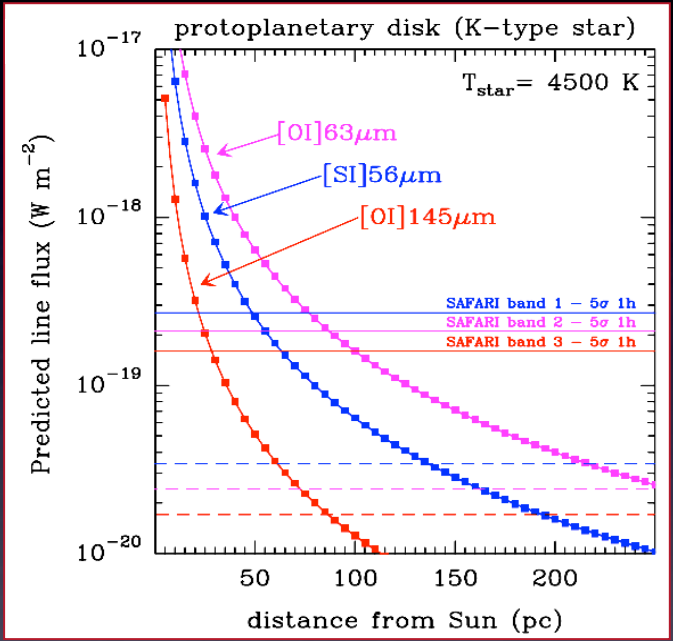
Gas traces in transitional discs

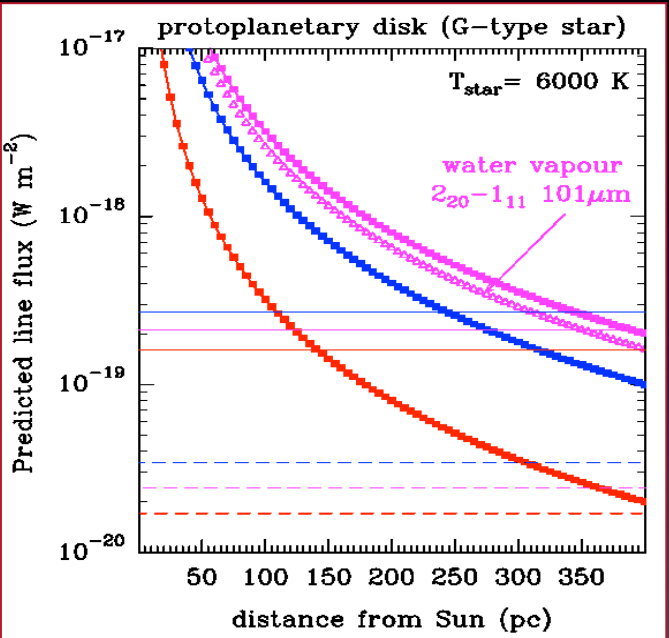
Transition disc models ($M_{gas} \approx 0.001\ M_{jup}$) predict:

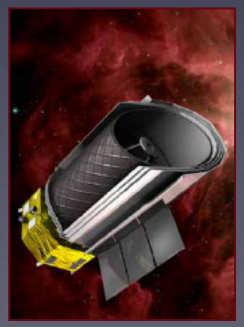
- $L \approx 10^{-8}\ L_{\odot}$: [OI] (145μm), [SI] (56μm), H_2O, OH, CO
- $L \approx 10^{-6} - 10^{-7}$: [OI] (63μm)

F_l (50pc) $\approx 10^{-11}\ (L_{line}/\ L_{\odot})$ Watt m^{-2}

F_l (150pc) $\approx 10^{-12}\ (L_{line}/\ L_{\odot})$ Watt m^{-2}







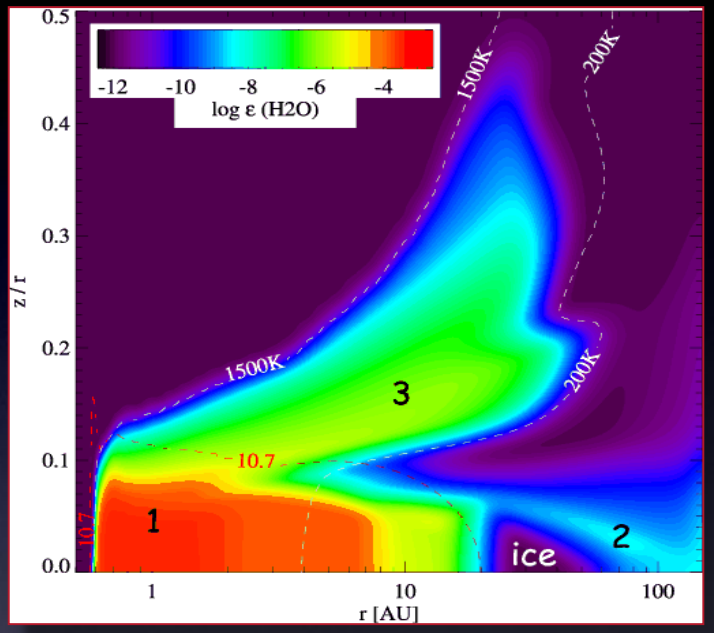
SPICA

- detection of small amount of gas in TDs
- statistically significant samples in nearby (≤ 150pc) SFRs
- Taurus, Upper Sco, TW Hya, Tuc Hor, Beta Pic, Eta Cha
- Disentangle mechanisms for giant planet formation

Water ice in protoplanetary discs

Woitke et al. (2009, A&A 501, L5): Hot and cool water in Herbig Ae protoplanetary discs

- **H_2O emission lines from Herbig Ae type protoplanetary disks beyond 70 μm**



- *big water reservoir in midplane, behind the inner rim*
- *belt of cold water around the distant icy midplane beyond the "snow-line" r > 20 AU*
- *layer of irradiated hot water at high altitudes, from about 1 AU to 30 AU (200 K < Tgas < 1500 K)*
- *snow-line (T < 150 K)*
- *Solar System: snow-line at about 2.7 AU*

SPICA

- detection of water ice in significant sample of different stellar types
- exact location of the snow line
- diagnostic tools:
  - *44μm crystalline and amorphous water ice*
  - *62μm crystalline water ice*
- ***water in inner disc regions: where rocky planets***

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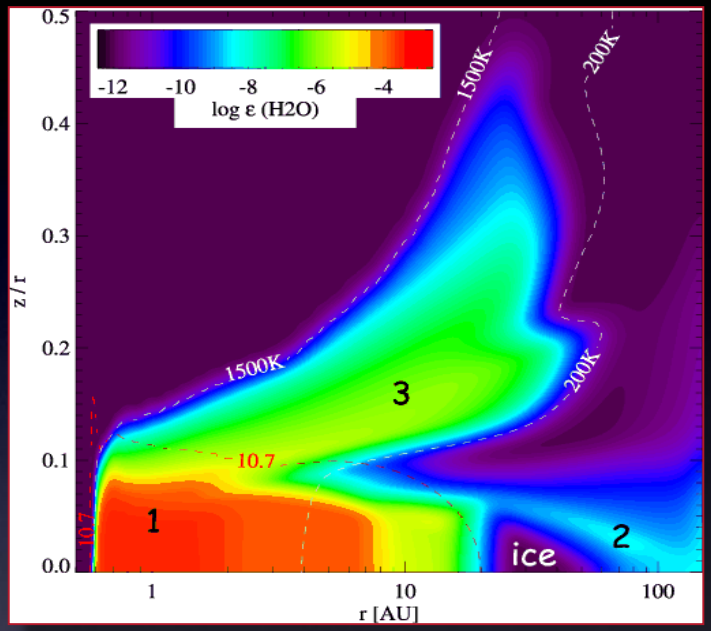

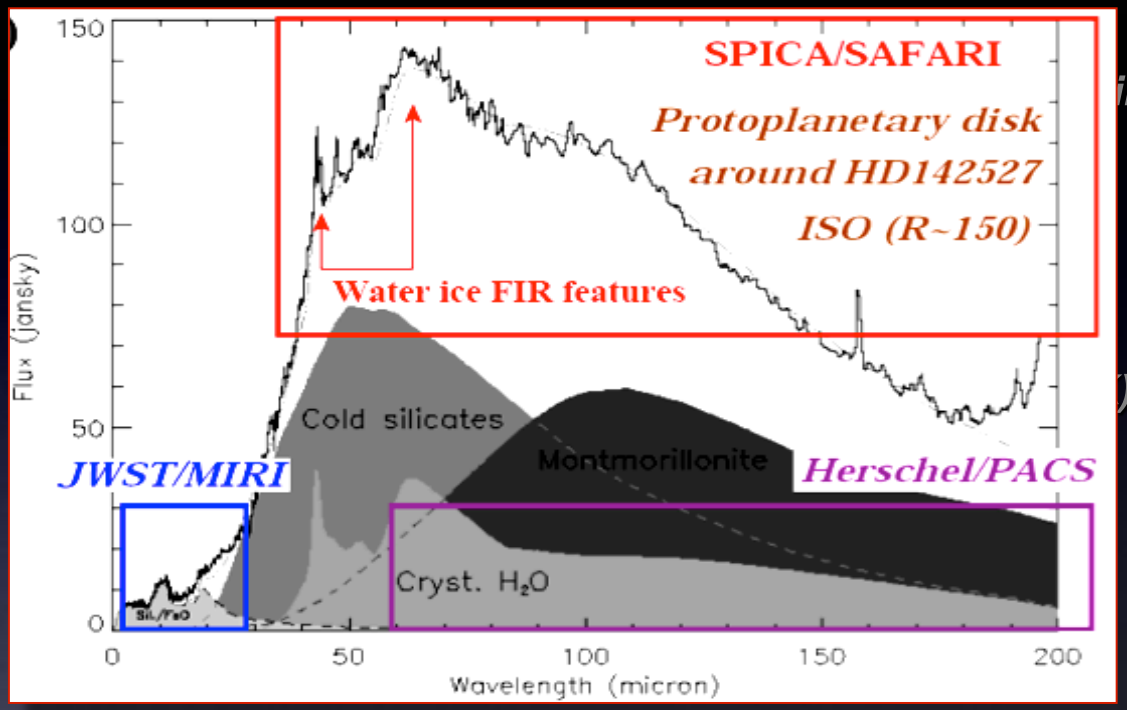

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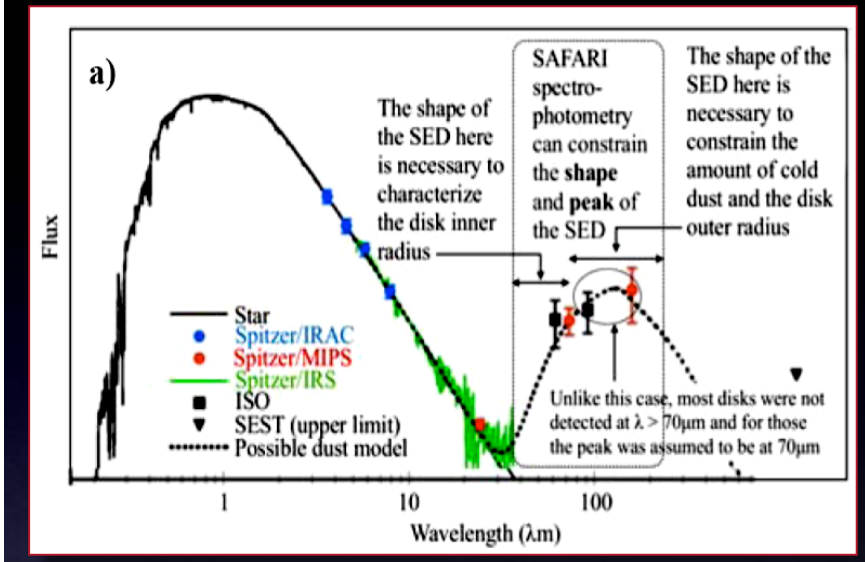
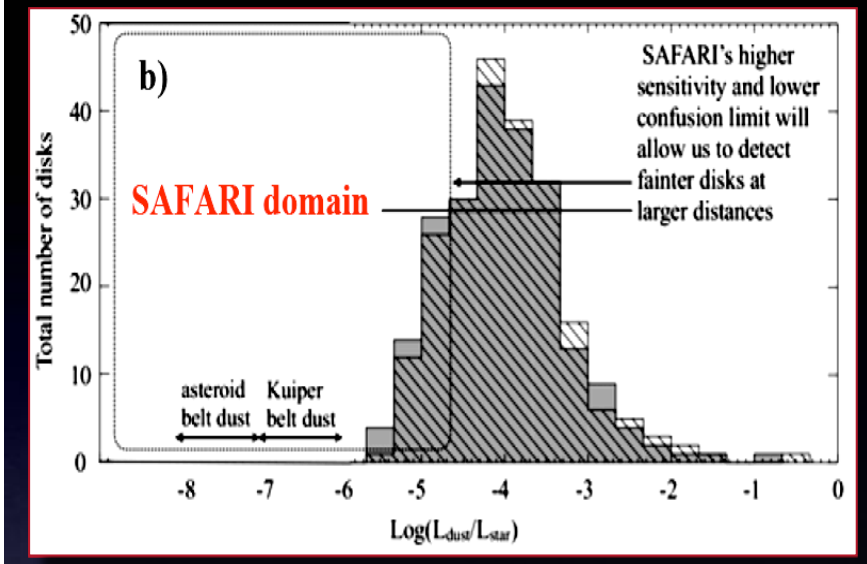
Surveys for debris discs



- debris discs may survive billions of years
  - almost gas-free,
  - collisions of planetesimals: 2nd generation debris disc
- detecting debris discs
  - strong signature of enmerging planetary system
  - 10% of solar-type stars surrounded by debris discs
  - analogous asteroid and Kuiper belts
- nearly 300 debris discs with ISO & Spitzer
  - but most in early type (< K -type) stars
  - bias due to sensitivity ?
  - debris discs till to be explored in low-mass stars

Surveys for debris discs



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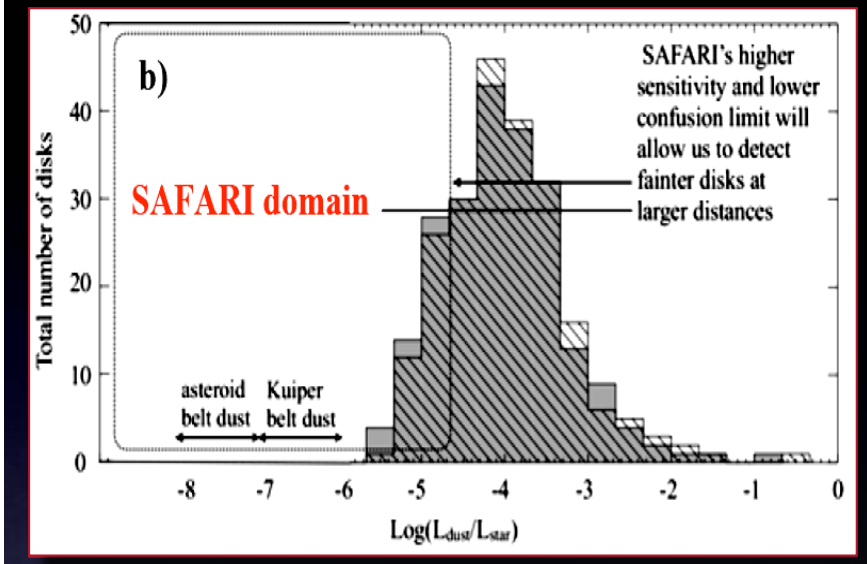

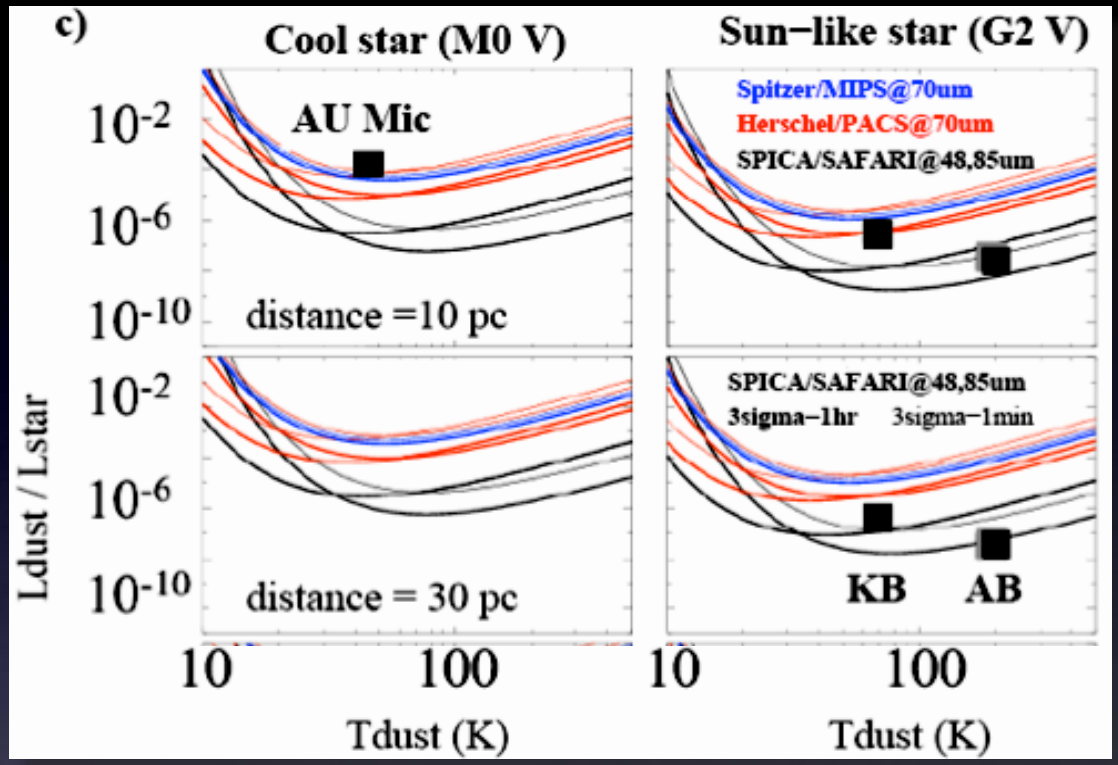

SPICA

- fast sensitive photometry @ 48μm, 85μm, & 160μm
- spectroscopy (R≈100) in the 30-300μm range (1mJy: 5σ in 1hour)
- some 10^5 F0-K2 stars within 150pc:
  will increas the No. of debris discs by about 3 orders of magnitude
  discs characteristics as function of spectral type
- statistics of debris discs in M-type stars (some 150 within 10 pc)

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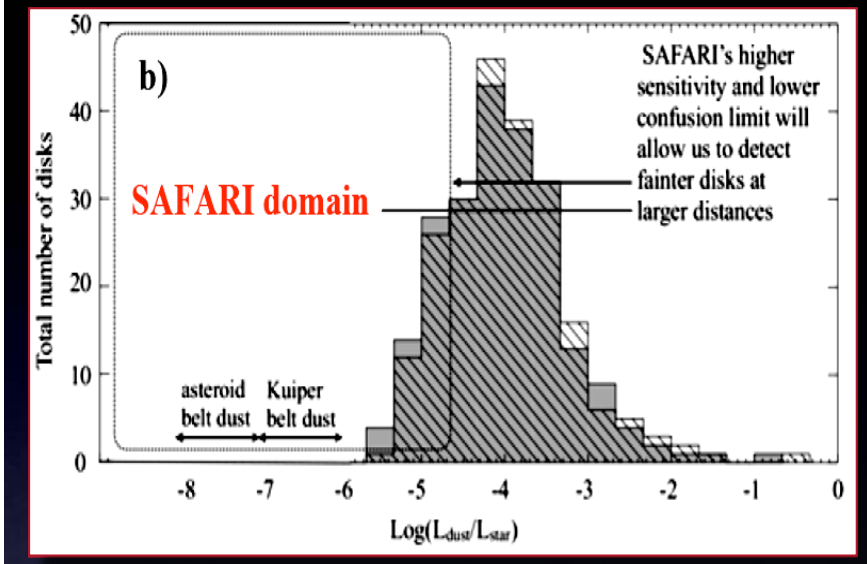

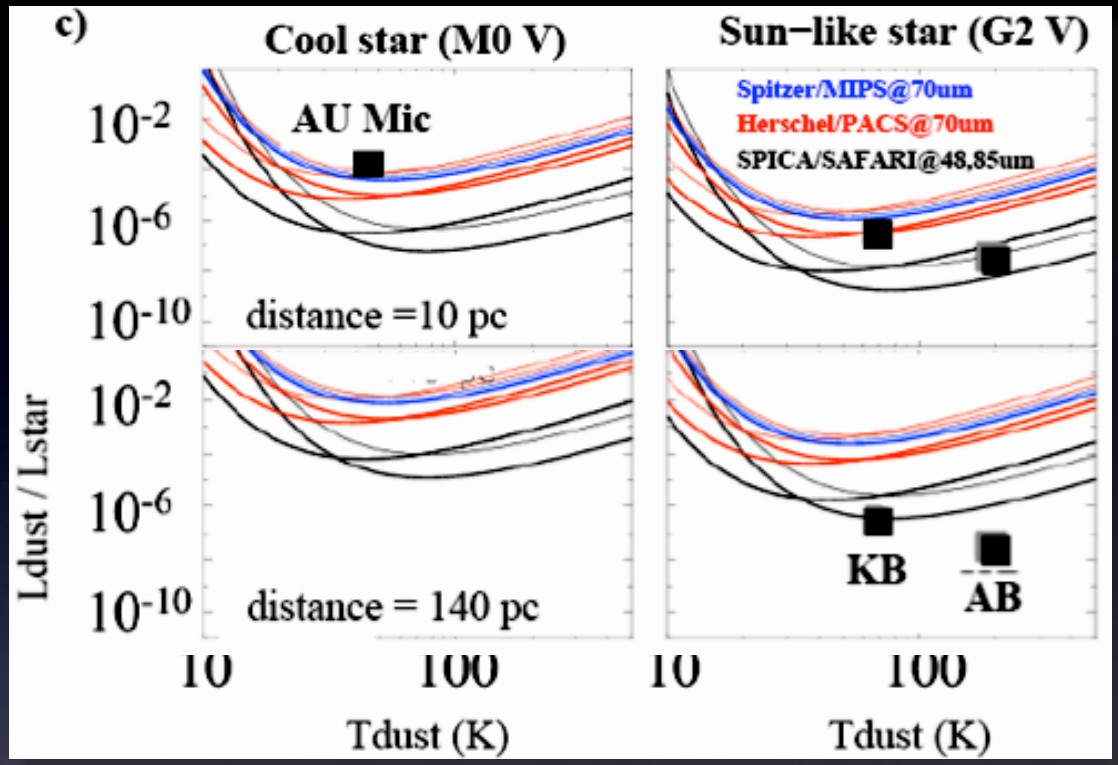

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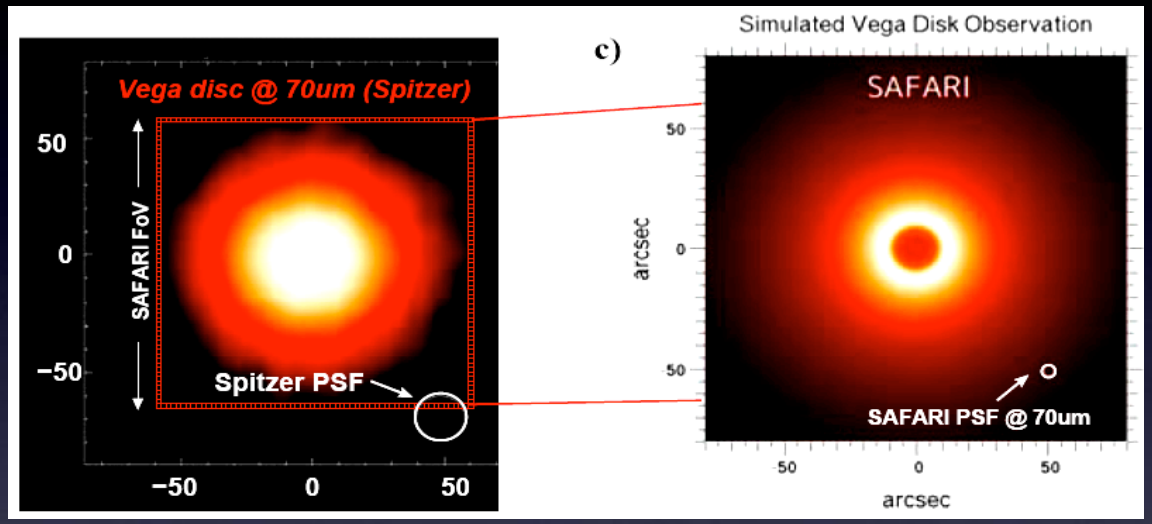
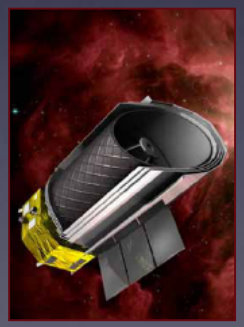
Spatially resolved discs

- @ 50 μm a resolution of 3.5 arc-sec: a 100 AU disk resolved if d < 30 pc
- stars closer than that: ***200 A-type ; 1000 F0-K2 type ; 3500 K2-M-type***





SPICA

- Objects closer than 10 pc (about 100 A-type):
  - snow-line expected to be between 20 and 50 AU
  - distribution of water ice & snow-line
- Disentangle mechanisms for giant planet formation
- water in the inner parts of planetary systems:
  late heavy bombardment ?