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星間塵表面での水分子とその重水素置換体生成
Formation of H_2O and its isotopologues on interstellar grains

大場 康弘 [1*], 渡部 直樹 [1], 羽馬 哲也 [1], 桑畑　和明 [1], 日高　宏 [1], 香内 晃 [1]
OBA, Yasuhiro[1*], WATANABE, Naoki[1], HAMA, Tetsuya[1], KUWAHATA, Kazuaki[1], HIDAKA, Hiroshi[1], KOUCHI, Akira[1]

[1] 北海道大学低温科学研究所
[1]Institute of Low Temperature Science, Hokkaido University

Solid H_2O is the most abundant component in icy grain mantles in molecular clouds. Since the observed abundance of solid H_2O in molecular clouds cannot be explained only by gas-phase synthesis, it has been considered that solid H_2O is produced on the surface of interstellar grains. Tielens and Hagen (1982) proposed that solid H_2O is produced by hydrogenation of O, O_2, or O_3. Since then, the formation of H_2O through those reactions has been experimentally demonstrated to occur by several research groups (e.g. Miyauchi et al. 2008; Ioppolo et al. 2008).

In addition to these hydrogenation processes, reactions of hydroxyl radicals (OH) with H_2 have been accepted as an important route to H_2O formation in dense molecular clouds where the UV field is very weak. Under those conditions, it is unlikely that the reaction thermally occurs due to the significant barrier of about 2000 K; the reaction should proceed through quantum tunneling if it really occurs in dense clouds. However, it has not been experimentally demonstrated so far.

In this presentation, we will show experimental results on the formation of H_2O and its isotopologues (HDO and D_2O) by the reaction of OH/OD with H_2/HD/D_2 at 10 K, and discuss its astrophysical implications.

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