A spectroscopic investigation of the O-type star population in four Cygnus OB associations. I. Determination of the binary fraction

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Context. Establishing the multiplicity of O-type stars is the first step towards accurately determining their stellar parameters. Moreover, the distribution of the orbital parameters provides observational clues to the way that O-type stars form and to the interactions during their evolution.
Aims. Our objective is to constrain the multiplicity of a sample of O-type stars belonging to poorly investigated OB associations in the Cygnus complex and for the first time to provide orbital parameters for binaries identified in our sample. Such information is relevant to addressing the issue of the binarity in the context of O-type star formation scenarios.
Methods. We performed a long-term spectroscopic survey of nineteen O-type stars. We searched for radial velocity variations to unveil binaries on timescales from a few days up to a few years, on the basis of a large set of optical spectra.
Results. We confirm the binarity for four objects: HD193443, HD228989, HD229234 and HD194649. We derive for the first time the orbital solutions of three systems, and we confirm the values of the fourth, showing that these four systems all have orbital periods shorter than 10 days. Besides these results, we also detect several objects that show non-periodic line profile variations in some of their spectral lines. These variations mainly occur in the spectral lines, that are generally affected by the stellar wind and are not likely to be related to binarity.
Conclusions. The minimal binary fraction in our sample is estimated to be 21%, but it varies from one OB association to the next. Indeed, 3 O stars of our sample out of 9 (33%) belonging to CygOB1 are binary systems, 0% (0 out of 4) in CygOB3, 0% (0 out of 3) in CygOB8, and 33% (1 out of 3) in CygOB9. Our spectroscopic investigation also stresses the absence of long-period systems among the stars in our sample. This result contrasts with the case of the O-type stellar population in NGC 2244 among which no object showed radial velocity variations on short timescales. However, we show that it is probably an effect of the sample and that this difference does not a priori suggest a somewhat different star forming process in these two environments.

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