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 simple 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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