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Cloud structure and YSOs distribution in the Dragonfish nebula

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Abstract

Star formation is a complex, multifaceted process involving multiple interacting physical mechanisms across different spatial scales. A better understanding of this process can be achieved by examining the spatial relationships between the distribution of gas and of newly formed stars within star-forming regions. For robust conclusions, such comparisons need quantitative and consistent descriptors applied to the same region.
This study focuses on the Dragonfish star-forming complex, where we used fractal analysis to compare the structure of the gas cloud with the distribution of young stellar objects (YSOs). Emission maps of the Dragonfish nebula were sourced from NASA/IPAC Infrared Science and Planck Legacy archives. Photometric data from the AllWISE catalog provided a selection of 1,082 YSOs. We derived the physical properties for some of these from their spectral energy distributions. For both the cloud images and YSOs, the three-dimensional fractal dimension (Df) was calculated using previously developed and calibrated algorithms. Our results show that the fractal dimension of the Dragonfish nebula (Df = 2.6–2.7) closely aligns with other known star-forming clouds, such as Orion, Ophiuchus, and Perseus. Interestingly, however, the YSOs display a lower average fractal dimension (Df = 1.9–2.0), indicating they are distributed in a more clumpy structure than the gas they formed from. Younger stellar sources, such as Class I and II objects, have a lower fractal dimension (Df = 1.7 ± 0.1) compared to the more evolved objects with transition disks (Df = 2.2 ± 0.1), suggesting that clumpy structures become more diffuse as newly formed stars evolve. The exact mechanism driving this clustering remains unclear, pointing to further areas for investigation in the dynamics of star formation.

My poster in zenodo.org can be found here