Mid-Infrared Variability in Binary Brown Dwarfs

Michael F. Sterzik\textsuperscript{1}, Gael Chauvin\textsuperscript{2}, Kerstin Geißler\textsuperscript{1,3} and Eric Pantin\textsuperscript{4}

\textsuperscript{1}European Southern Observatory, Casilla 19001, Santiago 19, Chile
\textsuperscript{2}Laboratoire d’ Astrophysique, Observatoire de Grenoble, 38041 Grenoble Cedex 9, France
\textsuperscript{3}Max-Planck-Institut for Astronomy, Königstuhl 17, 69117 Heidelberg, Germany
\textsuperscript{4}CEA/Saclay, DSM/DAPNIA/Service d’ Astrophysique, 91191 Gif-sur-Yvette, France

Abstract. We have spatially resolved several nearby binary brown dwarfs and obtained mid-infrared photometry with VISIR at the VLT. In particular, we have monitored $\varepsilon$ Indi B and HD 130948 in several narrow-band MIR filters. The 10.5$\mu$m band is a probe to constrain non-equilibrium chemistry in the atmosphere of cool brown dwarfs.

Keywords. stars: low-mass, brown dwarfs; binaries: close

1. Ground-based MIR measurements

Ground-based mid-IR imaging of binary brown dwarf systems with sub-arcsecond spatial resolution can complement high sensitivity, but low-spatial resolution space-based photometry as obtained e.g. with Spitzer. The spatially resolved photometry of the close (separation 0.7") brown dwarf binary $\varepsilon$ Indi Ba and Bb (Sterzik, Pantin, Hartung et al. 2005) and of three other brown dwarfs in binary systems, GJ 229 B (separation 7.8"), HD 130948 B (separation 2.6", B itself a L4 binary with a separation of 0.1") and HR 7329 B (separation 4.2") allows to constrain atmospheric models of ultra-cool brown dwarfs of various ages and metallicities (Geißler, Chauvin and Sterzik 2008). On-source integration times of about one hour in the 8.6$\mu$m, 10.5$\mu$m and 11.3$\mu$m bandpasses yield 3$\sigma$ detection sensitivities of less then 1-2 mJy for point sources. In case of the HD 130948 B, we have noticed a flux variation of at least 1.7$\pm$0.6mJy within 48 hours in the 10.5$\mu$m bandpass and could not explain it through insufficient sensitivity during one epoch of observations. Therefore we conducted time-series measurements in order to probe potential variability. In particular, significant variations in the 10.5$\mu$m band may be expected in the atmospheres of brown dwarfs at the L/T transition in case non-equilibrium chemistry affecting the CO, CH\textsubscript{4} and NH\textsubscript{3} abundances is important (Hubeny and Burrows 2007). While in the case of HD 130948 B the likelihood of variability is small (Geißler et al. 2009), $\varepsilon$ Indi Ba (a L/T transition object) may be variable in 10.5$\mu$m.

References

Geißler, K., Chauvin, G., & Sterzik, M. F. 2008, \textit{A\&A} 480, 193