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Alien Seas: Fluid Mechanics of Oceans Throughout the Solar System¹

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Recent robotic spacecraft missions have discovered that liquid water oceans occur not just on Earth, but beneath the surface of several large icy moons in the outer solar system, including Europa, Enceladus, and Titan. Our observations of these oceans are indirect, but they allow us to widen the scope of physical oceanography beyond our own planet. How do these alien seas compare with the Earth's, in their force balance, energy transport, and pattern of circulation? Can fluid physics help us to determine whether these oceans could be habitats for life? I will describe the basic physical constraints and parameters common to all oceans, and survey our latest attempts to understand icy world oceans, from basic scaling analyses and laboratory analogues to computer simulations of ocean circulation, on both the local and global scale. I will also discuss ways in which future spacecraft might detect and probe these oceans from space.

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