

Formation Process of Complex Organic Molecules in Protoplanetary Disks

NOMURA, Hideko^{1*}

¹Tokyo Institute of Technology

It is believed that chemical reactions in protoplanetary disks will lead the origin of materials in our Solar System. Recently, many complex organic molecules (COMs) have been found in molecular clouds by radio observations of molecular transition lines. Meanwhile, amino-acids are found in a comet and meteorites in our Solar System. In this work we investigate the synthesis of complex organic molecules in protoplanetary disks using a large gas-grain chemical network together with a 2D steady-state physical model of a disk irradiated by UV and X-rays from the central star. We find COMs are efficiently formed on cold and warm grains in the disk midplane via grain-surface reactions through efficient migration of icy species on grain surface. Radiation processing on ice forms reactive radicals and helps build further complexity. We find the grain-surface abundances predicted by our calculations are consistent with those derived from cometary comae observations. We also predict line spectra of COMs, which are partly photodesorbed into gas from grain surface, will be observable in nearby protoplanetary disks with ALMA. In this talk I would like to discuss further on formation process of COMs on grains in the asteroid belt region, too.

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