

Assessing Ocean World Habitability with HWO

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Many icy moons and volatile-rich dwarf planets could harbor saline reservoirs or global saline oceans beneath their icy exteriors. Liquid water in the interiors of these icy “ocean worlds” could reach their surfaces via fractures that extend to liquid layers, as is likely the case on Jupiter’s moon Europa and the dwarf planet Ceres, depositing salts and other internally-derived compounds that can help constrain internal habitability. At Saturn’s moon Enceladus, ocean material is being jetted into space by a large plume, much of which falls back onto its surface. Studying the surface and exosphere compositions of icy ocean worlds can therefore provide invaluable insights into their ocean chemistries and potential habitability.

Existing observations of icy ocean worlds are often limited to low signal-to-noise (SNR) and low resolving power (R) datasets, in particular over UV wavelengths that are largely inaccessible with state-of-the-art facilities like the James Webb Space Telescope (JWST). Future observations made with an integral field spectrograph (IFS), spanning the UV (~100 – 400 nm) with moderate resolving power (R ~ 3000+), on the Habitable Worlds Observatory (HWO) would allow investigation of plume and exospheric activity on known active worlds and enable an assessment of other, possibly active icy worlds, spanning Ceres to the Trans-Neptunian region. High SNR, UV imaging spectroscopy will be crucial for identifying ionized and neutral species in their exospheres, sustained by sputtering and outgassing processes operating over short timescales. Contemporaneous NIR spectral capabilities (~1 – 5 μm , R ~ 3000+) would provide measurements of H₂O vapor, CO₂ gas, and solid-state ices and provide continuity of long temporal observations that have been started with JWST.