Introducing myself

Spatially resolved imaging of the ϵ Eridani inner debris disk

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Introducing myself

Professional

- Study: Physics in Leipzig, Germany (2003 – 2007)
- Diploma: Thuringian State University Tautenburg, Germany (2007 – 2008), Supervisor: Helmut Meusinger
- PhD: Kiel, Germany (2008 – **10.02.2012**), Supervisor: Sebastian Wolf

What have I done before?

- No period in Quasar long term variability on time scales up to $\sim$ 50 years (Diploma thesis)

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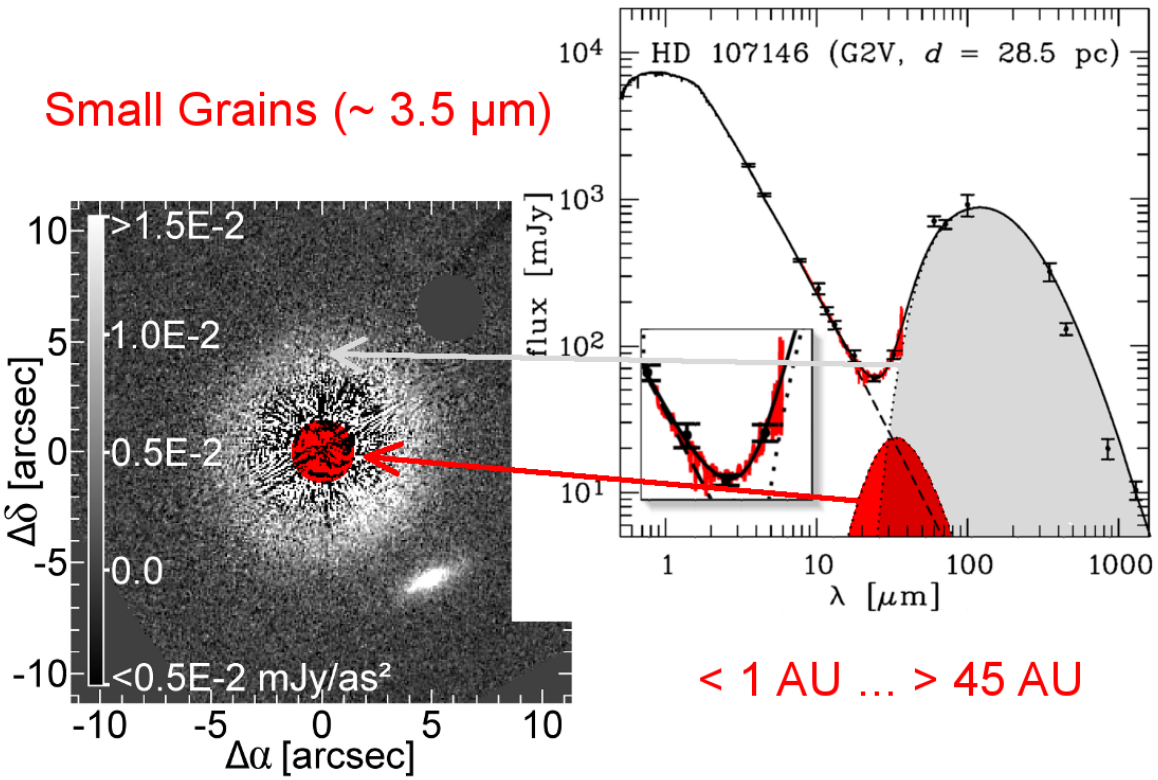
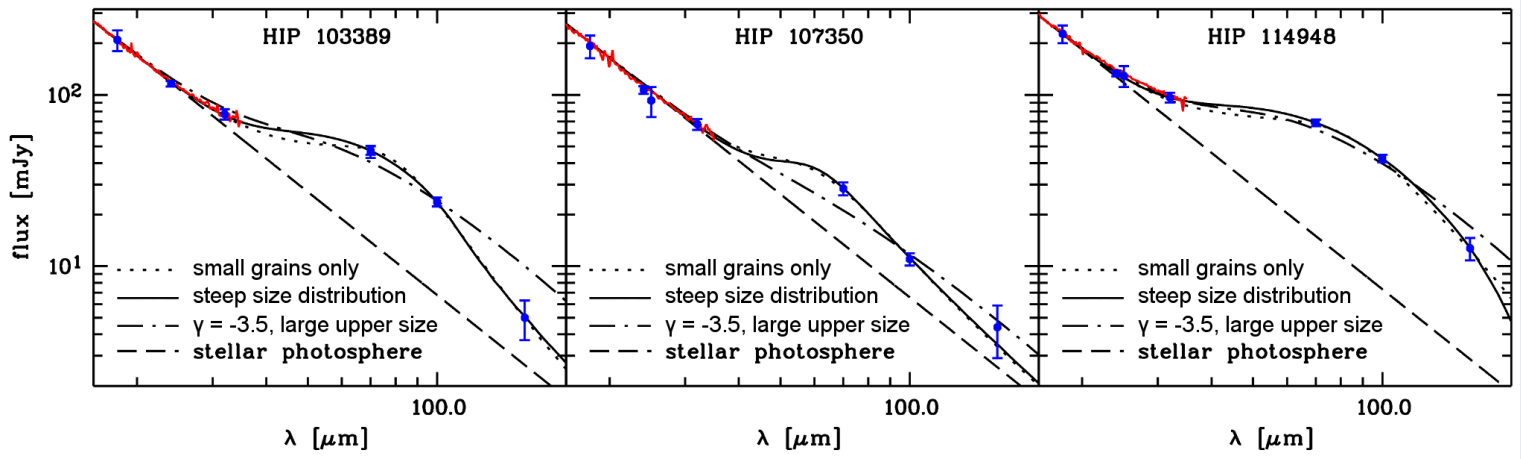
Dust in the inner regions around HD 107146 (Ertel et al. 2011)

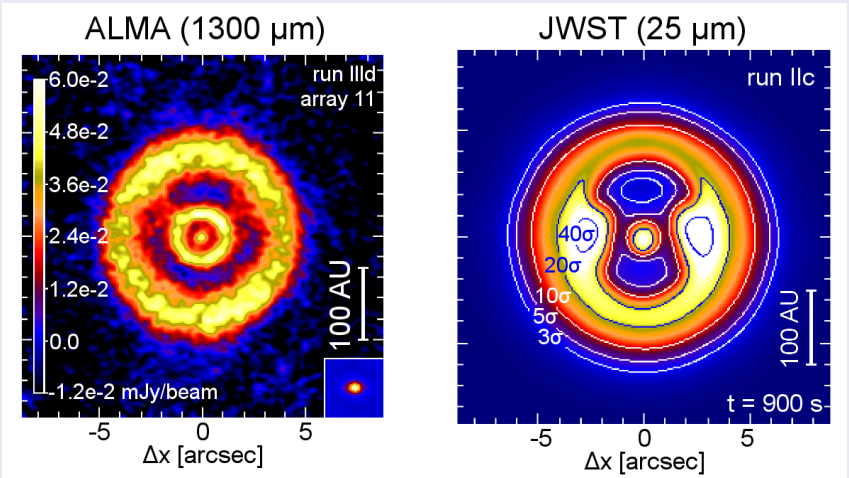


What have I done before?

Peculiar debris disks from Herschel/DUNES (Ertel et al., submitted)



Observations of planet-disk interaction (Ertel et al., in prep.)



What have I done before?

Miscellaneous

- Modeling of DUNES targets, developement of SAnD (simulated annealing fitting tool for debris disks)
- *N*-body simulations of planet-disk interaction in debris disks
- Instruments (preparation/execution of observations and/or data reduction): VLT/NACO, VLT/VISIR, Herschel, Spitzer, IRAM 30m (MAMBO II), ALMA, (JWST)

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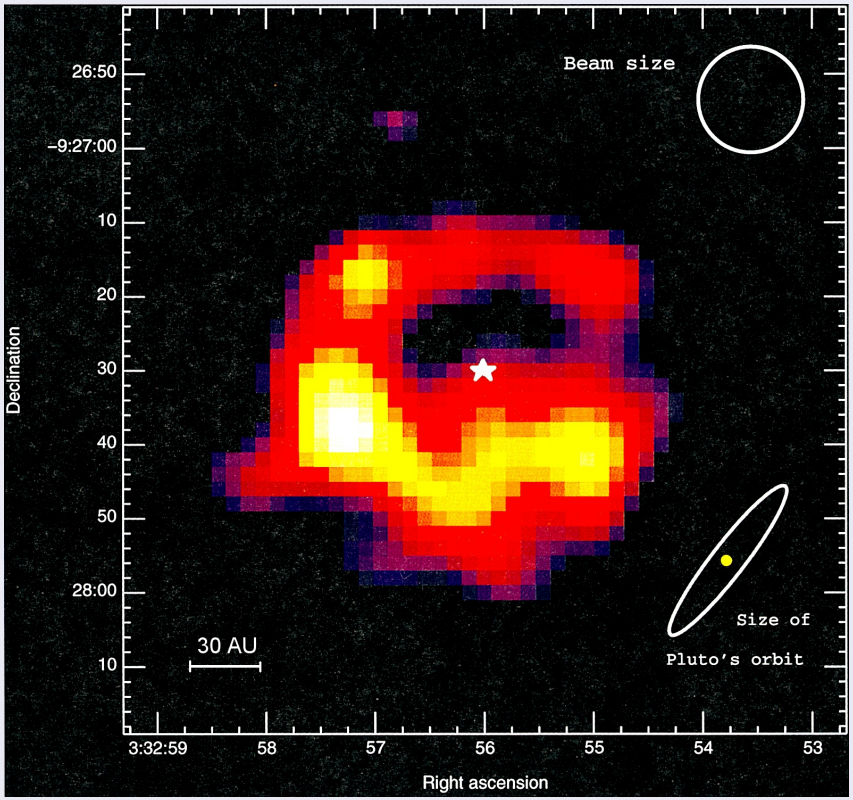
Evidence for warm dust from Spitzer



Greaves et al. 1998 (SCUBA 850 μm)

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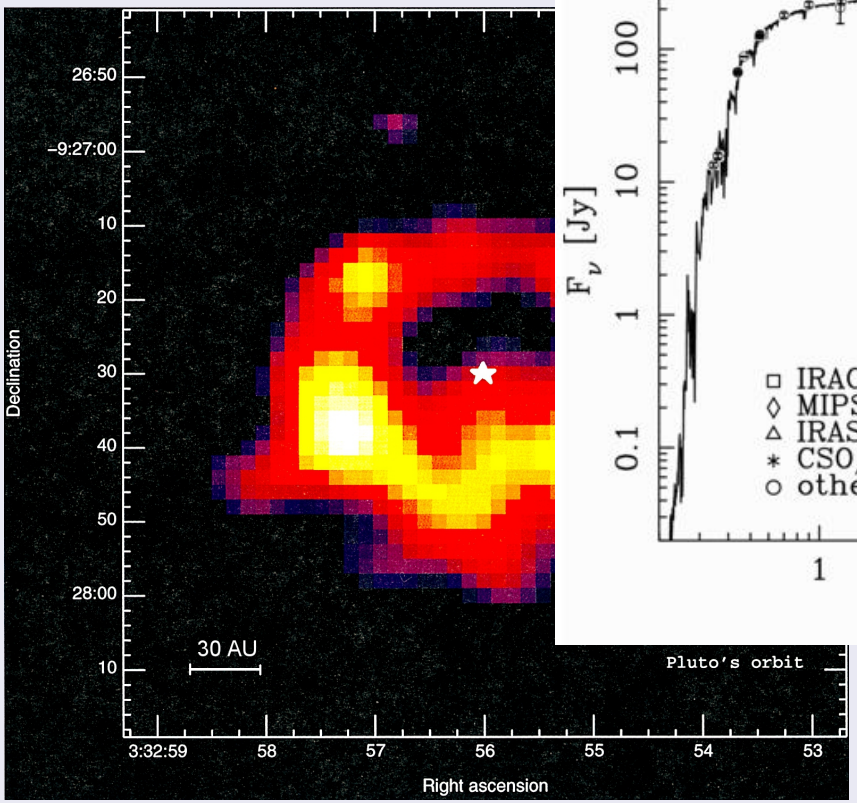

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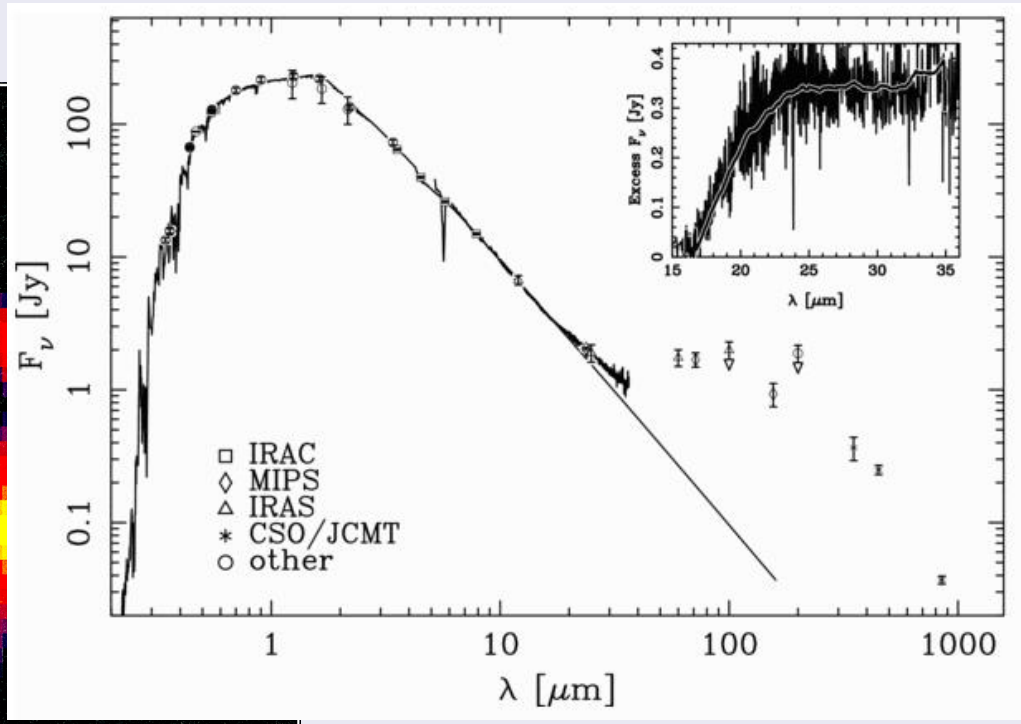

Backman et al. (2009)

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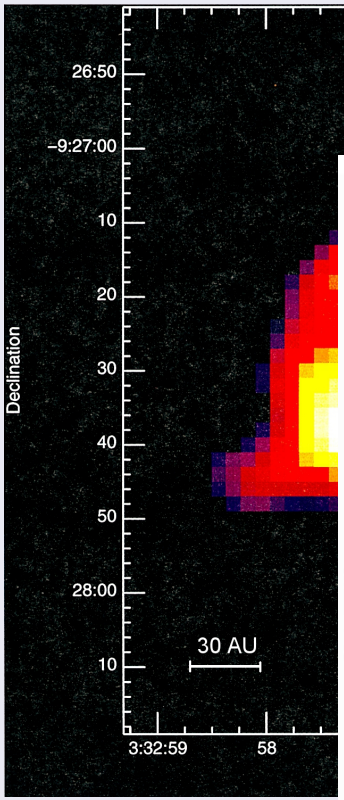

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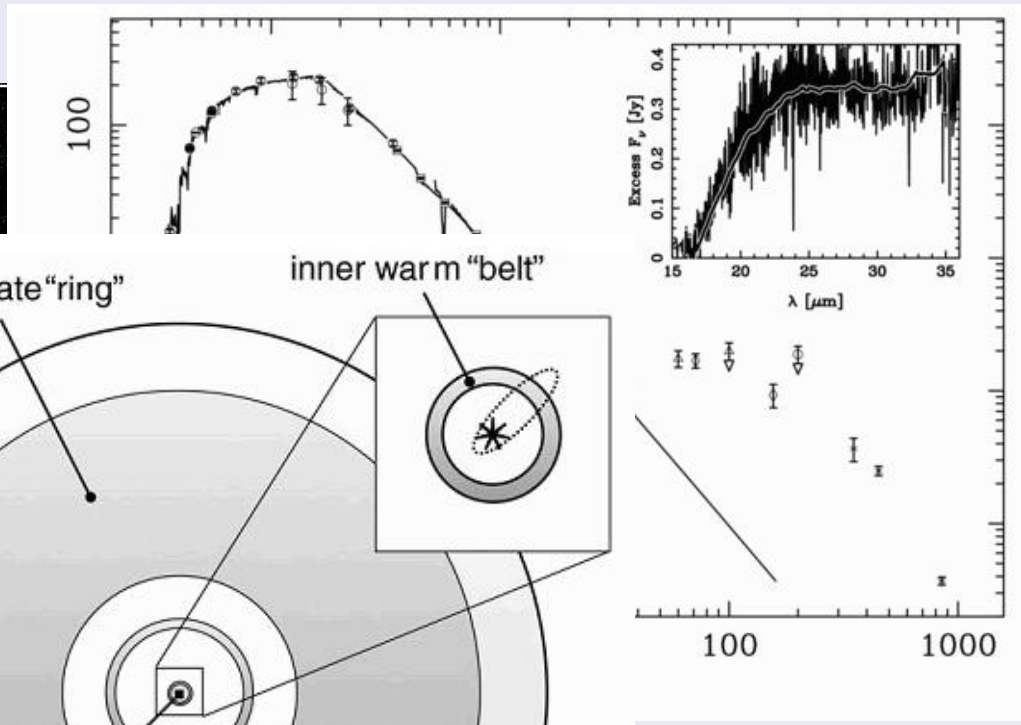

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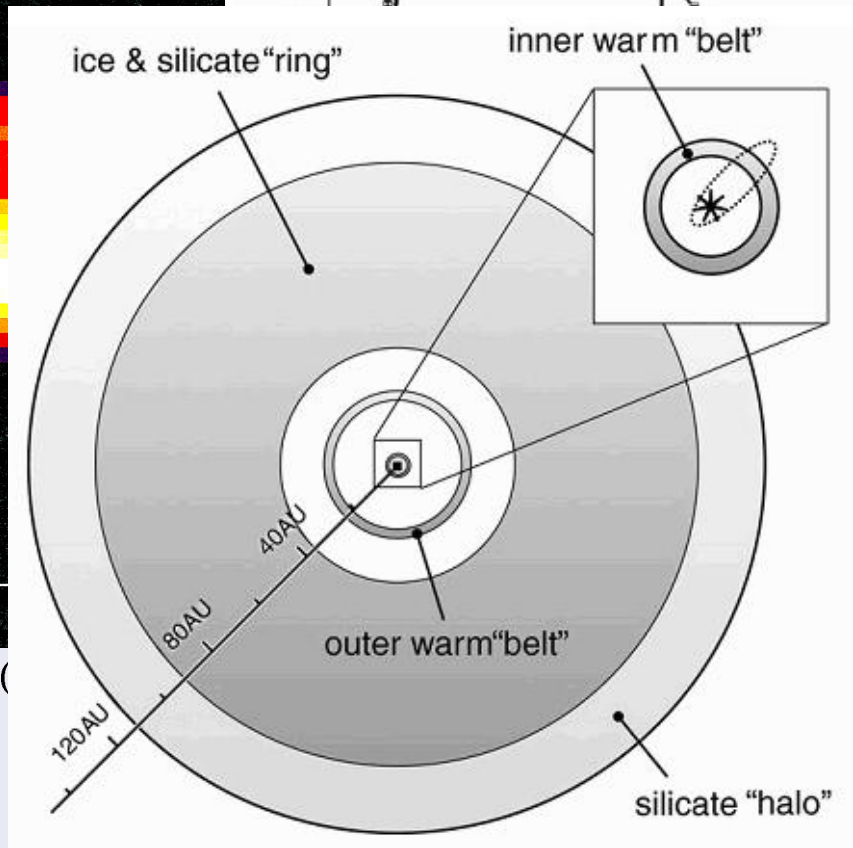

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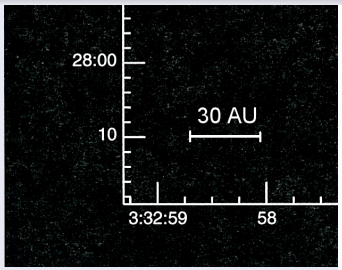
The system

- Star: K2 V
- $d = 3.22\,\mathrm{pc}$ **(!!!)**
- Disk seen $\sim$ face-on
- Multi-ring structure
  (few AU ... $> 100\,\mathrm{AU}$)
- Planet ($a \approx 3.4\,\mathrm{AU}$,
  $M \sin i = 0.86\,\mathrm{M_J}$)
- Inner component: $R \sim 3\,\mathrm{AU}$



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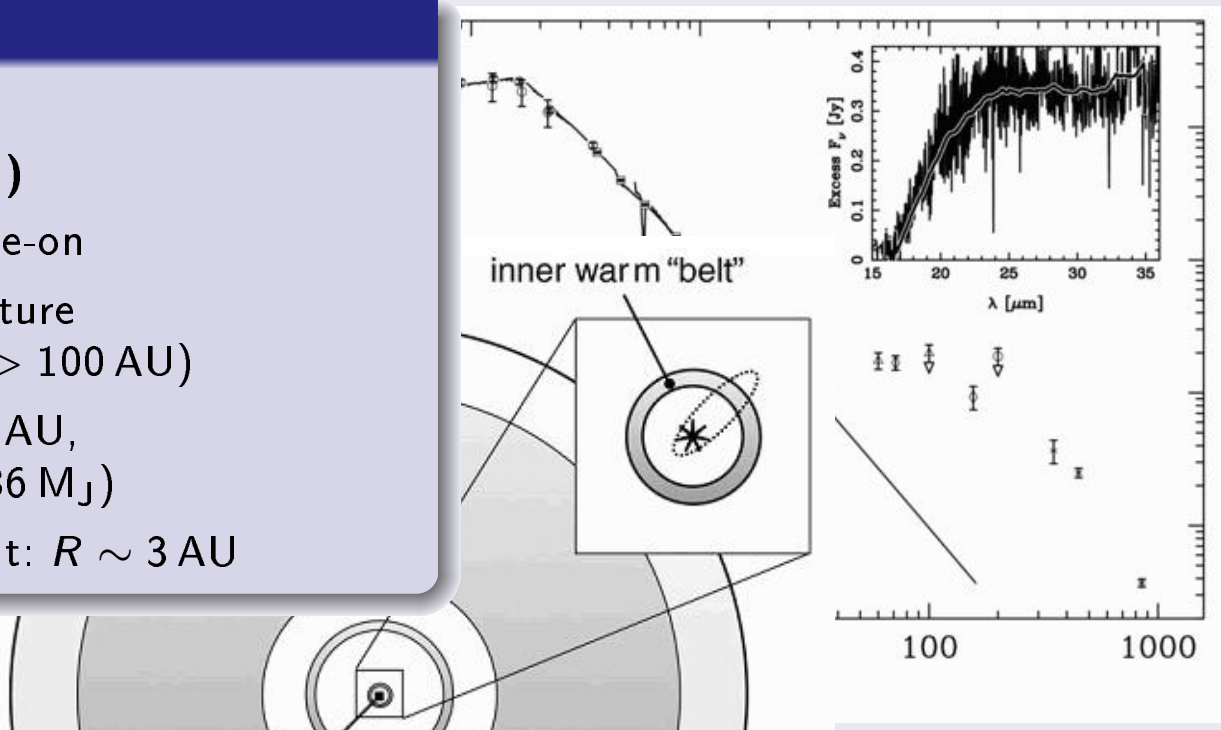

Backman et al. (2009)

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Observations: Strategy

- Total integration time: ~ 40 min planned, ~ 20 min executed
- Q band: diffraction limited observations
- Reference star (γ Eri) directly before and after science target observations

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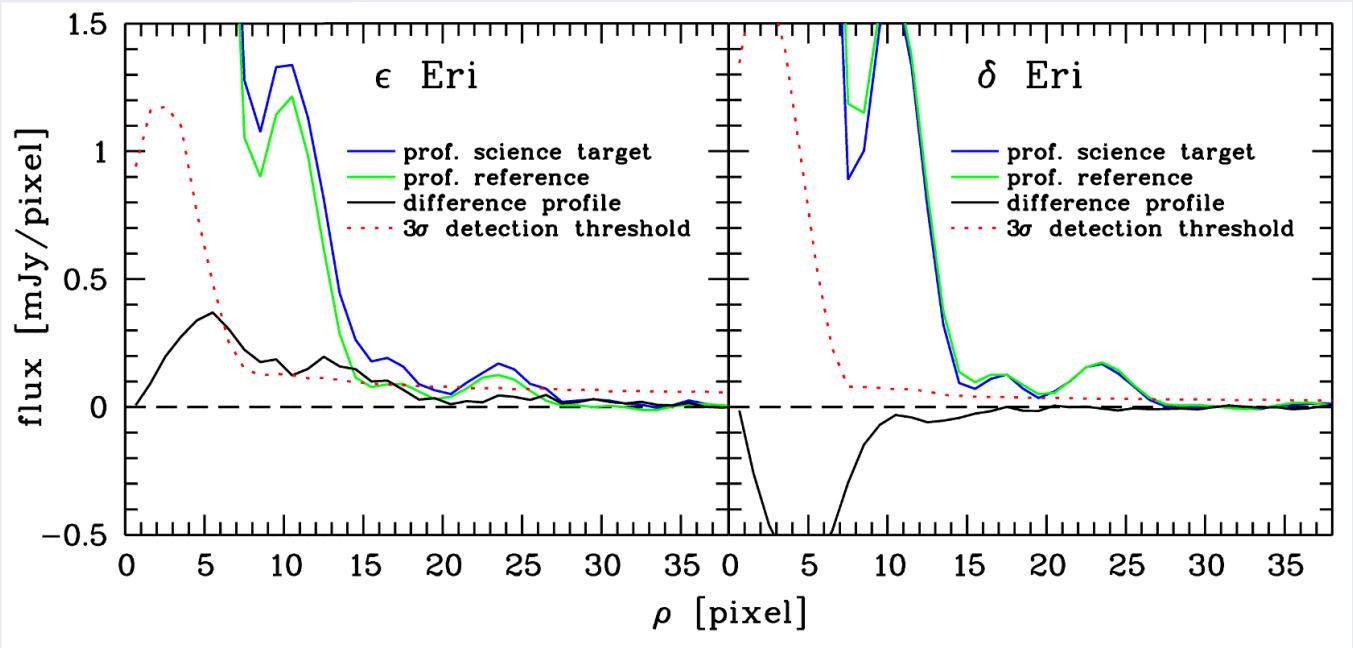
Results: Photometry

- ϵ Eri: $F = 2.68 \pm 0.27$ Jy
  (vgl. $F_{\star,\mathrm{model}} = 2.7$ Jy, $F_{\mathrm{disk,Spitzer}} \approx 0.13$ Jy)
- γ Eri: $F = 32.0 \pm 3.2$ Jy

Reduction: Profiles

- **Standard approach:**
  - Scale image of reference star to stellar contribution of science target
  - Subtract image of reference image from science image
  - Derive profile from difference image
- **BUT:** $\sigma_{\text{photometry}} \gg F_{\text{disk}}$, low sensitivity
- **THUS:**
  - Derive profiles from Science target & reference (averaging azimuthally, uncertainty: standard error of the mean)
  - Scale both profiles to same peak hight
  - Subtract reference profile from science profile (accept possible oversubtraction due to incorrect scaling)

Results: Profiles



- Problem: Bad seeing, not all integrations guaranteed to be diffraction limited (dl)
  - Reference observations: 50% dl for ϵ Eri, 25% dl for δ Eri (second science target)
  - **BUT:** all science observations dl

    $\Longrightarrow$ Over subtraction of reference possible, but never under subtraction

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Results: Is the ϵ Eri stellar contribution oversubtracted?

- Integrated flux in "disk profile" consistent with Spitzer measurment?

  $\Longrightarrow$ $F = 119.1 \pm 30.8\,\mathrm{mJy}$ $(\geq 3\sigma)$
  Spitzer: 130 mJy (Yes!)

$\Longrightarrow$ Disk with $R_{\mathrm{in}} \approx 1.5\,\mathrm{AU}$, $R_{\mathrm{out,sens}} \approx 4\,\mathrm{AU}$

Conclusions on planet-disk intaraction

- Brogi et al. (2009): Planet keeps dust outside, thus dust produced inside planetary orbit
- Reidemeister et al. (2011): Planet has minor impact on raidal migration of dust, thus dust produced outside
- Our observations: Dust and planet "cospatial", thus Reidemeister scenario preferable

What you might **realy** want to know: EXOZODI

First relevant (?) idea for EXOZODI

Disk inclination

- Scatter in Visibilities due to different orientation of baselines?
- Significance? Constraints on inclination of single disks? Disks vs. clouds (statistics)?
- If not (sufficiently) significant: Impact on data analysis?

$\longrightarrow$ Modeling, simulation of observations, data analysis