Herschel-PACS observation of gas lines from the disc around HD141569A

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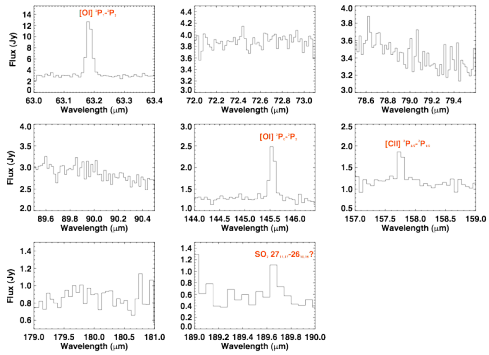
HD 141569A was observed by Herschel as part of the Gas in Protoplanetary Discs Survey (Dent et al. 2013). We complemented with ground-based observations to constrain the gas and dust in the disc.

Herschel-PACS GASPS programme : [OI] 63, 145 & [CII] lines detected

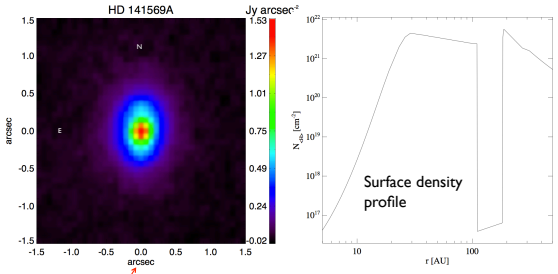


Model parameters

B9.5V star, 5 Myrs, d=108pc
M_{dust}(disc) ~ 2.6 x 10^{-6} M_{Sun}
M_{gas}(disc) ~2.5 x 10^{-4} M_{Sun}
M_{PAH}(disc) ~ 1.8 x 10^{-12} M_{sun}
Inner disc: 5-110 AU
Outer disc: 185-500 AU

Gas mass/Dust mass ~ 100

Density structure consistent with VISIR image at 8.6 micron



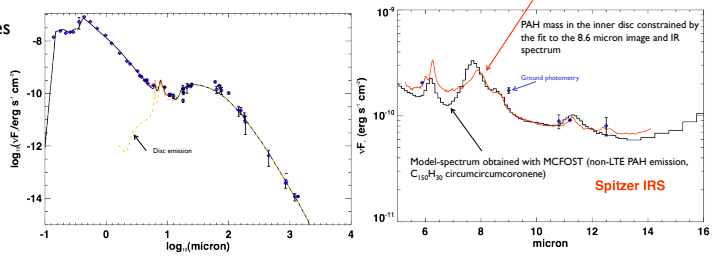
PAH emission at 8.6 micron

Disc continuum modelling with MCFOST

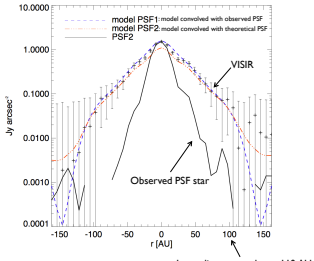
Fit to the SED + PAH features with MCFOST (Pinte et al. 2006)

nlte PAH + dust opacities treated simultaneously

PAH treatment: Draine & Li



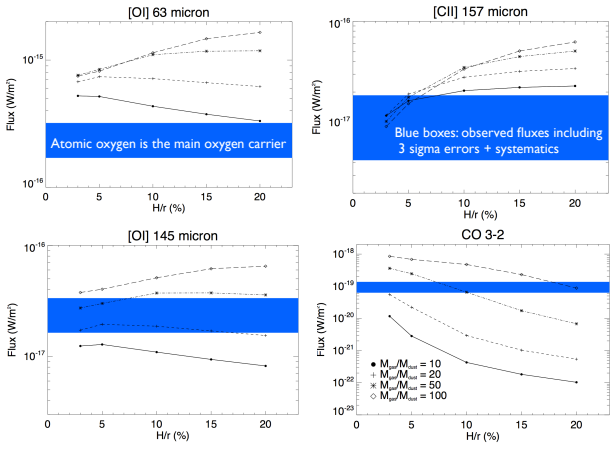
Cut along the North-South direction: the PAH emission is resolved



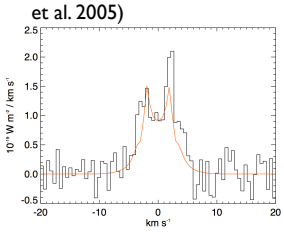
Inner disc outer edge at 110 AU

Gas chemistry and line transfer modelling with ProDiMo

[OI] 63, [OI] 145, [CII], and CO 3-2: flat, gas-to-dust~100 disc models produce fluxes within a factor 2 except for [OI] 63.



Comparison modelled CO 3-2 profile with observations (Dent et al. 2005)



Reference:
HD141569, article submitted to A&A
MCFOST: Pinte et al. 2006 A&A 459, 797
ProDiMo: Wotike et al. 2009 A&A 501, 383
Dent et al. 2005 2005, MNRAS, 359, 663
GASPS project: Dent, Thi, Kamp, et al., 2013, PASP, 125, 477
DIANA project: http://www.diana-project.com/

Conclusions

- From the PAH image, the inner disc extents to at least 110 AU.
- All models with gas-to-dust mass ratio from 10 to100 overpredict the [OI] 63 micron flux. The oxygen chemistry may need to be revised.
- A model with gas-to-dust mass ratio of 100 is consistent with all the other gas constraints.
- Disc models with low opening angles (H/r) are favored due to the sensitity of the [CII] and CO 3-2 flux on the gas density (flt discs are denser).

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