GT KP Observations of evolved stars with PACS/SPIRE

Main Science

• Circumstellar matter in evolved objects AGB, P-AGB, PNe, RSG, WR, LBV

- Photometric mapping of nearby objects
- Spectroscopy of nearby objects

Mapping of nearby objects

Goal:

Study of asymmetries in, and the time evolution of, the mass loss process in post-MS objects

- Well studied process in optical and NIR, but non-optimal wavelength region
- IRAS: poor resolution
- ISO also gave few results (PHOT32 mode difficult to calibrate; poor resolution and mapping area)
- PACS/SPIRE resolution well matched to current mm-interferometers of a few arcsec



Fig. 1. 90 μ m image of Y CVn taken with PHT-CI 00 array detector and C90 filter displayed in linear brightness scale.



Fig. 2. 160 µm image of Y CVn taken with PHT-C200 array detector and C160 filter displayed in linear brightness scale.

Y CVn; Izumiura et al. (1996), 8'× 35' PHT32 map





HD 168625; Pasquali et al.; ISO SW5, LW8, 1.5"



TT Cyg; Olofsson et al., PdB CO (1-0)

Spectroscopy of nearby objects

Goal: Study of dust properties, molecular lines, emission lines



NGC 6302; Molster et al., SWS + LWS spectre Perenter 2006 - p.7/13

Dust and Ices

mineral	chemical	'60+' band
	formula	positions [μ m]
fosterite	Mg_2SiO_4	69–70
fayalite	Fe_2SiO_4	93–94, 110
diopside	$CaMgSi_2O_6$	65-66
calcite	CaCO ₃	92
dolomite	$CaMg(CO_3)_2$	62
graphite	С	50–70
water ice	H_2O	62
methanol ice	$lpha$ -CH $_3$ OH	68, 88.5
dry ice	CO_2	85
PAHs "flopping modes"		(far-IR)

Molecular- and emission lines

[O I]	63.184
[Si I]	68.473
[O III]	88.357
[N II]	121.898
[Si I]	129.682
[O I]	145.525
[C II]	157.741
CO(13-12)	200.3
CO(40-30)	65.3
H, H_2O, NH_3, CH, HCN	

Interested parties for GT KP

- PACS Working group on Post-main-sequence objects: Groenewegen, Kerschbaum (coord.) 140 h Belgium + \sim 50 h Austria
- SPIRE SAG 6: Mike Barlow (coord.)
 56 h SPIRE

 (+20 h for mapping young SN remants; SPIRE only)
- HSC: Garcia-Lario 12-15 h PACS on "transition objects"
- MS: Cernicharo 20 h PACS to complement HIFI GT observations

PACS Target List

• 90 in photometry

-rms 2 mJy at 170 $\mu m.$

-1 pointing (3.5' × 3.5') will take 0.3h in 3 bands.
-Largest map (CW Leo) wil be 7 × 7 pointings.
AGB, post-AGB, PN, SGe, LBV, WR, RSG
M-, S-, C- spectral type
L, SR, M-variability type
from no to extreme mass loss rates

• 45 in spectroscopy

-Minimum number of targets to sample all phases, yet to have a good inventory. -Of order 2h per source.

Target List

- SPIRE targets will be sub-set of the PACS target list: 24 in photometry, 20 in spectroscopy
- Coordination with HIFI GTKP to maximise science return

