Gas in circumstellar systems from *Herschel*-PACS observations.

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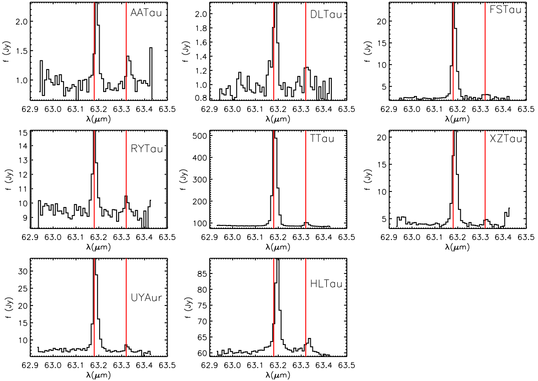
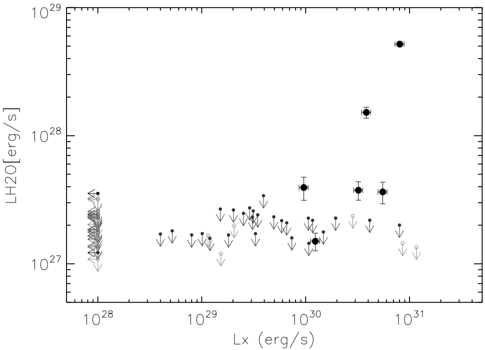
- Herschel: PACS + SPIRE + HIFI
- PACS:
  - I ScanMap photometry $(70, 100, 160\ \mu\mathrm{m})$
  - II Spectroscopy: 25 spaxels, 47x47 arcsec^2 FOV (9.7 arsec/spaxel), 55-210 $\mu\mathrm{m}$, $\lambda/\ \lambda \sim$ 1000-5000. Two observing modes:
    - a Line Spectroscopy: simultaneous observations at $55-73\ \mu\mathrm{m}$ or $102-210\ \mu\mathrm{m}$ and $70-220\ \mu\mathrm{m}$.
    - b Range Spectroscopy: spectral features over a wavelength range wider than 1 $\mu\mathrm{m}$. Three ranges:

      70-105 $\mu\mathrm{m}$ + 102-220 $\mu\mathrm{m}$

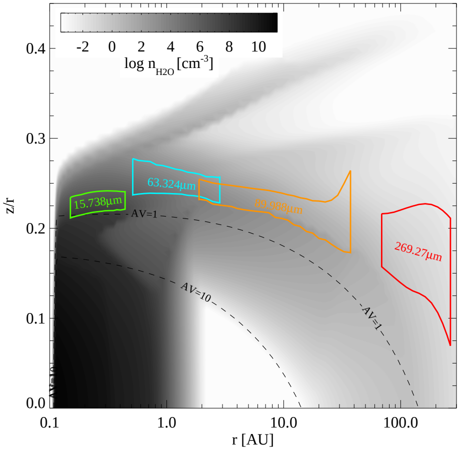
      51-73 $\mu\mathrm{m}$ + 102-220 $\mu\mathrm{m}$
- GASPS: Open Time Key Programme *GAS in Protoplanetary Systems* (P. I. W. Dent). To study the presence and distribution of gas and dust in circumstellar discs around young low- and intermediate-mass stars. Observed $\sim$ 250 stars within 400 hours both in photometry and spectroscopy. Several associations at different ages, from Taurus, with 1-3 Myr, to Tucana Horologium, $\sim$ 30 Myr. From HAeBe stars to T Tauri stars, with spectral types from A0 to M6.

- 68 Taurus members observed by *Herschel Space Telescope* for GASPS
- Eight detections of a feature at 63.32 μm ($\sim$ 12 %)
- We identify the emission feature as the o-H_2O $8_{18} \rightarrow 7_{07}$ line at 63.32355 μm, ($E_{\mathrm{UpperLevel}}$=1070.7 K) with a transition probability A=1.751 s^{-1}.

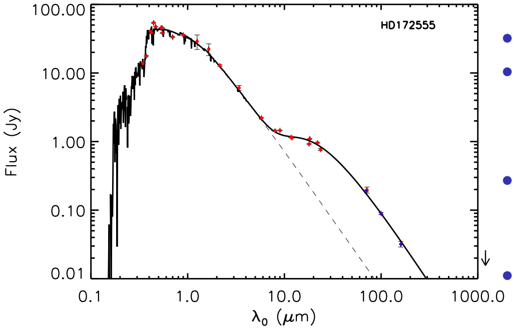




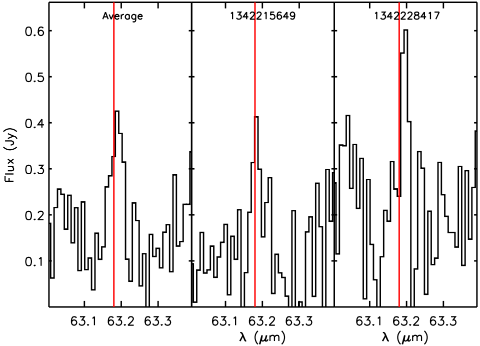
- Aresu et al. (2011): the X-ray effects on the gas temperature ([OI]) are triggered for $L_X > 10^{30} erg/s$, i. e., the chromospheric level during a flaring period in a T Tauri star



- The warm 63.32 μm line may originate from the same inner H_2O reservoir as the rovibrational hot H_2O lines that were observed by Spitzer toward many T Tauri discs: Carr & Najita (2008, 2011) and Pontoppidan et al. (2010).
- Models show that the Spitzer hot water emission mostly comes from the 0.1 to 10 AU region (Salyk et al. 2008, Pontoppidan et al. 2009, Meijerink et al. 2009). Detailed thermo-chemical disc models do indeed predict high water vapour abundances of 10^{-4} H_2O/H in the inner disc up to the snow line (Woitke et al. 2009)
- We need a region of the order of 3 AU to produce the emission. Snow line?



- HD 172555 is an A7V star than belongs to BPMG.
- Warm debris disc.
- IR fractional luminosity $>$ 86 times greater than maximum value expected from steady-state collisional evolution (Wyatt et al., 2007)
- IRS spectra: glassy silica, SiO gas?: violent production process. Hypervelocity collision (Lisse et al., 2009)
- Atomic oxygen emission detected with Herschel-PACS at 63.18 μm: $L_{[OI]} \sim 10^{-18}$ W/m^2



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Gas mass depends on exact location of the emission:

$$\mathrm{N_{[OI]}} \simeq 9.5 \times 10^{36} \frac{F_{\mathrm{line}}(\mathrm{erg\ s^{-1}\ cm^{-2}}) \times D^2(\mathrm{pc}^2)}{\frac{h\nu}{4\pi} A_{ul}\, x(T)} \times R^2(\mathrm{AU}^2) \quad (1)$$

- Hypervelocity collision (Lisse et al., 2009): glassy silica, SiO gas?.
- Wyatt et al. (2007): IR fractional excess too high: stochastic event?
- Steep grain size distribution, typical of hypervelocity collision, not in collisional cascade equilibrium (Takasawa et al., 2011; Lisse et al., 2009)
- Source of fresh material (0.1 Myr) to be consistent with SiO recondensation.
- Silicate constituents (Si, O, Mg, Fe) released during hypervelocity collisions (Pahlevan et al., 2011)

- Only a few debris discs with gas emission detected: β Pictoris, HD 21997, 49 Ceti,... now HD 172555.
- We have detected atomic oxygen emission in HD 172555.
- Huge gas mass compared to dust mass. Gas mass depends on exact location.
- Origin of the gas to be understood.