DUst around NEarby Stars (DUNES): description of the project and results

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On behalf of the DUNES consortium

The DUNES team

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DUNES

DUst around NEarby Stars

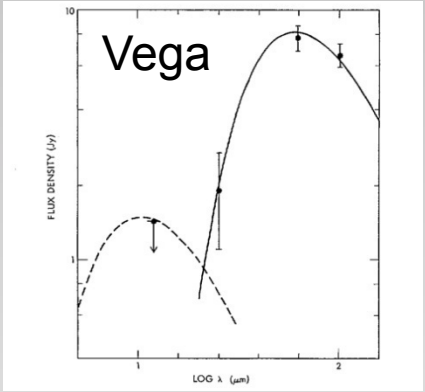
"Cold Disks around Nearby Stars. A Search for Edgeworth-Kuiper Belt Analogues"

- 'Open Time Key Programme' de *Herschel* with the aim of detecting and study cold, dusty discs -analogues to the *Edgeworth-Kuiper Belt (EKB)* in the Solar System- around solar-type stars in our neighbourhood.

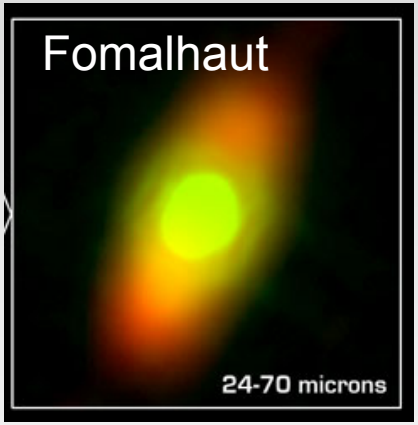
- Tools: PACS photometry at 70, 100 y 160 μm
  SPIRE photometry at 250, 350, 500 μm

Context

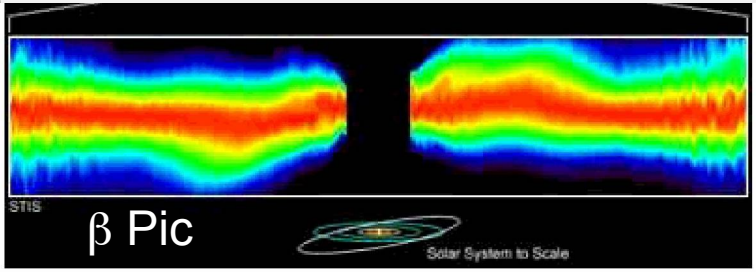
The detection of IR excesses around PMS and MS stars was one of the main discoveries made by IRAS (1983).



- Debris discs: dusty discs replenished by collisions between large bodies (planetesimals).
- Second generation discs: the primordial gas has disappeared almost totally.



- Debris discs provide information on the presence of planetesimals and planets.
- Relevant contributions from ISO (1995-1998) and mainly Spitzer (2003-2009) and ground based facilities.



Sample and observing strategy

- Sample: 133 FGK stars:
  - Distance < 20 pc.
  - Stars with known planets (d < 25 pc).
  - Debris discs detected by *Spitzer* (d < 25 pc).

  + 106 stars shared with OTKP DEBRIS.

Volume limited sample

- Strategy: integrate as long as necessary to reach the *photospheric* flux at 100 μm, with the only limitation of the background confusion.

Note that we aim to detect a few mJy above photospheres with fluxes of the same order and both in the Herschel detection limits.

  - F_* (100 μm) $\gtrsim$ 4 mJy.
  - An analogue to the EKB at 10 pc, 100 μm: ~ 7 – 10 mJy.

Summary of results

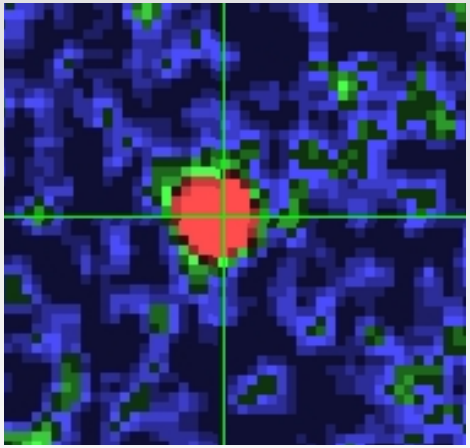
	F	G	K	Total
Observed	27	52	54	133
No excess	16	37	42	95 (71%)
Excess (new)	9 (2)	12 (3)	10 (5)	31 (10)
Affected by field contamination	2	3	2	7
Resolved (new)	5 (4)	6 (4)	5 (5)	16 (13)

Cold discs: a DUNES discovery

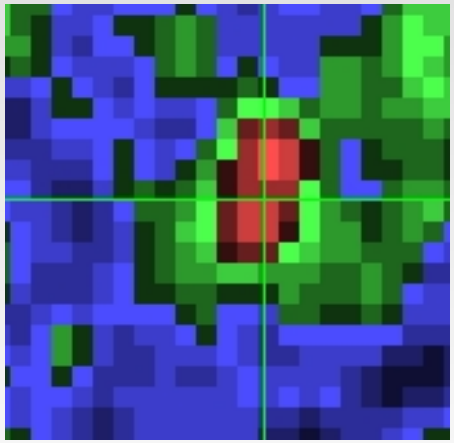
Some stars show excesses only at 160 μm

This implies cold dusty discs: T_{dust} ~ 20 - 25 K (<30 K) and faint L_{dust}/L_{*} ~ 10^{-6}

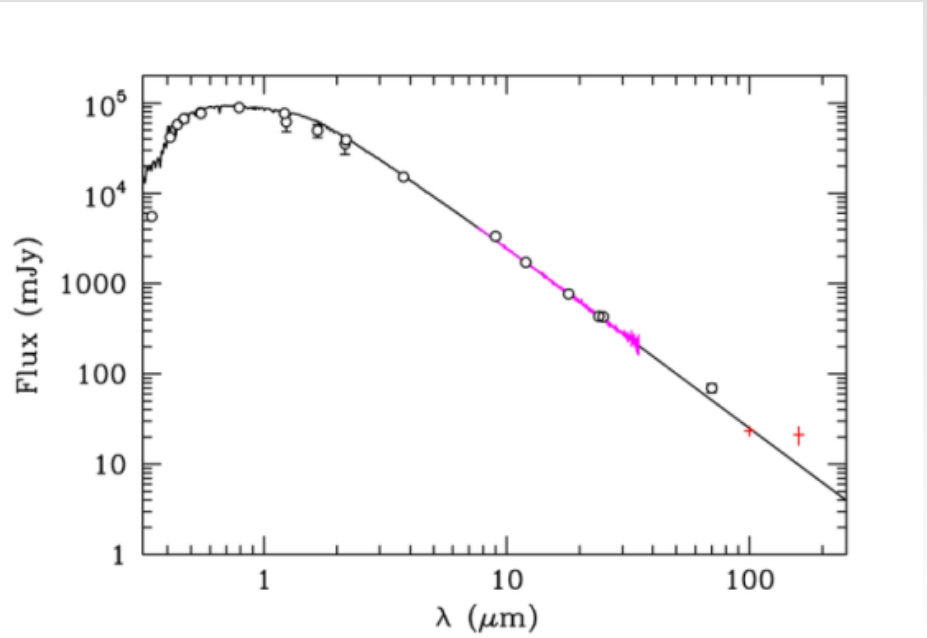
These discs cannot be explained within the paradigm of any known scenario



100 μm



160 μm



Summary and conclusions

- ~ 30% of debris discs: remarkable increase with respect to previous statistics, new discs mainly around K-type stars.
- Flux levels similar to that of the EKB reached.
- A large number of resolved discs (5 x previous number).
- Contribution to stellar physics: the *observation* for the first time of the chromospheric temperature minimum in a star other than the Sun (α Cen A, Liseau et al. 2013)
- Peculiar classes of debris discs: excess only at 160 μm (Eiroa et al. 2011, Krivov et al. 2013), steep SEDs (Ertel et al. 2012)

DUNES goals accomplished: survey paper (Eiroa et al. 2013) submitted, analysis of the observations and interpretation of the results in progress.