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Probing Dust around Brown Dwarfs: The Naked LP 944-20 and the Disk of Cha Hα2

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Abstract. We present the first mid-infrared (MIR) detection of a field brown dwarf (BD) and the first ground-based MIR measurements of a disk around a young BD candidate. We prove the absence of warm dust surrounding the field BD LP 944-20. In the case of the young BD candidate Cha Hα2, we find clear evidence for thermal dust emission from a disk. Surprisingly, the object does not exhibit any silicate feature as previously predicted. We show that the flat spectrum can be explained by an optically thick flat dust disk but not by a flared one.

1. Introduction and Observations

The presence of disks around BDs and their properties are crucial in distinguishing between the various formation scenarios. Still, only few BDs with MIR excess are known and none of them has been studied in detail.

Using the TIMMI2 MIR camera at the 3.6m ESO Telescope, we carried out sensitive observations of 7 field BDs and the young BD candidate Cha Hα2. We detected the field BD LP 944-20 at 5, 9.8 and 11.9 μm. The observed fluxes are 39, 24 and 22 mJy, respectively. These fluxes can be easily fitted by a black body, thus no significant amount of warm dust is present around LP 944-20. The other 6 nearby field BDs were not detected, therefore they have a 9.8 μm flux less than 15 mJy.

We observed Cha Hα2 (Comerón, Neuhäuser, & Kaas 2000) at 9.8 and 11.9 μm, probing the 9.7 μm silicate feature. The observed fluxes are 17±2 and 21±3 mJy, respectively. The similar fluxes at the wing and on the peak exclude the

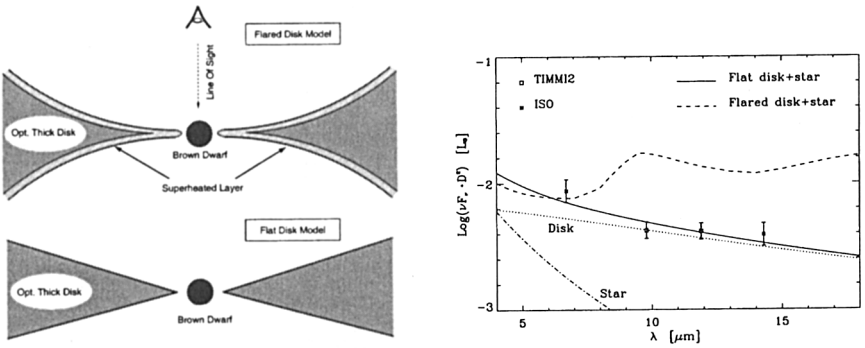

Figure 1. **Left:** Flared and flat disk models. **Right:** SED of a flat and a flared disk compared to the observations. Asterisks: ISO measurements (20% error bars); squares: TIMMI2 observations (15% error bars).

presence of any silicate feature. We plot these values together with the ISO measurements (Comerón, Neuhäuser, & Kaas 2000) in Figure 1.

2. Disk models for Cha Hα 2

We find that the T Tauri-like flared disk model (Chiang & Goldreich 1997) applied to BDs first by Natta & Testi (2001) is unable to explain our observations, regardless of its inclination, optical dust properties or dimensions.

A much simpler and more straightforward solution is the assumption that the Cha Hα2 is surrounded by an optically thick flat disk. Since this disk is entirely optically thick, its SED is independent of the dust properties. The model does not show any feature. The continuum of a power-law flat disk has the observed slope. In Fig. 1. we compare the measurements with the model's predictions.

A more detailed description of our observations and modelling is given in Apai et al. (2002).

References

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