Triggered Star Formation in a Turbulent ISM
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The history of star formation in the Galactic young open cluster NGC 6231

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Abstract. We study the star formation history of the galactic young open cluster NGC 6231 using new, deep, wide-field $BVRI$ imaging. Contrary to previous suggestions, we do not find a lack of low-mass cluster members; our derived mass function is compatible with a Salpeter IMF. The star formation history of NGC 6231 appears to be bi-modal, with a first wave of star formation activity 3–5 Myr ago, followed by a new generation of stars forming $\sim$ 1 Myr ago.

Keywords. Star Formation, Pre-main sequence Stars, Open clusters and associations

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The star formation history of the rich open cluster NGC 6231 has been hotly debated in the literature ever since the suggestion by Eggen (1976) that a violent process must have triggered star formation in the region. In the largest photometric study of the region to date, Sung *et al.* (1998) suggested an abrupt decrease in the number of low-mass stars in NGC 6231 - giving further credibility to a scenario in which star formation in this region may have been triggered. Interestingly, Reed & Cudworth (2003), recently found that the trajectory of the globular cluster NGC 6397 intersected that of the natal cloud of NGC 6231 around five million years ago - close to the estimated age of NGC 6231 – thus providing a plausible candidate for the triggering mechanism.

New $BVRI$ images of a region of 30′ centered on the core of NGC 6231 were obtained with the Wide Field Imager (WFI) on the ESO/MPG 2.2m telescope at La Silla, Chile. Photometry in all three broadband filters was extracted for all stars down to $V = 21$ and combined with JHK photometry from 2MASS whenever available.

A fit of isochrones to the background-corrected colour-magnitude diagram of NGC 6231 confirms its young age ($\sim$ 3 Myr). We have detected 19 intermediate-mass stars with large amounts of near-infrared excess radiation. They are most likely young stars surrounded by disks (i.e. Herbig Ae/Be and classical T Tauri stars). We do not find evidence for a lack of low-mass cluster members, as suggested by Sung *et al.*; within our completeness limit, the cluster luminosity function appears to be compatible with a Salpeter IMF. Interestingly enough, we do find strong evidence for the existence of a significant age spread within our cluster members. We conclude that if star formation in NGC 6231 is indeed triggered – either by a recent supernova or by the passage of NGC 6397 through the galactic plane – this did not simply result in one single burst of star formation activity. Rather star formation activity in this region appears to have started gradually around 5 Myr ago, reached a local maximum around 3 Myr ago, and experienced another burst of star forming activity around 1 million years ago.

References

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