

An experimental study of the UV-induced photo-isomerization of interstellar molecules

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Molecules of the same composition with different structures (e.g. HCCH and HHCC) are called isomers. Many of polyatomic molecules among nearly 200 species already discovered in interstellar space by astronomical observations are suggested to have isomers. As different isomers show different chemical properties and behaviors in the interstellar space, transitions between different isomers sometimes play a crucial role in characterizing the chemical environment of the clouds. Probing the astronomical objects in terms of the abundance ratio of isomers may also provide a detailed information on their chemical conditions, such as the gas temperature, flux and polarizability of radiation, isotope enrichment factors and so on.

We have started a new experimental study on the isomerization of interstellar molecular ions with a focus on those induced by a UV radiation above the ionization limit of hydrogen. The experiment is based on three parts; one is the preparation of isolated molecular ions in the gas phase and this will be done by electro-spray, electron-discharge, and gas-jet ionization methods depending on the species. The second part is the generation of monochromatic UV radiation with a substantial intensity. A dedicated UV beamline for this experiment is under development in the laser plasma light source facility in Rikkyo University. As the last part, the molecular structure has to be identified, although this is not usually straightforward since the isomers have the same mass and velocities. The low-temperature ion-mobility spectrometry (IMS) method will be used to separate the isomers during the time they drift through a cold tube filled with a helium gas. Figure 1 shows the the present view of the drift-tube apparatus in the laboratory. The status of the experimental developments and the basic concepts of the research will be presented.



Figure1: Photograph of the IMS apparatus.