

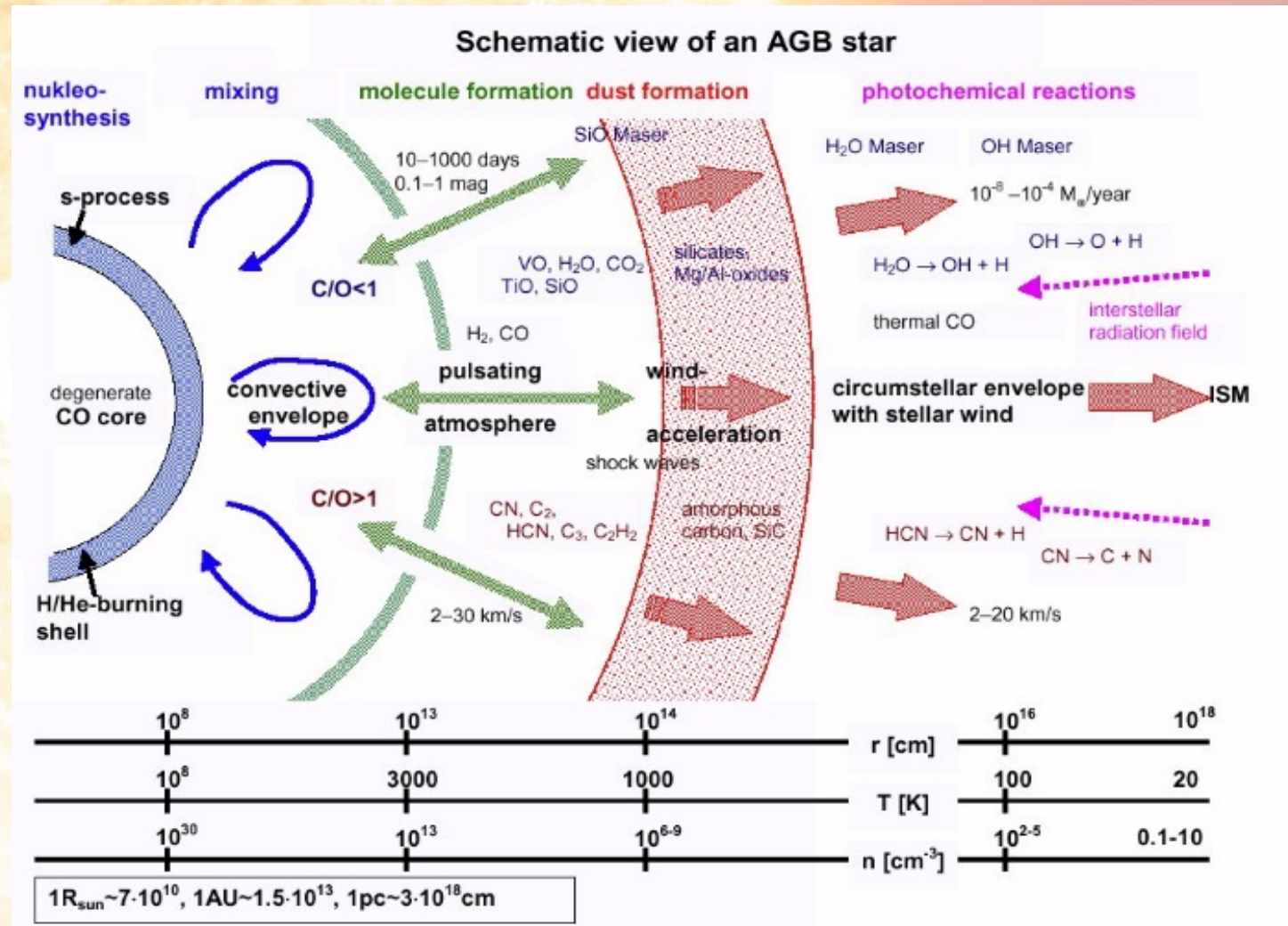
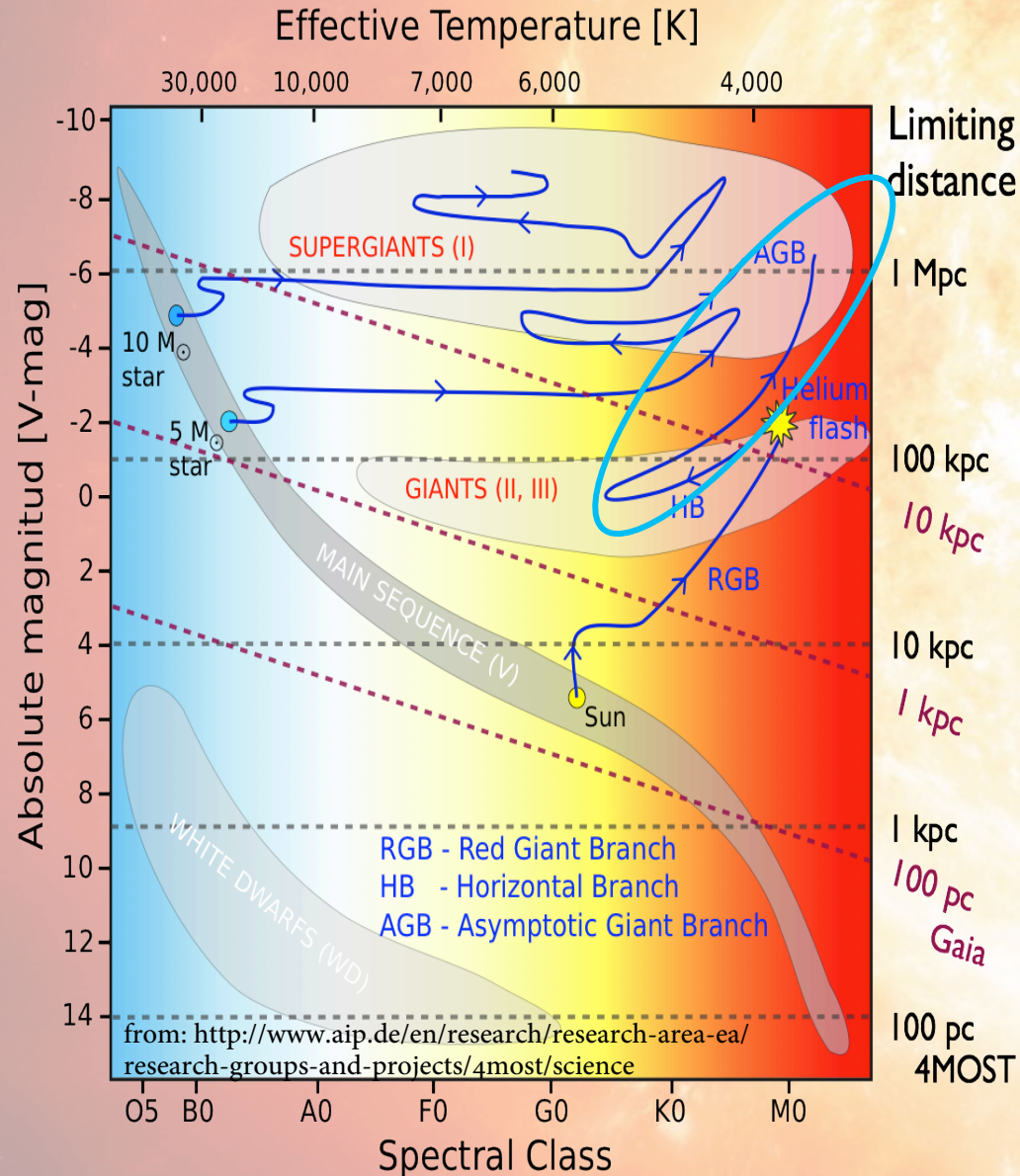
# Resolving the mass-loss history of nearby Asymptotic Giant Branch stars

Analysis plan for JCMT 15B HARP and SCUBA2 observations of AGB stars

Thavisha Dharmawardena  
Academia Sinica Institute of Astronomy and Astrophysics



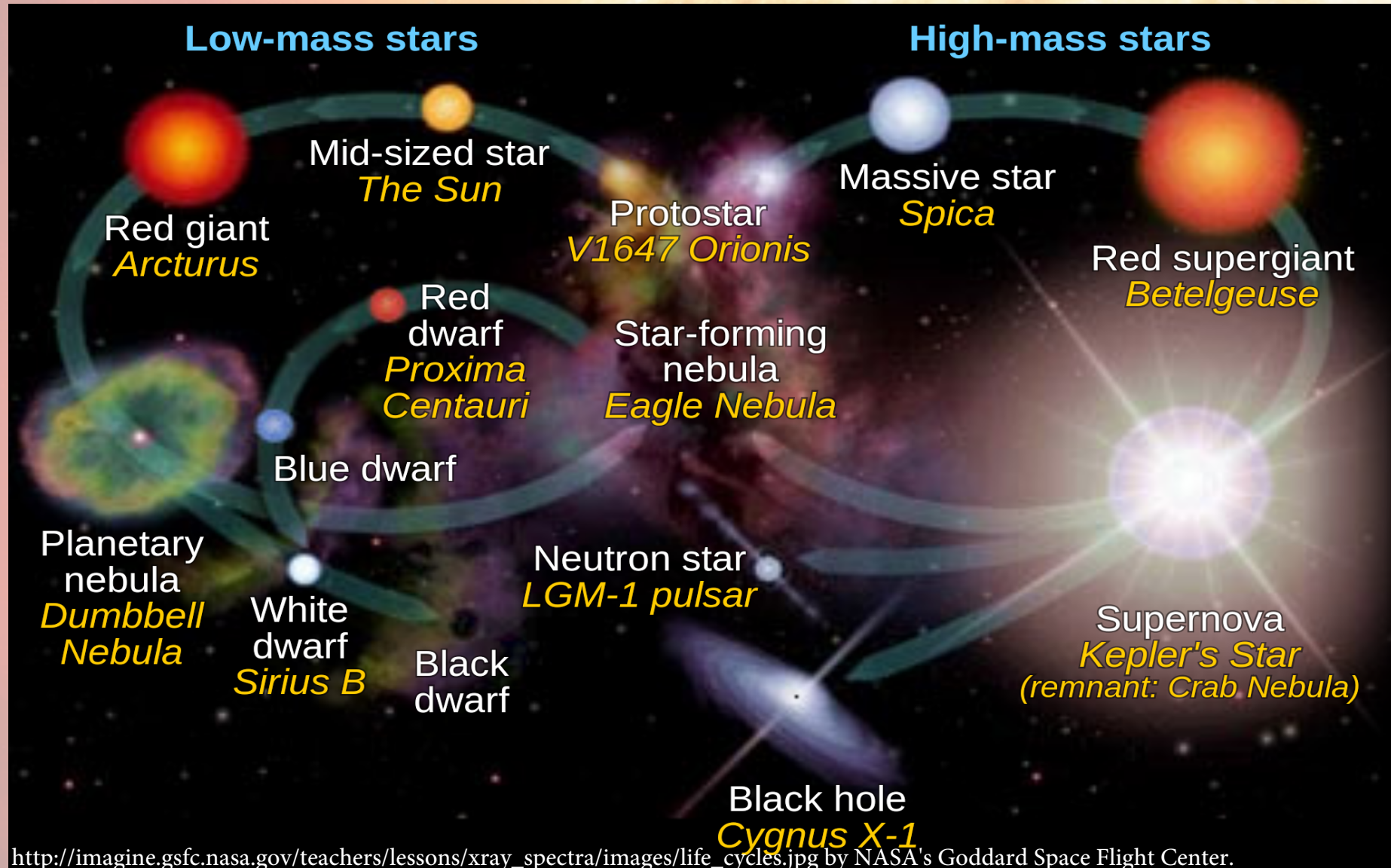
# Asymptotic Giant Branch (AGB) Stars



Schematic view of an AGB star - extended version: (by J. Hron) <http://www.univie.ac.at/agb/agbdetail.html>



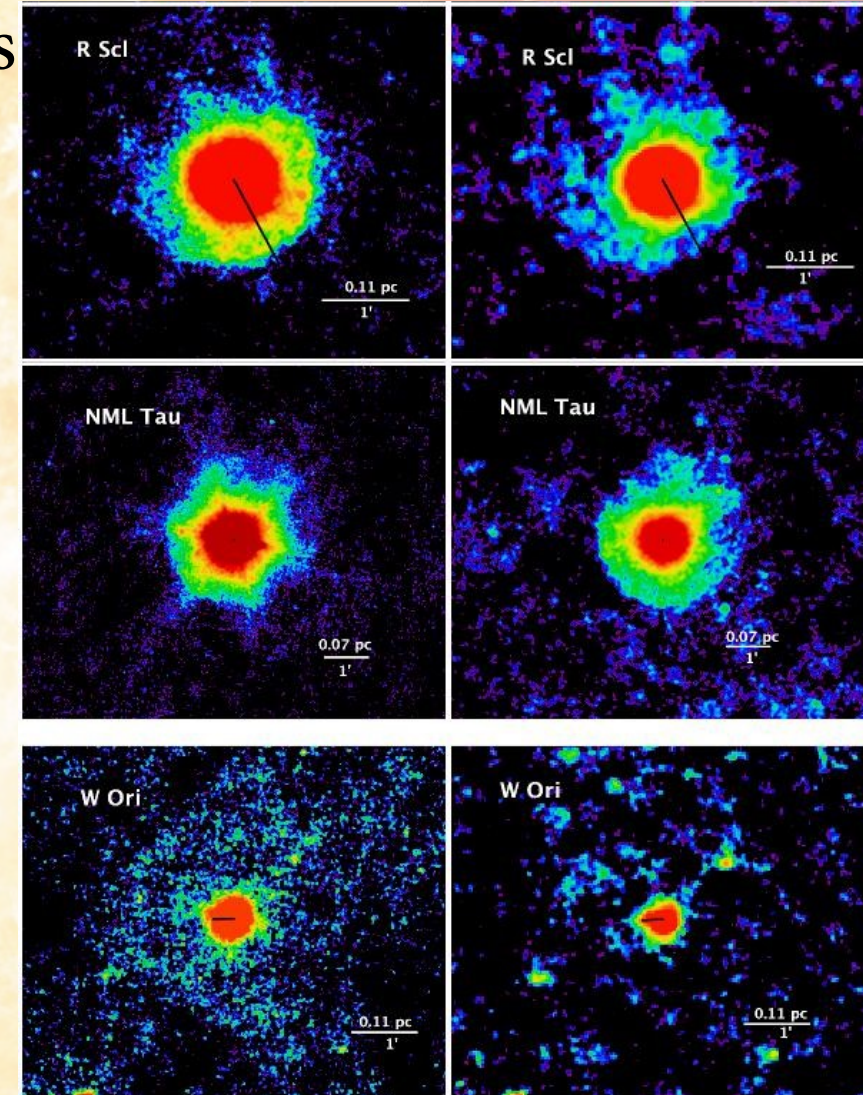
# What makes AGB stars and their winds important to Galaxies?





# Long overdue need for a study of nearby AGB stars

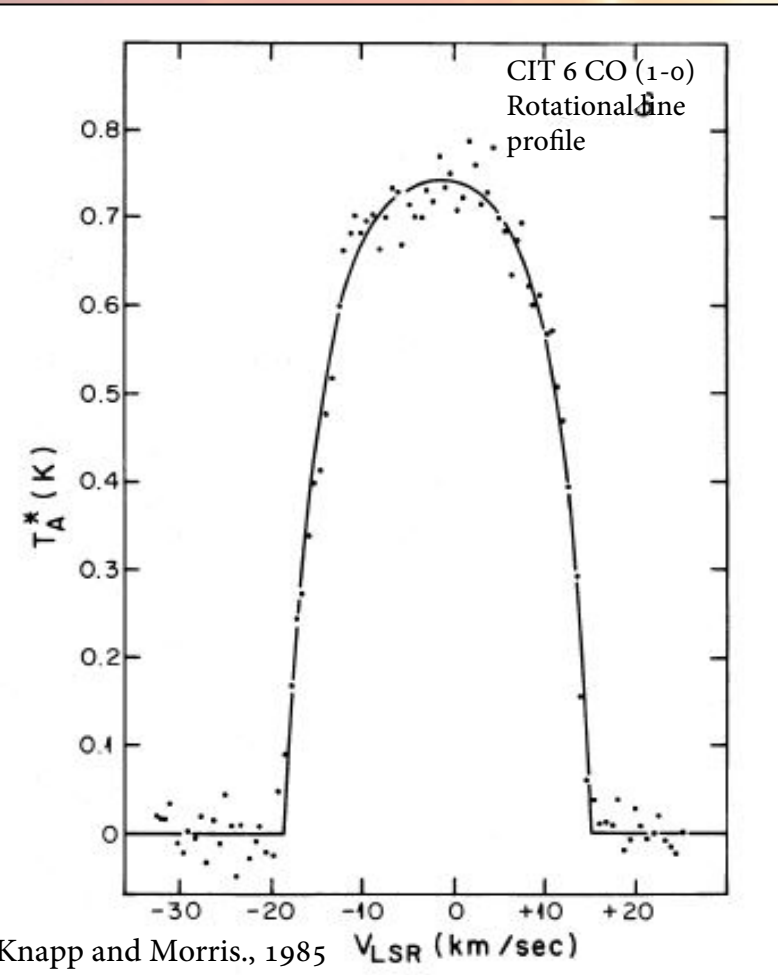
- The Herschel Mass-loss of Evolved StarS (MESS) survey - extended emission for nearby AGB stars up to radii  $\sim 1''$ - $2''$  at  $70\ \mu\text{m}$  and  $160\ \mu\text{m}$ .
- Most sub-mm observations for AGB star - often limited to central position pointings - lacking spatial information.
- JCMT can overcome this - low resolution large scale maps.
- HARP CO (3-2): Spatial information about the gaseous component of the winds.
- SCUBA2: Thermal dust component of the stellar winds. Combined with the Herschel maps - derive dust mass loss histories



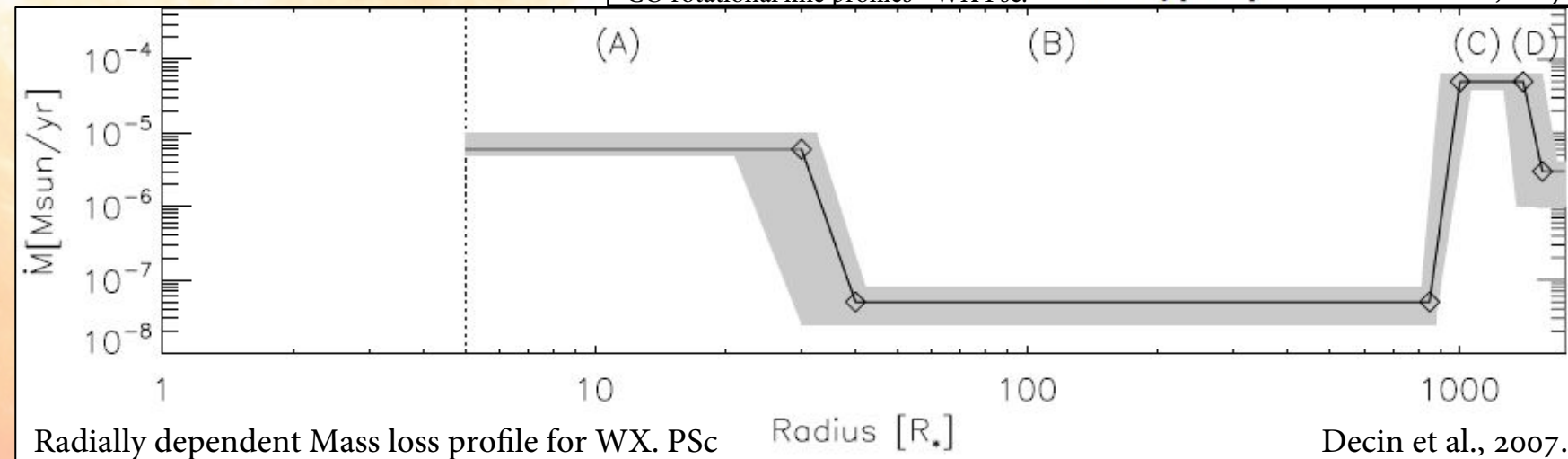
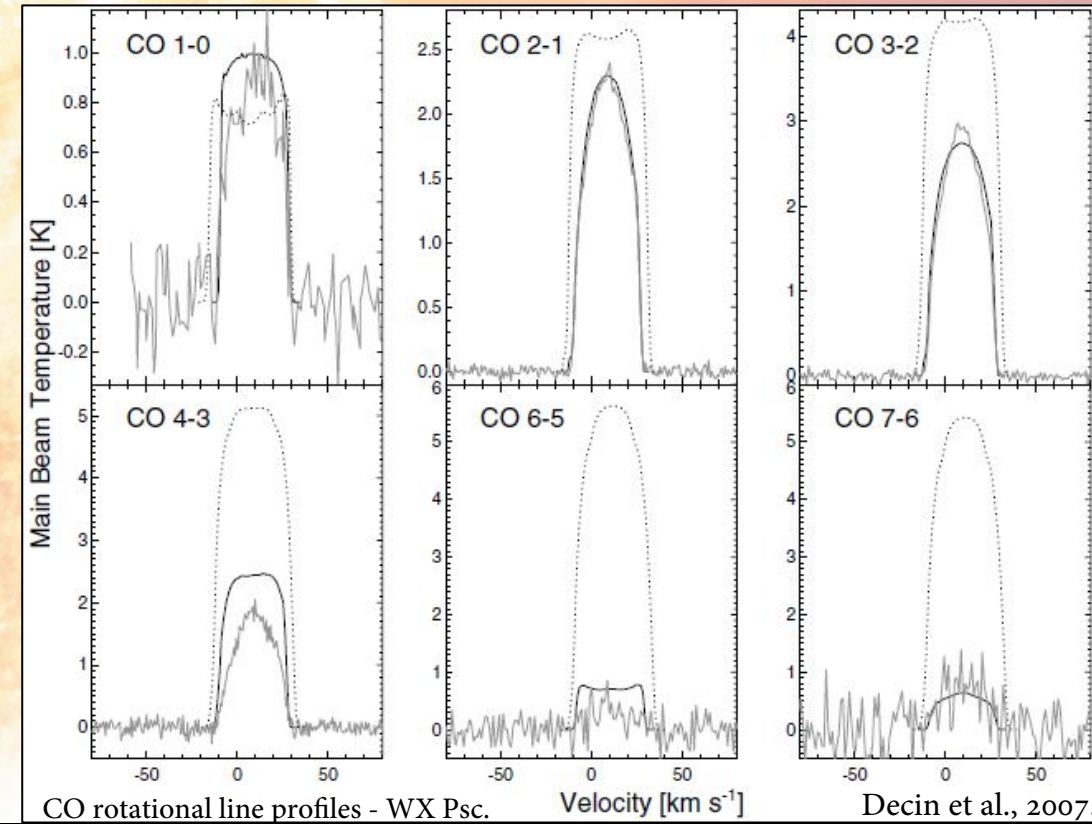
Herschel MESS observations. Left: PACS  $70\ \mu\text{m}$ , Right: PACS  $160\ \mu\text{m}$  (right). Cox et al., 2012.



# HARP observations - CO line analysis: Gas mass loss rates



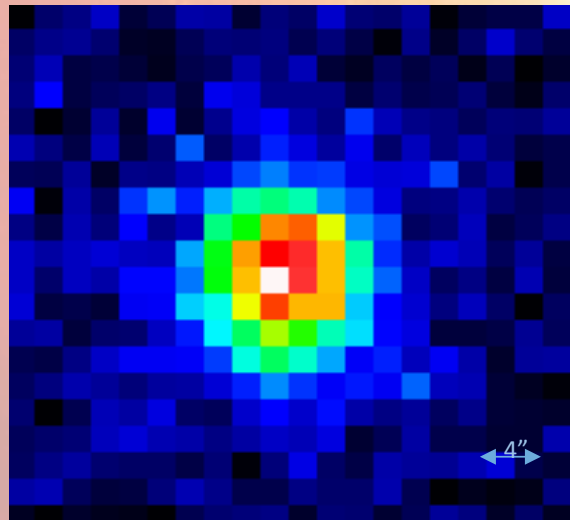
Knapp and Morris., 1985



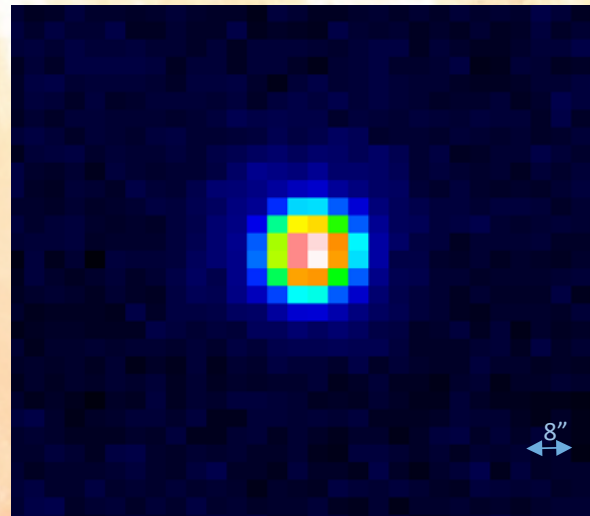


# SCUBA2: Thermal dust mass loss rates

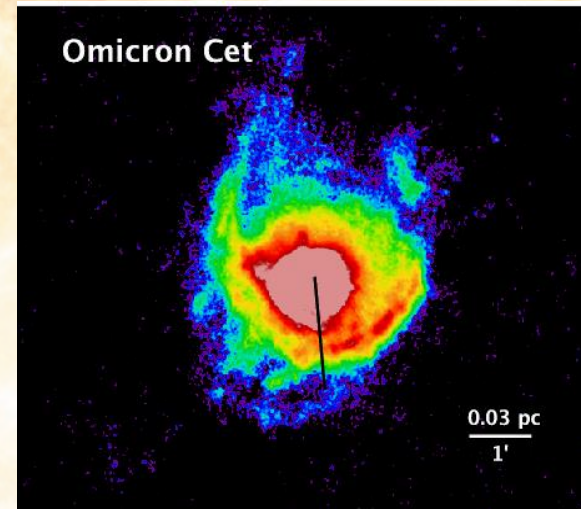
- Thermal dust emission maps at  $450\ \mu\text{m}$  and  $850\ \mu\text{m}$ .
- MESS survey maps at  $70\ \mu\text{m}$  and  $160\ \mu\text{m}$ .
- Fit SEDs at each point - determine dust temperature profiles
- Derive dust mass loss profiles.



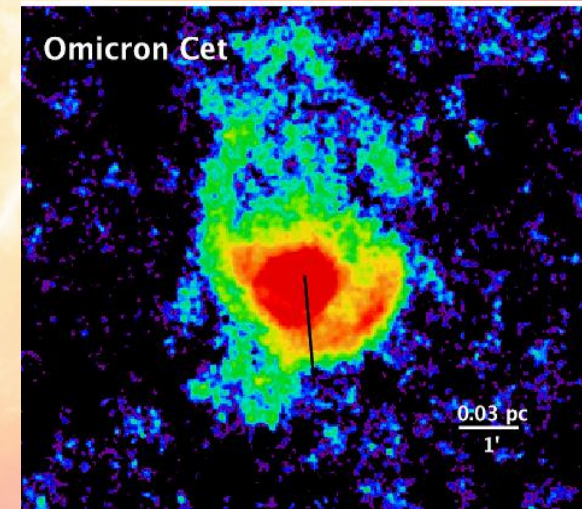
SCUBA2  $450\ \mu\text{m}$



SCUBA2  $850\ \mu\text{m}$



PACS  $70\ \mu\text{m}$



PACS  $160\ \mu\text{m}$



## To Conclude..

- AGB stars are important replenishes of the ISM.
- The Herschel MESS survey obtained FIR maps at  $70\mu\text{m}$  and  $160\mu\text{m}$ .
- Complimentary JCMT HARP maps in CO (3-2) and SCUBA2  $450\mu\text{m}$  and  $850\mu\text{m}$  continuum maps for a sample of the MESS targets.
- Spatially resolve the gas and dust mass loss history for these AGB stars.
- Lead to a robust measurement of the radial dust/gas ratio and its variations in AGB stars for the first time at all since Knapp., 1985 and first time ever it will be done using spatially resolved information.