

Toward understanding the origin and habitability of icy bodies in the Solar System with millimeter/sub-millimeter observations

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The discovery of plume activities on geologically-active icy bodies, such as Enceladus, Europa, and Ceres, has provided essential windows to directly reveal the chemical and isotopic compositions of volatiles within their subsurface oceans. Surface ices and salts also would preserve building materials of these bodies and reactants of water-rock interactions on the seafloor. Although these observational data could contain critical information on the origin, evolution, and habitability of these bodies, the interpretation of the observations critically depends on our understanding of the nature of geochemistry in these planetary bodies. To address the primary questions regarding the origin and habitability of these bodies, a research at interactions of astronomy, planetary science, and Earth science is highly required. The present paper will discuss some proxy indicators in millimeter/sub-millimeter observations to constrain the disk temperature where these icy bodies formed and to reveal the presence of hydrothermal environments on the seafloor. We also discuss how we can promote this interdisciplinary research in Japan in the upcoming age of large ground-based telescopes, such as ALMA and TMT, and spacecraft missions, such as Europa Clipper and JUICE.

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