

Molecular Line Emission Towards High-Mass Clumps: The MALT90 Catalogue

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Resumen

The Millimetre Astronomy Legacy Team 90 GHz survey aims to characterise the physical and chemical evolution of high-mass clumps. Recently completed, it mapped 90 GHz line emission towards 3 246 high-mass clumps identified from the ATLASGAL 870 μ m Galactic plane survey. By utilising the broad frequency coverage of the Mopra telescope's spectrometer, maps in 16 different emission lines were simultaneously obtained. Here, we describe the first catalogue of the detected line emission, generated by Gaussian profile fitting to spectra extracted towards each clumps' 870 μ m dust continuum peak. Synthetic spectra show that the catalogue has a completeness of >95%, a probability of a false-positive detection of <0.3%, and a relative uncertainty in the measured quantities of <20% over the range of detection criteria. The detection rates are highest for the (1-0) transitions of HCO+, HNC, N₂H+, and HCN (similar to 77-89%). Almost all clumps (similar to 95%) are detected in at least one of the molecular transitions, just over half of the clumps (similar to 53%) are detected in four or more of the transitions, while only one clump is detected in 13 transitions. We find several striking trends in the ensemble of properties for the different molecular transitions when plotted as a function of the clumps' evolutionary state as estimated from Spitzer mid-IR images, including (1) HNC is relatively brighter in colder, less evolved clumps than those that show active star formation, (2) N₂H+ is relatively brighter in the earlier stages, (3) that the observed optical depth decreases as the clumps evolve, and (4) the optically thickest HCO+ emission shows a 'blue-red asymmetry' indicating overall collapse that monotonically decreases as the clumps evolve. This catalogue represents the largest compiled database of line emission towards high-mass clumps and is a valuable data set for detailed studies of these objects.

Palabras clave

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