An XMM-Newton view of the young open cluster NGC 6231 -- II. The OB star population

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In this second paper of the series, we pursue the analysis of the 180 ks XMM-Newton campaign towards the young open cluster NGC 6231 and we focus on its rich OB star population. We present a literature-based census of the OB stars in the field of view with more than one hundred objects, among which 30% can be associated with an X-ray source. All the O-type stars are detected in the X-ray domain as soft and reasonably strong emitters. In the 0.5-10.0 keV band, their X-ray luminosities scale with their bolometric luminosities as log(Lx)-log(Lbol)=-6.912+/-0.153. Such a scaling law holds in the soft (0.5-1.0 keV) and intermediate (1.0-2.5 keV) bands but breaks down in the hard band. While the two colliding wind binaries in our sample clearly deviate from this scheme, the remaining O-type objects show a very limited dispersion (40% or 20% according to whether `cool' dwarfs are included or not), much smaller than that obtained from previous studies. At our detection threshold and with our sample, the sole identified mechanism that produces significant modulations in the O star X-ray emission is related to wind interaction. We thus propose that the intrinsic X-ray emission of non-peculiar O-type stars can be considered as constant for a given star. In addition, the level of X-ray emission is accurately related to the star luminosity or, equivalently, to its wind properties.

Among B-type stars, the detection rate is only about 25% in the sub-type range B0-B4 and remains mostly uniform throughout the different sub-populations while it drops significantly at later sub-types. The associated X-ray spectra are harder than those of O-type stars. Our analysis points towards the detected emission being associated with a physical (in a multiple system) PMS companion. However, we still observe a correlation between the bolometric luminosity of the B stars and the measured X-ray luminosity. The best fit power law in the 0.5-10.0 keV band yields log(Lx) = 0.22(+/-0.06) log(Lbol)+22.8(+/-2.4).

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