Near-infrared interferometric observation of the Herbig Ae star HD144432 with VLTI/AMBER

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Introduction

HD144432 is an isolated Herbig Ae (HAE) star with spectral type A9/F0 (The et al. 1994; Sylvester et al. 1996). It belongs to the group II objects in the classification scheme by Meeus et al. (2001), i.e., it has a flat IR spectrum and a weaker MIR excess than the group I objects.

We observed HD144432 in the low spectral resolution mode (R = 35) in the H and K band on 2009 Apr 18 and 2010 Apr 18 with VLTI/AMBER using the linear baseline configuration E0-G0-H0 and the triangle configuration D0-H0-G1, respectively. We employed geometric and temperature-gradient models to fit both the visibility and SED data.

Geometric modeling

We first modeled the disk as an uniform-brightness ring of 20% radial thickness. We derived ring-fit radii of 0.21 ± 0.01 AU for the K band and 0.20 ± 0.01 AU for the H band.

By adding a halo component to the model, a more satisfactory fitting was achieved. The best-fitting star+disk+halo model shows that 11 ± 2 % of the K-band flux is emitted by the halo, and that the disk has a ring-fit radius of 0.17 ± 0.01 AU. In the H band, the halo contributes 7 ± 2 % to the total flux and the ring-fit radius is 0.17 ± 0.01 AU.

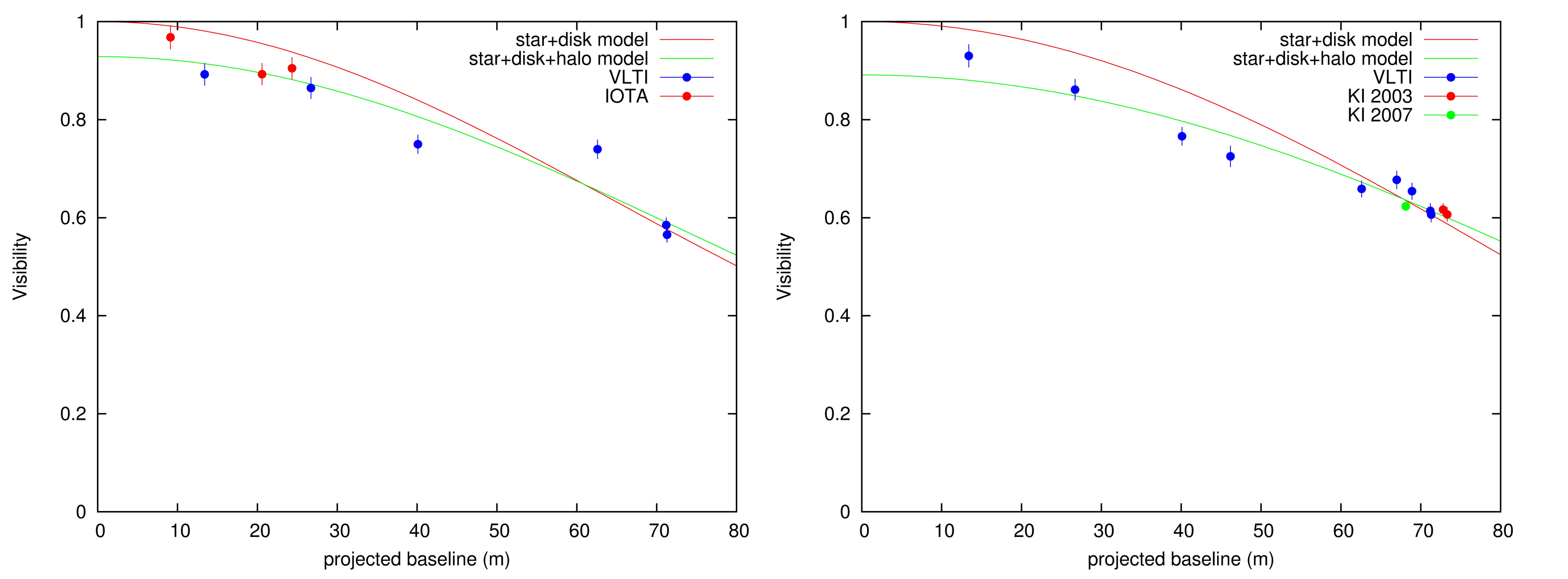


Fig. 1. Band-averaged visibility as a function of baseline length. The dots with error bars are the observations (blue dots: our VLTI data; red and green dots: IOTA and KI data taken from Monnier et al. 2005, 2006; Eisner et al. 2009). The lines are best-fitting geometric models (without inclination, red: star+ring-shaped disk model; green: star+disk+halo model). **Left panel**: H band. **Right panel**: K band.

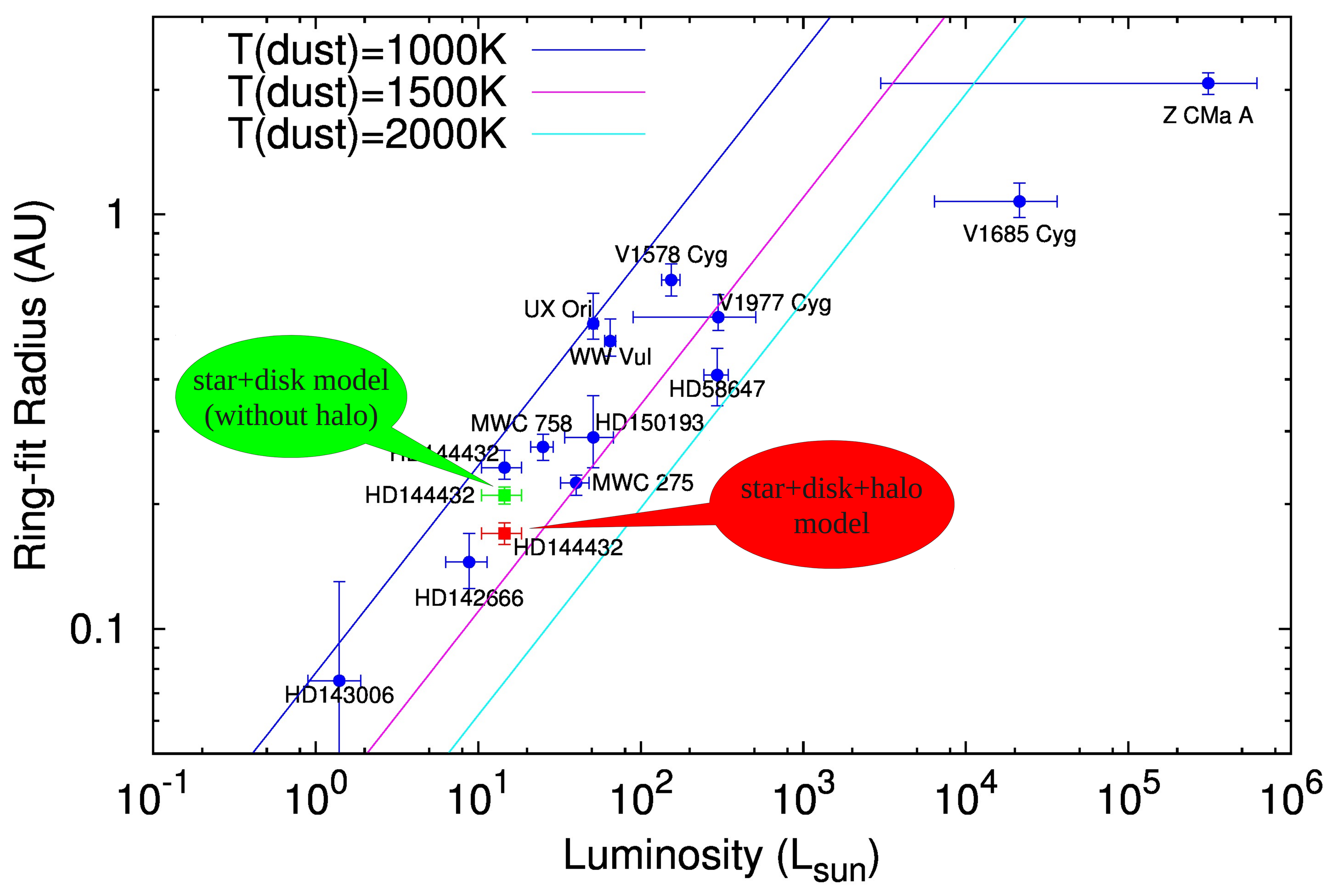
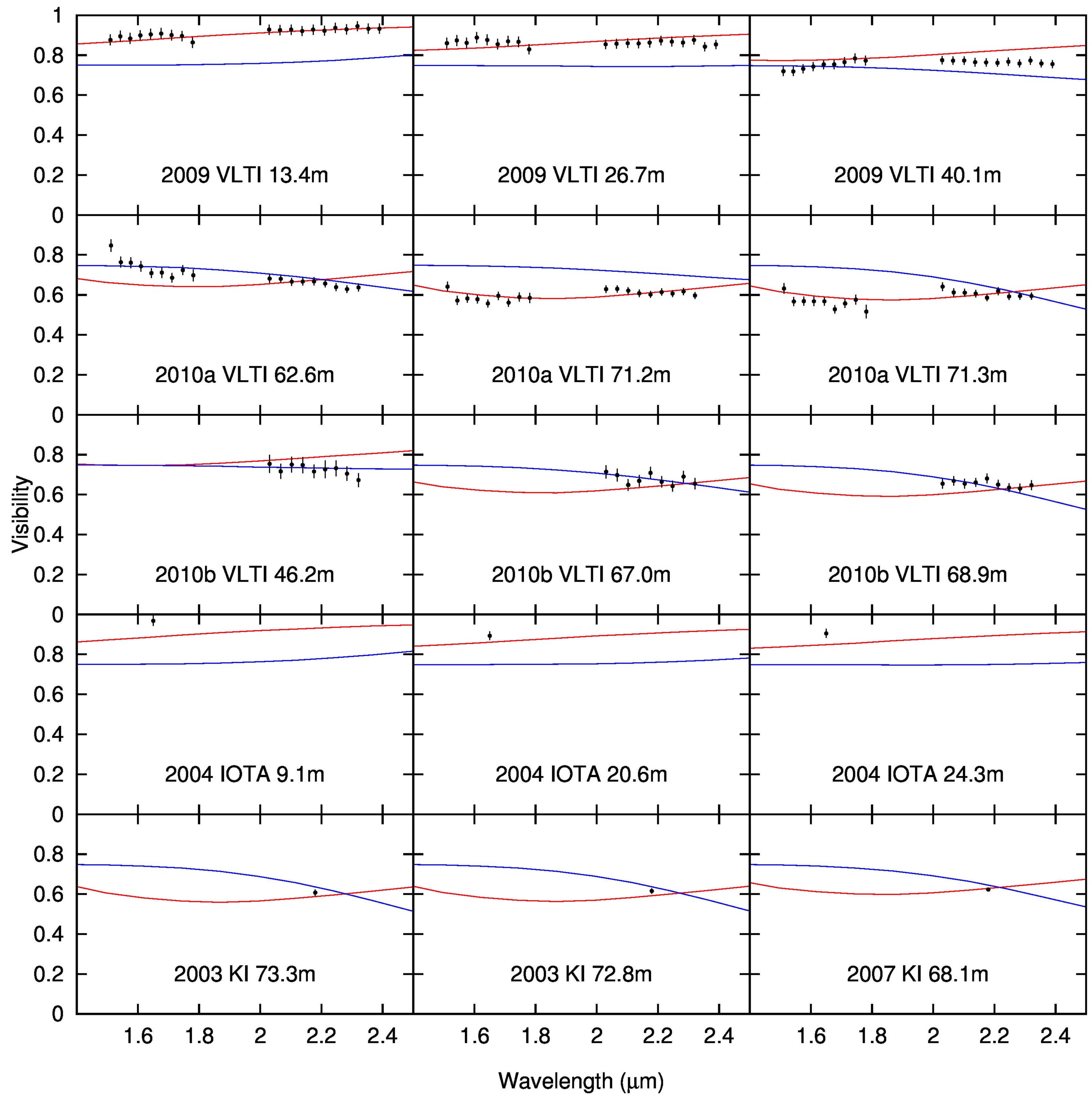
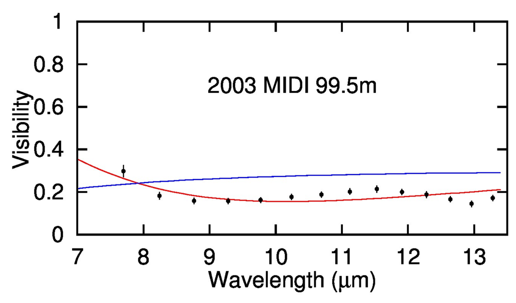


Fig. 2. Size-Luminosity diagram for HAeBe stars. Blue dots: data taken from Monnier et al. (2005). The red square: HD144432 (ring-fit K- band radius of the star+ring+halo uninclined model). The green square: HD144432 (ring-fit K-band radius of the star+ring uninclined model). Lines: sublimation radius for three different dust sublimation temperatures.

Temperature-gradient modeling

Our temperature-gradient modeling suggests that, instead of a smoothly-dropping temperature profile, the disk consists of two parts. The inner part is a thin ring at an inner radius of ∼0.22 AU with a temperature of ∼1500 K and a radial thickness ∼0.02 AU. The outer part extends from ∼1 AU to ∼10 AU with an inner temperature of ∼400 K. The modeling confirms that the disk is seen roughly face-on with an inclination angle of i<23°.





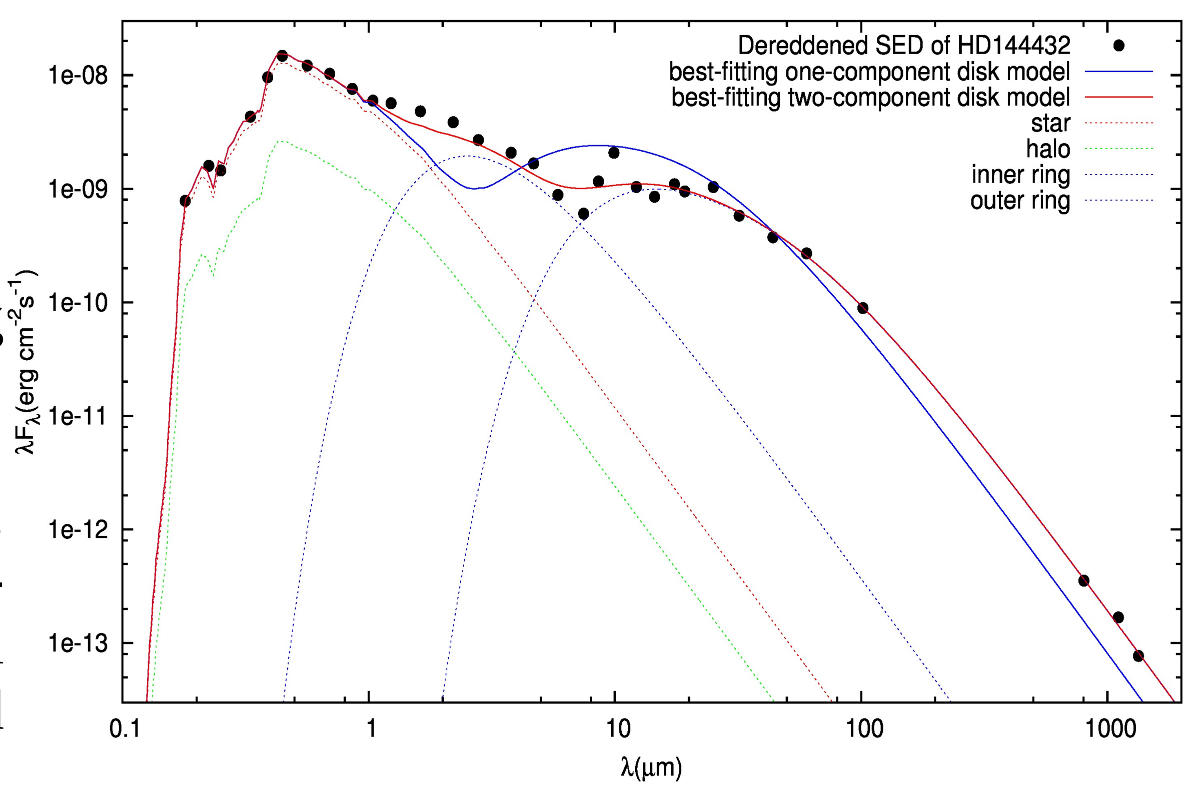


Fig. 3. The best-fitting two-component temperature-gradient disk model (red lines), and best-fitting one-component disk model (blue lines) compared with the observations.

Top and Bottom left: near- and mid-infrared visibility.

Bottom right: SED. The dashed lines denote the contributions from individual components in the best-fitting two-component temperature-gradient disk model.

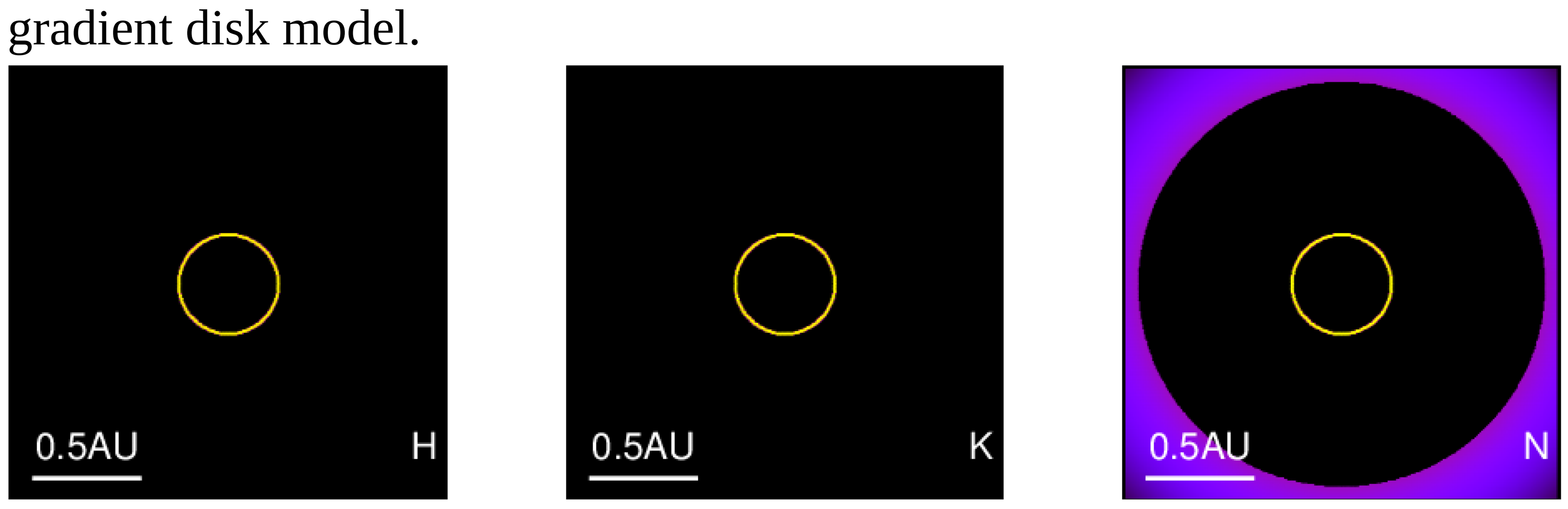


Fig . 4. H-, K-, and N-band intensity distributions of the best-fitting two-component temperature-gradient disk model. The second component of the disk, i.e., the more extended part (violet color), is visible only in N-band. The star and halo are not plotted.