WAVES ON A TORUS OF FLUID

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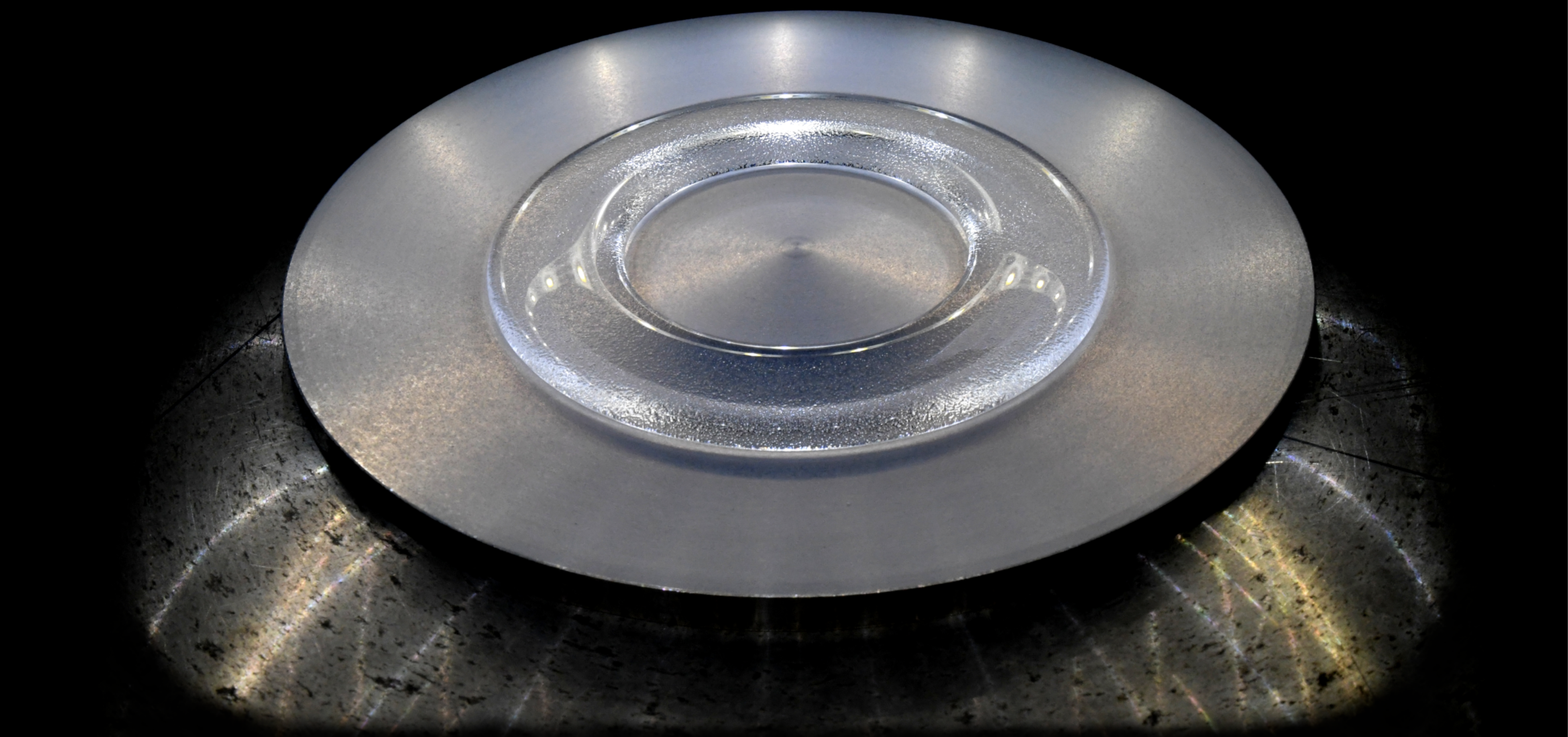
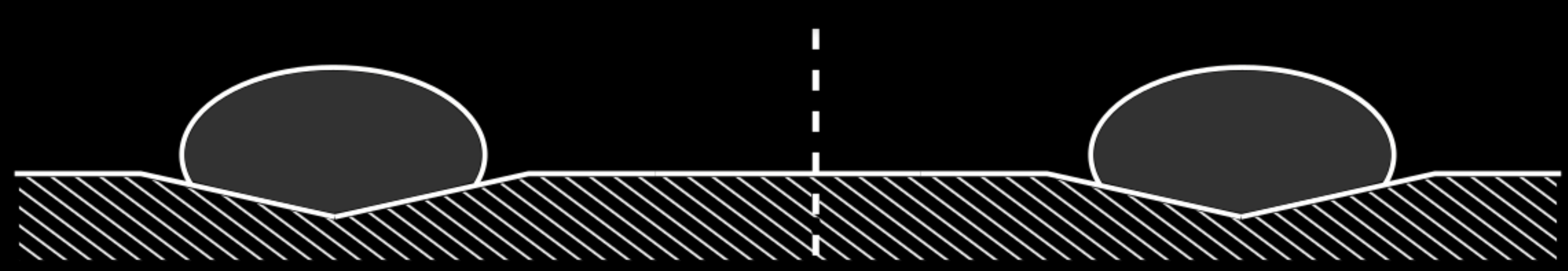
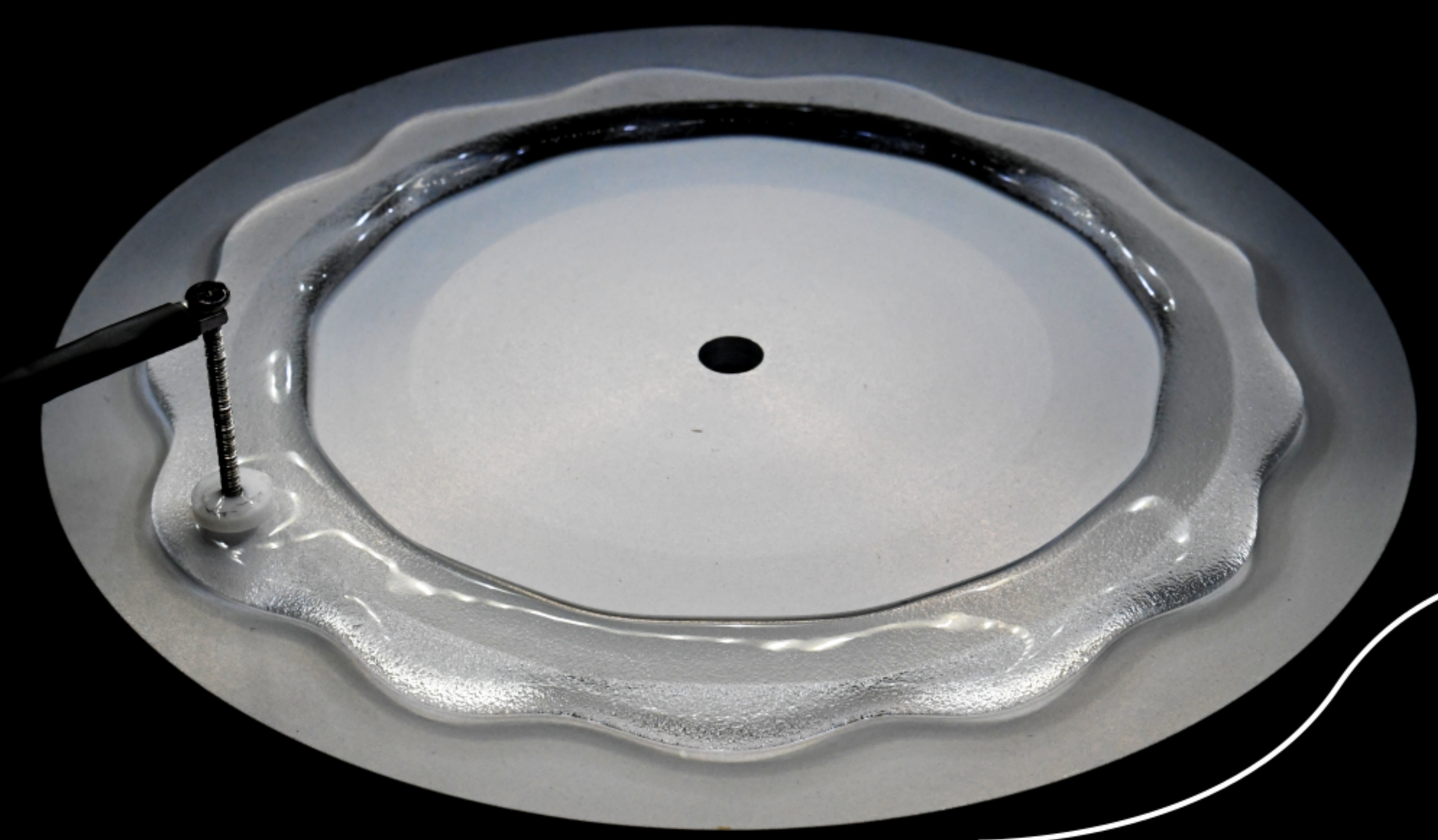


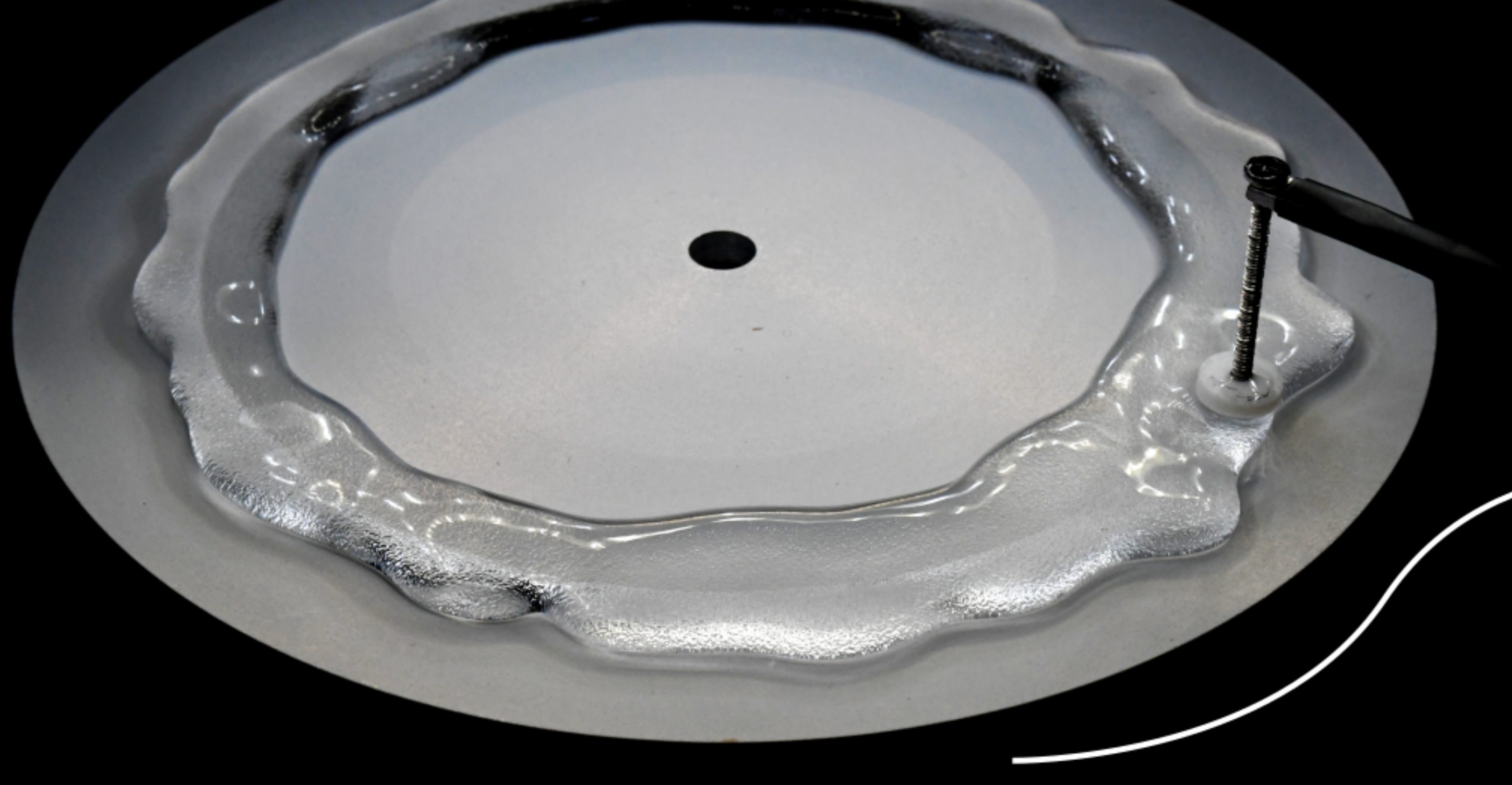
A torus of water is formed using a circular plate with an axisymmetric groove running along its perimeter with a superhydrophobic coating. The slope of the groove prevents capillarity from closing the torus' central hole due to gravity, making it stable indefinitely. A high-resolution camera above the torus measures its inner and outer deformation.





Using a shaker with a pure sine forcing, we are able to observe axisymmetric linear waves and their propagation around both the inner and outer borders of the torus. We find that there are three modes that propagate on the torus: gravity-capillary waves, much like the ones on a water puddle; sloshing waves which contain a transverse radial component across the torus and also a center-of-mass mode, which moves the torus section in the groove.

When the border of the torus is deformed by a short pulse, we can see two localized waves propagate along its border. Because of their large amplitude, these waves are nonlinear. On top of that, we find that these waves actually correspond to solitons, a type of wave that balances nonlinearity with dispersion, thus propagating for a long time. But due to the geometry of the torus we find that periodicity has a crucial effect, and leads to observation of new types of solitons.



Using a random frequency forcing, one can also expect to observe wave turbulence, a statistical set of weakly nonlinear dispersive waves in interaction. This geometry will allow us to study in particular the role of periodicity and finite size on wave turbulence in the absence of boundaries.

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