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Herschel/DUNES observations and modelling of newly resolved debris discs

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Abstract

We present results of modelling *Herschel* PACS and SPIRE observations of three *Spitzer*-discovered debris discs in the *Herschel*/DUNES sample. The debris discs presented here have been resolved for the first time at far-infrared wavelengths in the PACS observations, enabling better constraint of the circumstellar dust properties by constraining the dust radial location. We calculate the disc extent of each target to be comparable to that of the Solar System's own cold debris disc, the Edgeworth-Kuiper belt (EKB), around 50–100 AU in radius and fractional luminosities ($L_{\rm IR}/L_{\star}$) in the range 10^{-6}–10^{-5}, comparable to that expected of the EKB.

1. Introduction

In this paper we present *Herschel* [1] PACS [2] and SPIRE [3] observations of three debris discs. The large aperture *Herschel* telescope provides arcsecond resolution allowing detailed imaging of these systems, resolving the circumstellar disc at 100 μm in each case. In addition, greater precision and denser coverage of the disc spectral energy distributions (SED) has been obtained, extending beyond the peak of the disc's emission. In combination, these improvements enable better constraints to be placed on the physical extent and dust physical properties compared to previous observations.

2. Observations

As part of the *Herschel* DUNES survey [4], we have observed all the *Spitzer*-detected debris discs within 25 pc of the Sun [5], resolving the emission from several of these systems for the first time. Previous models of the debris discs in the systems presented here were limited by the lack of information on the disc spatial extent and lack of constraint on the sub-millimetre slope of the disc emission, thereby yielding degenerate solutions to the disc's properties from modelling.

3. Deconvolution

In order to measure the true extent of the discs, the images were deconvolved from the instrument PSF, a technique which has previously proved successful in revealing the inner structure of such discs [6,7]. An observation of α Boötis was used as the PSF model for the deconvolution, rotated to match the roll angle of the telescope at the time of observation for each star. Prior to deconvolution, a point source with a peak equivalent to the predicted stellar photospheric contribution was subtracted from the observed disc image. The star subtracted image was then deconvolved using a Richardson-Lucy algorithm.

4. Modelling

The SEDs of the three discs were fitted using two complementary thermal emission models, previously used to successfully analyse both the photometry and structure of resolved debris discs in the DUNES survey [8,9]. We assumed the dust grains were solid uniform spheres composed of pure astrosilicate in the modelling process.

5. Summary and Conclusions

Using *Herschel* PACS and SPIRE we have obtained resolved far-infrared images of three nearby debris discs and photometry between 100–500 μm, covering peak and fall off of the disc thermal emission. Via deconvolution, we have determined the orientation and physical extent of the dust ring in each case and applied this new constraint to thermal emission models of the discs to provide better constraint of the dust physical parameters in these systems.

References

[1] Pilbratt, G.L., Riedinger, J.R., Passvogel, T. et al. 2010: *Herschel Space Observatory. An ESA facility for far-infrared and submillimetre astronomy*, AA 518, L1+

[2] Poglitsch, A., Waelkens, C., Geis, N. et al. 2010: *The Photodetector Array Camera and Spectrograph (PACS) on the Herschel Space Observatory*, AA 518, L2+

[3] Griffin, M.J., Abergel, A., Abreu, A. et al. 2010: *The Herschel-SPIRE instrument and its in-flight performance*, AA 518, L3+

[4] Eiroa, C., Fedele, D., Maldonado, J. et al. 2010: *Cold DUst around NEarby Stars (DUNES). First results. A resolved exo-Kuiper belt around the solar-like star ζ^2 Ret*, AA 518, L131+

[5] Trilling, D.E., Bryden, G., Beichman, C.A. et al. 2008: *Debris Disks around Sun-like Stars*, ApJ, 674, pp.1086+

[6] Liseau, R., Eiroa, C., Fedele, D. et al. 2010: *Resolving the cold debris disc around a planet-hosting star. PACS photometric imaging observations of q1 Eridani (HD 10647, HR 506)*, AA 518, L132+

[7] Marshall, J.P., Löhne, T., Montesinos, B., et al., 2011: *A Herschel resolved far-infrared dust ring around HD 207129*, AA 529, A117+

[8] Augereau, J.-C., Ertel, S., Müller, S. et al.: *A Kuiper-like belt around the planet-host star q1 Eri. Modeling of Herschel/PACS and SPIRE images*, in preparation

[9] Löhne, T., et al.: *Does HD207129 harbour a perfect debris disc?*, in preparation