Molecular Diagnostics of Disk Forming Regions

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In the formation of sun-like protostars, a disk structure forms around a newly formed protostar and evolves to a protoplanetary disk and eventually to a planetary system. Along this physical process, chemical composition of the interstellar gas also evolves into that of planetary materials. For thorough understandings of the origin of the Solar System, it is of fundamental importance to elucidate these physical and chemical processes in detail. With this in mind, we are studying molecular distributions of nearby low-mass protostellar cores by an extensive use of the state-of-the-art radio telescopes including Atacama Large Millimeter/submillimeter Array (ALMA). Some highlights are summarized as follows:

(1) Chemical composition in low-mass protostellar cores is much more complex than ever thought. Interestingly, the chemical composition is found to be different from object to object [1,2]. This chemical diversity is found to be delivered to disk forming regions. Thus, the chemical diversity will be inherited to protoplanetary disks, and eventually to planetary systems [3-5].

(2) On the other hand, a basic physical structure of disk forming regions consists of an infalling-rotating envelope, a rotating disk structure, and a transition zone between them regardless of chemical characteristics.

(3) It is found that chemical composition drastically changes in the transition zone, which corresponds to the centrifugal barrier of the envelope. Some specific molecules are found to trace specific physical parts just like 'a molecular marker'. Thus, we can disentangle complex physical structures of disk forming regions by using molecular distributions [3-7].

These results provide us with new insight into the origin of the Solar System, and more systematic studies are in progress.

References (Cambria 10 pt, bold face, aligned to the left)

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