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K-band spectroscopy of deeply embedded, young OB stars

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Abstract. We have obtained high resolution (R = 10,000) K-band spectra of candidate young massive stars deeply embedded in high-mass star-forming regions. These objects were selected from a near-infrared survey of 44 regions of high-mass star-formation (Kaper et al (2006)). In these clusters, 38 OB stars are identified whose K-band spectra are dominated by photospheric emission. In almost all those stars, the K-band spectra are indistinguishable from field stars. However, in some stars the profile of the Brγ line is different (less deep, or absent) from those of the O field stars. One of the explanations of these profiles might be an enhanced mass-loss.

1. Introduction

The advent of high-quality near-infrared instrumentation has opened up a new window on the birth sites of massive stars. The formation time scales of a massive star is short, of the order of 100,000 years. This means that the newly born stars are still deeply embedded in their parental molecular cloud. Not much is known about the onset of the stellar wind or the initial rotation properties of young massive stars. Occurring behind large amounts of extinction, inside their natal molecular cloud, these evolutionary stages can only be observed at near-infrared wavelengths.

We have identified 38 OB type stars inside massive star forming regions (Bik et al, (2005)) using K-band spectroscopy. They are classified based on the classification scheme of Hanson et al, (1996). Three O3-O4 stars are detected, while only a few O3 stars are known in our galaxy. The K-band spectra of the OB stars are in general similar to those of the (more evolved) OB stars located in OB associations and the field. This suggest that the K-band spectral properties of the very young OB stars are already indistinguishable from those of the more evolved stars.

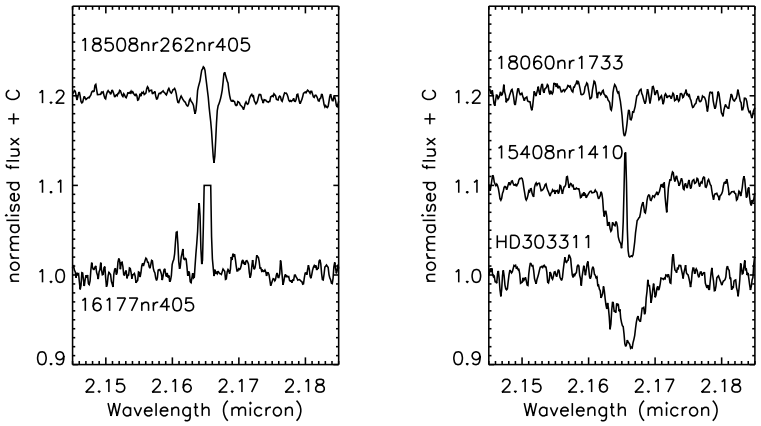

Figure 1. Brγ profile of 4 young O5-O6 V stars in comparison with a Brγ profile of a O5V field star (lower spectrum, right panel).

2. Stellar winds

A few stars classified as early O stars (O5-O6V) show a peculiar behaviour of the Brγ line (Fig. 1); the line is either not present, in emission, or the profile is partly filled in. This might be caused by an enhanced mass-loss. However, this would only happen if the stellar mass-loss is as high as that of supergiants (Lenorzer et al, (2004), Lenorzer et al, these proceedings). Veiling by dust or free-free emission is unlikely as the intrinsically weak lines like CIV and NIII are detected.

Contrary to the suggestion found in our data that the young stars possess a relatively strong wind, evidence has been presented for a class of young OB stars which have unusually weak winds for their spectral type (Heydari et al, (2002), Martins et al, (2004)).

To distinguish between these two scenarios for the stellar wind of the youngest OB stars, a careful analysis of spectral lines sensitive to the wind density is needed. The Brγ line in the K-band is not the best line for this analysis. Brα in the L-band is more sensitive to the stellar wind density (Lenorzer et al, (2004)). Currently a observing program to obtain high resolution spectra of the Brα line with ISAAC on the VLT is underway.

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