

Completing the protostellar luminosity function in Cygnus-X with SOFIA/FORCAST imaging

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Abstract

We present a new SOFIA/FORCAST mid-infrared survey of luminous protostars and crowded star-forming environments in Cygnus X, the nearest million-solar mass molecular cloud complex. We derive bolometric luminosities for over 1000 sources in the region with these new data in combination with extant Spitzer and UKIDSS photometry, with 63 new luminous protostar candidates identified by way of the high-quality SOFIA/FORCAST data. By including FORCAST data, we construct protostellar luminosity functions (PLFs) with improved completeness at the high luminosity end. The PLFs are well described by a power-law function with an index of ~ -0.5 . Based on the Herschel temperature and column density measurements, we find no obvious dependence of the PLFs on the local gas temperature, but PLFs in regions of high stellar density or gas column density exhibit some excess at higher luminosities. Through the comparison between our observed PLFs and existing accretion models, both the turbulent core and the competitive accretion models are consistent with our results, while the isothermal sphere model is disfavoured. The implications of these results on the star formation process are discussed. © 2022 The Author(s) Published by Oxford University Press on behalf of Royal Astronomical Society.

Author keywords

infrared: stars; ISM: clouds; stars: formation; stars: luminosity function, mass function; stars: protostars