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Using Immersed Boundary Method to Understand the Dynamics of Nematocyst Firing

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Using Immersed Boundary Method to Understand the Dynamics of Nematocyst Firing

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Nematocysts are specialized cell organelles found in all Cnidarians, including corals and jellyfish, and some amphibian single-celled protists, such as dinoflagellates. There is an incredible assorted variety in the morphology and function of nematocysts, with a range of uses, such as prey capture, assimilation, and defense. The firing of the nematocyst is one of the quickest known accelerations in nature and is an understudied phenomena. Since nematocyst firing happens on such a fast time scale and small spatial scale, it has so far proven impossible to image directly. We aim to answer questions like: How do organisms generate enough force to accelerate through the fluid flow boundary layer? Can we design fluid flow simulations to capture the known dynamics that are known? What mechanisms do the organisms use to fire the nematocyst? We investigate the forces necessary to expel the nematocyst and acquire the prey using Immersed Boundary Method, which allows for fluid-structure interactions. This work will help provide insight into the mechanisms used by the organism.