

Anomalously High Deuteration Fraction in a Translucent Molecular Cloud

We report the first detection of DCN in a low-density translucent sightline ($n_{H_2} \sim 390 \text{ cm}^{-3}$, $A_V \sim 0.85 \text{ mag}$) through sensitive absorption-line observations with NOEMA. The observed DCN/HCN ratio is two orders of magnitude higher than the elemental deuterium-to-hydrogen abundance ratio ($D/H \sim 10^{-5}$), challenging predictions from current chemical models. This discrepancy suggests a significant and unexpected boost in deuterium fractionation under low-density conditions. To reconcile this result, we propose that the observed cloud may represent a dispersal phase of a previously denser core, where the gas density in its evolutionary history must have exceeded $10^{3.5} \text{ cm}^{-3}$.

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Session Classification: Session 6