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VLT Spectra of the Companion Candidate Cha Hα 5/cc 1

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Abstract. We obtained optical and infrared spectra of Cha Hα 5/cc 1, a faint possibly sub-stellar companion candidate next to the M6-type brown dwarf candidate Cha Hα 5 in Cha I, using FORS1 and ISAAC at the VLT. The VRIJHK colors of Cha Hα 5/cc 1 are consistent with either an L-type companion or a K-type background giant. Our spectra show that the companion candidate actually is a background star.

1. Introduction

Twelve M6- to M8-type objects called Cha Hα 1 to 12 were found in deep infrared, Hα, and X-ray surveys (Comerón et al. 2000). To search for faint visual companions around these bona-fide and candidate brown dwarfs, we have taken deep images with HST WFPC2 (R, I, Hα), VLT FORS1 (VRI), and NTT SofI (JHK_s) and detected one particularly promising companion candidate: Cha Hα 5/cc 1, a companion candidate 1.5 arc sec off Cha Hα 5, is 3.8 to 4.7 mag fainter than the primary and its colors are consistent with an early- to mid-L spectral type. Assuming the same distance, absorption, and age as for the primary, the faint object would have a mass of 3 to 15 Jupiters according to Burrows et al. (1997) and Chabrier & Baraffe (2000) models. The probability for this companion candidate to be an unrelated fore- or background object is $\leq 0.7\%$, its VRIJHK colors are marginally consistent with a strongly reddened background K giant. These results are published in Neuhäuser et al. (2002).

Even with the best currently achievable astrometric precision (few mas), we would have to wait several years for checking whether this visual pair is a common proper motion pair. Alternatively, and faster, one can check by spectroscopy whether the faint companion candidate is either an L-type companion or a reddened K-type background giant.

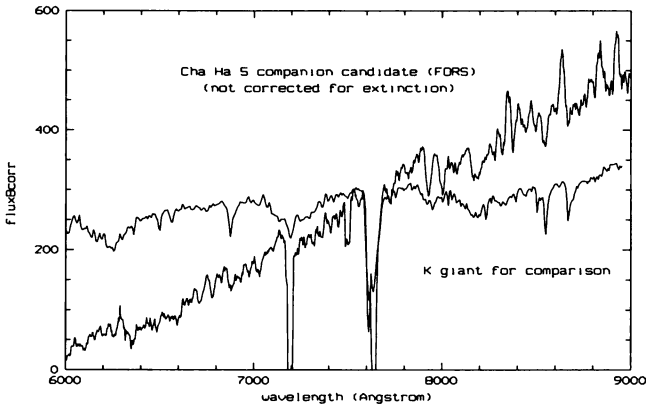

Figure 1. VLT/FORS spectrum (not corrected for reddening) of Cha Hα 5/cc 1 compared to a K-type giant.

2. Observations

Spectra were taken with ISAAC and FORS1 at the VLT in early 2002.

The H- and K-band spectra show that the companion candidate is as red as concluded before from its VRIJHK colors. However, in the K-band spectrum of the companion candidate, the sharp drop of the quasi-continuum at ≥ 2.3 μm due to CO lines is not present. This drop and the CO lines can be seen in the spectrum of Cha Hα 5, but should be even stronger in an L-type object.

In the optical spectrum, the three CaII lines at 8661.7, 8541.7, and 8497.6 Å, which are typical for K stars, but are not present in L-dwarfs, are detected. Also, the typical features of L-dwarfs, like K, Rb, Cs, FeH, and CrH lines are not detected. In Fig. 1, we compare the companion candidate's spectrum with a typical K-type giant star showing the similarities in absorption lines and their relative strength (companion candidate not corrected for strong reddening).

From the previous imaging data, we concluded that the companion candidate is either an unabsorbed L-type companion or a reddened K-type background giant, with the former alternative being much more likely (99.3%). From the follow-up spectra, we conclude that this candidate is a background star, probably a K-type giant.

References

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