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SiO Gas Emission as a Window into Low- and High-Mass Protoplanetary Disk Evolution

Understanding the evolution of planet-forming disks is essential for advancing our knowledge of matter cycles in the interstellar medium and the processes of planet formation \cite{kamp2017multiwavelengthobservationsplanetforming}. The diverse temperature ranges and multi-wavelength emissions of these disks make them ideal for studying the rotational transitions of small molecules, which provide critical insights into gas dynamics, kinematics, and chemical behavior. The Atacama Large Millimeter Array (ALMA) is particularly effective for mapping line tracers in these systems, as it captures relevant rotational transitions while achieving high resolution in the inner regions.
In Class II disks ($1 < r < 10$, AU), previously considered 'dead zones' due to limited ionization sources, cosmic rays play a significant role by driving chemical reactions that produce new molecular species, some of which remain undetectable with current instruments. Recent studies have identified silicon monoxide (SiO) as a stable molecular species in these environments, sustained by radiation near the protostar \cite{chaparro}. While commonly associated with high-mass stellar systems and linked to dust destruction processes such as jets and outflows \cite{refId0}\cite{OUTFLOWTRACER}, SiO may also reside undetected in low-mass systems where it accumulates in the upper layers of the disk via vertical drift. This research aims to bridge observations of high and low-mass disks by enhancing SiO detection through processing, filtering, and imaging of raw and calibrated interferometric data at high resolution \cite{ Loomis_2018}. By reconstructing molecular lines from three different datasets including well-studied ALMA sources from the MAPS Survey \cite{maps_survey}, a two-dimensional chemical model could benchmark disk evolution, considering accretion and formation driven by the central object. Isolating the SiO line and refining disk models will enhance our understanding of star and planet formation processes. By utilizing archival data we aim to advance our knowledge of the fundamental building blocks of the universe through new and undetected molecular lines.

Nivel de formación

Maestría

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