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Vortex ring refraction at large Froude numbers[1] KERRY KUEHN, MATTHEW MOELLER, MICHAEL SCHULZ, DANIEL SANFELIPPO, Wisconsin Lutheran College — We have experimentally studied the impact of a planar axisymmetric vortex ring, incident at an oblique angle, upon a sharp gravity-induced interface separating two fluids of differing densities. After impact, the vortex ring was found to exhibit a variety of subsequent trajectories, which we have organized according to both the incidence angle, and the ratio of the Atwood and Froude numbers, A/F. For relatively small angles of incidence, the vortices tended to penetrate the interface. In such cases, the more slowly moving vortices, having values of $A/F \gtrsim .004$, tended to subsequently curve back up toward the interface. Quickly moving vortices, on the other hand, tended to refract downward, similar to a light ray entering a medium having a higher refractive index. A simplistic application of Snell's law of refraction cannot, however, account for the observed trajectories. For grazing angles of incidence, fast moving vortices tended to penetrate the interface, whereas slower vortices tended to reflect from the interface. In some cases, the reflected vortices executed damped oscillations before finally disintegrating.

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Kerry Kuehn
Wisconsin Lutheran College

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