

An XMM-Newton view of the young open cluster NGC 6231 III. Optically faint X-ray sources

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We discuss the properties of the X-ray sources with faint optical counterparts in the very young open cluster NGC 6231. From their positions in the H-R diagram, we find that the bulk of these objects probably consists of low-mass pre-main sequence stars with masses in the range 0.3 to 3.0 M_{\odot} . The age distribution of these objects indicates that low-mass star formation in NGC 6231 started more than 10 Myr ago and culminated in a starburst-like event about 1 to 4 Myr ago when the bulk of the low-mass PMS stars as well as the massive cluster members formed. We find no evidence for a spatial age gradient that could point towards a sequential star formation process. Only a few X-ray sources have counterparts with a reddening exceeding the average value of the cluster or with infrared colours indicating the presence of a moderate near-IR excess. The X-ray spectra of the brightest PMS sources are best fitted by rather hard thermal plasma models and a significant fraction of these sources display flares in their light curve. The X-ray brightest flaring sources have decay times between 2 and 16 ks. The X-ray selected PMS stars in NGC 6231 have $\log(L_{\text{X}}/L_{\text{bol}})$ values that increase strongly with decreasing bolometric luminosity and can reach a saturation level ($\log(L_{\text{X}}/L_{\text{bol}}) \sim -2.4$) for non-flaring sources and even more extreme values during flares.

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