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Jumping hoops on water EUNJIN YANG, HO-YOUNG KIM, Seoul National University — Small aquatic arthropods, such as water striders and fishing spiders, are able to jump off water to a height several times their body length. Inspired by the unique biological motility on water, we study a simple model using a flexible hoop to provide fundamental understanding and a mimicking principle of small jumpers on water. Behavior of a hoop on water, which is coated with superhydrophobic particles and initially bent into an ellipse from an equilibrium circular shape, is visualized with a high speed camera upon launching it into air by releasing its initial elastic strain energy. We observe that jumping of our hoops is dominated by the dynamic pressure of water rather than surface tension, and thus it corresponds to the dynamic condition experienced by fishing spiders. We calculate the reaction forces provided by water adopting the unsteady Bernoulli equation as well as the momentum loss into liquid inertia and viscous friction. Our analysis allows us to predict the jumping efficiency of the hoop on water in comparison to that on ground, and to discuss the evolutionary pressure rendering fishing spiders select such dynamic behavior.

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