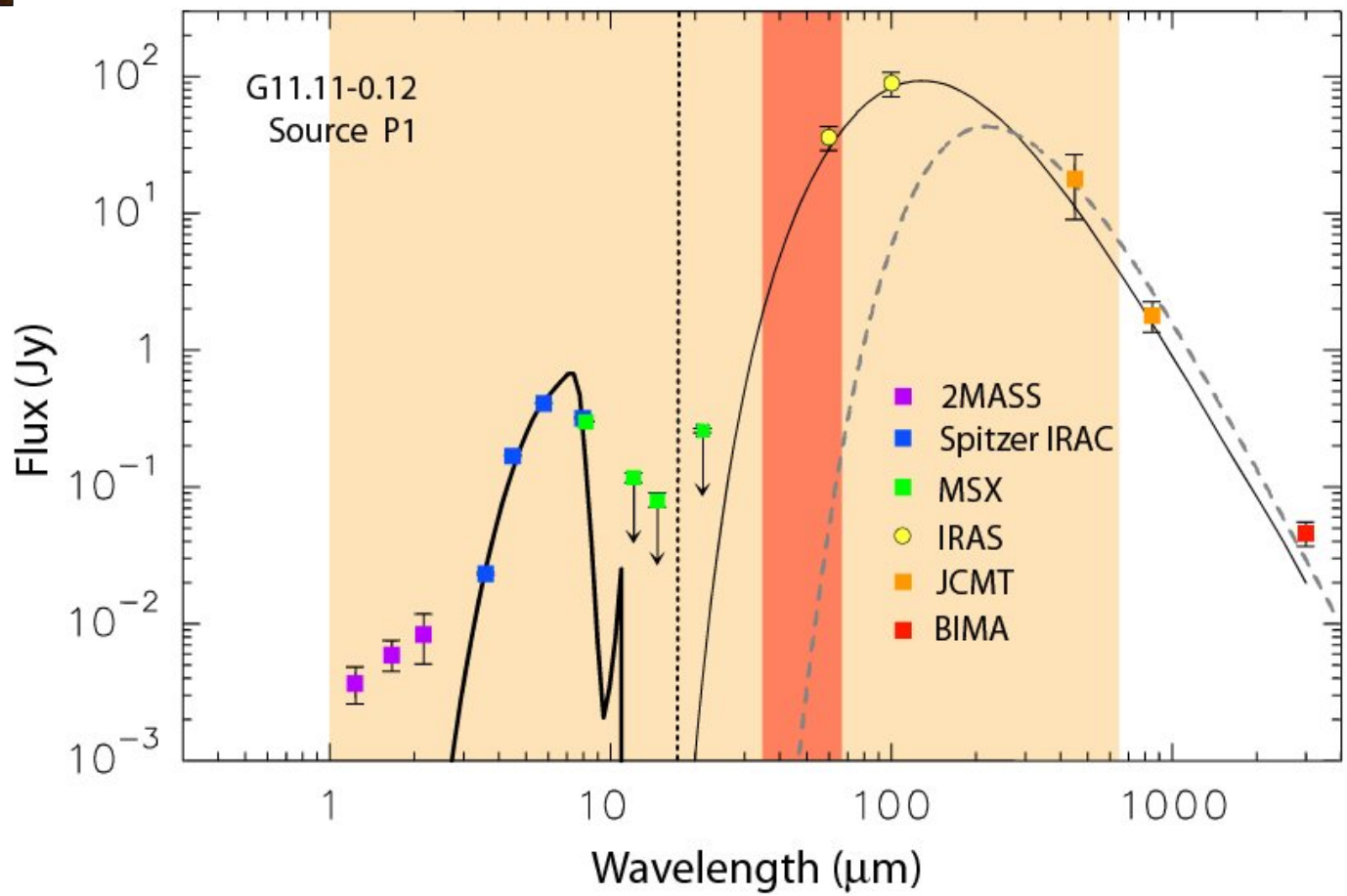
SOFIA will help disentangle the sources of luminosity in massive star cores



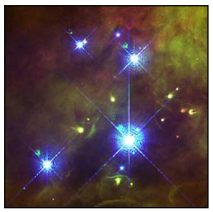
- The fundamental property of a star is its luminosity!
- For many massive star cores being studied it is unclear if the luminosities observed at short and long wavelengths are coming from the same source or multiple sources



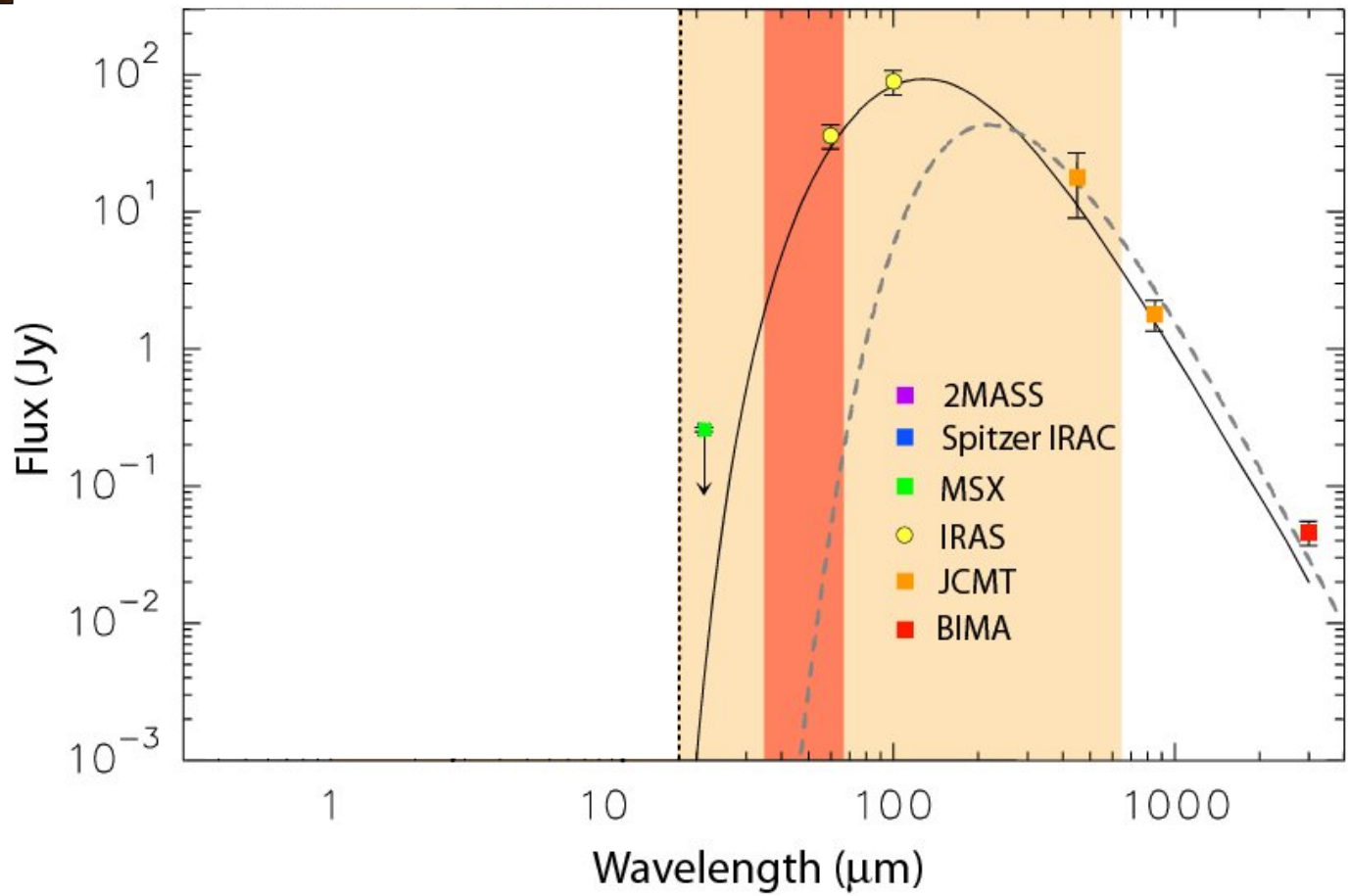
20 to 100 μm provides a key link between shorter and longer wavelengths of the SED



- Sources with short & long wavelength emission require more data with good spatial resolution and spectral sampling from 20-100μm to determine the sources of luminosity



Many sources have no (or poor) data at λ<350μm; understanding their true nature is extremely difficult



- Observations are easy with SOFIA (sources are bright in FIR)
- Narrow filters will allow detailed sampling of SED

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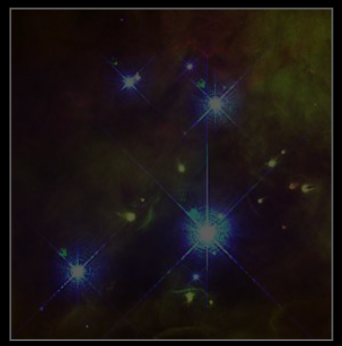

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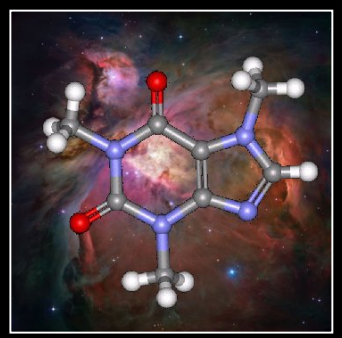

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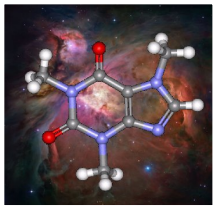
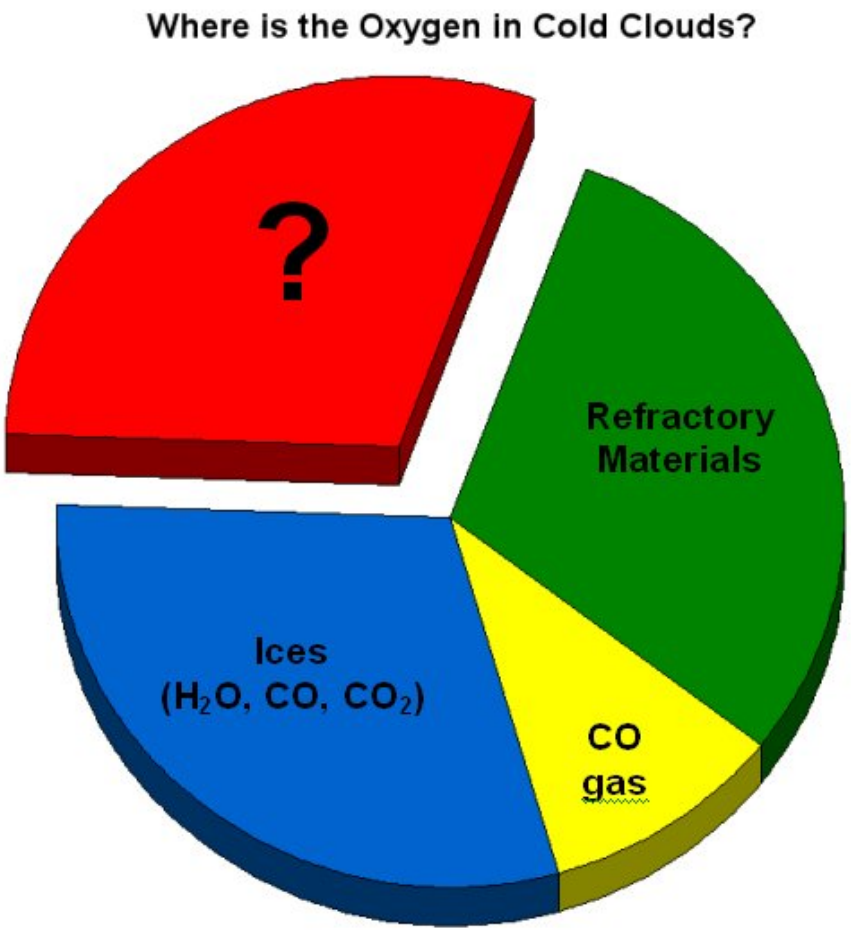


SOFIA may resolve the puzzle of the missing oxygen in cold clouds



- Understanding the oxygen cycle is a key astrobiological concern

- SOFIA is the only mission that can provide spectrally resolved data on the [OI] lines at 63 and 145 μm

- Gaseous atomic O is the likely reservoir for the missing oxygen that can be probed by the above lines, but velocity resolution is needed to localize the emission

- The other main reservoirs that can be probed are OH (ground state line at 119μm) and H_2O

SOFIA's Role in Star and Planet Formation Studies

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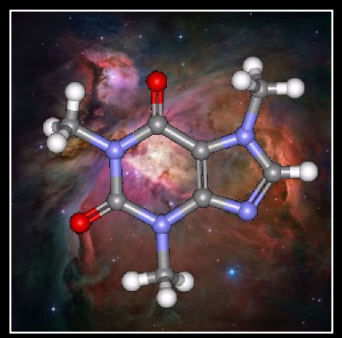

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