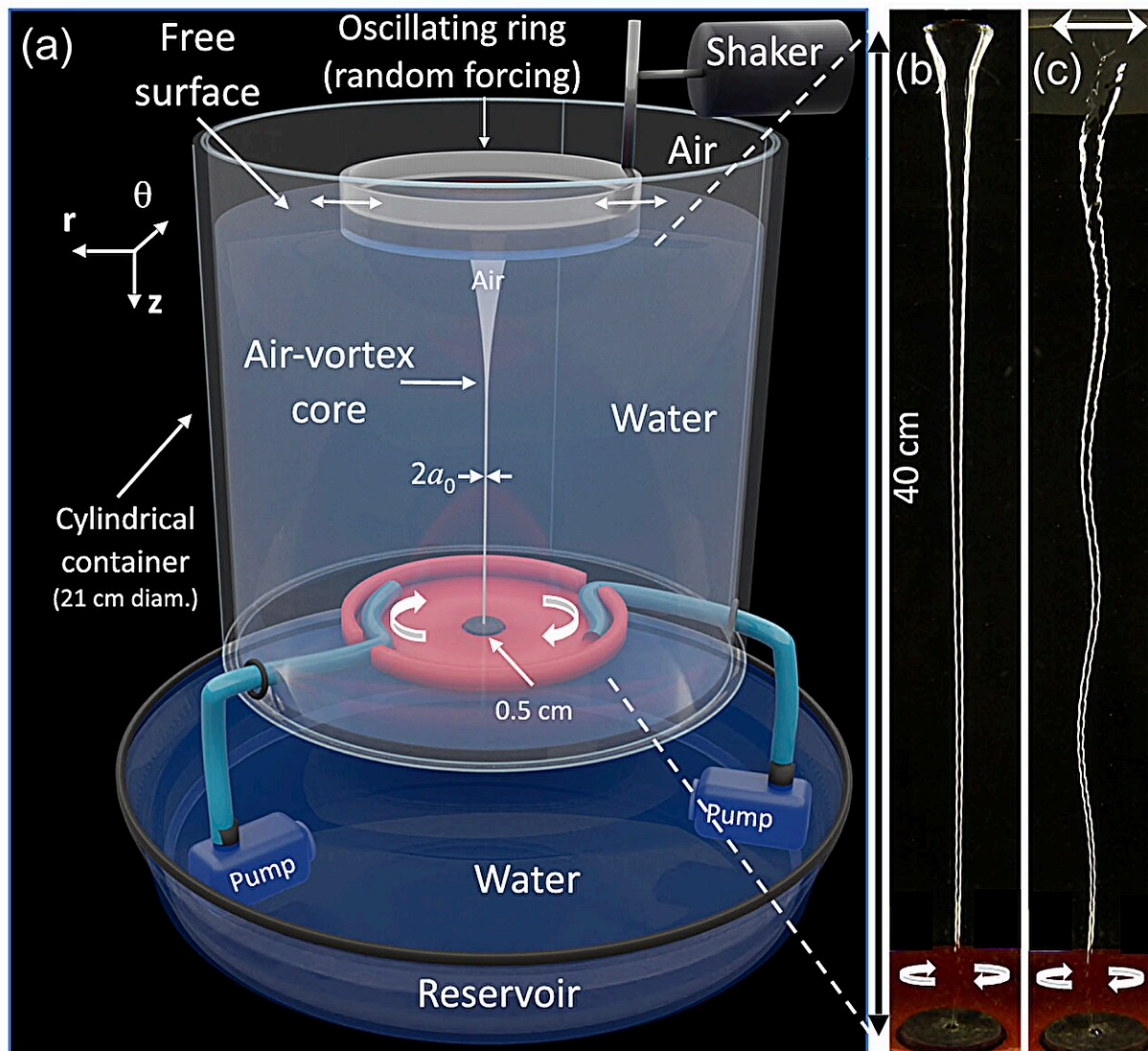


Whirlpool in a water tank reveals long-predicted wave turbulence

September 24 2026, by Sam Jarman



Vortex in a water tank enabled the team to observe Kelvin-wave turbulence experimentally. Credit: Jason Barckicke et al.

When water drains from a bathtub, a whirlpool often forms above the drain, and its narrow core can start to wobble and twist. For almost 150 years, physicists have predicted that these wobbles can become turbulent, passing energy from large ripples down to ever smaller ones. Until now, however, this "Kelvin-wave turbulence" had never been seen directly in an experiment.

In new research published in [Physical Review Letters](#), a team led by Eric Falcon at Université Paris Cité has observed the effect using a carefully controlled whirlpool in a tank of water.

Elusive ripples

Kelvin waves are corkscrew-shaped ripples that travel along the core of a vortex. First described mathematically in 1880 by Scottish physicist Lord Kelvin, they are now thought to play a key role in superfluids: exotic, ultracold liquids that flow with no friction at all. When a superfluid is stirred, its swirling motion becomes concentrated into tangles of extremely thin vortices that launch Kelvin waves as they cross and reconnect.

During these interactions, Kelvin's theory predicts that the waves should pass energy along to shorter and shorter ripples, until it can finally escape as sound. Since superfluids have no friction to slow them down, this process is thought to be how their turbulence eventually dies away. However, because vortices can be just fractions of a nanometer wide in some superfluids, their ripples are extremely difficult to track in experiments.

Whirlpool in a tank

To sidestep this problem, Falcon's team considered how Kelvin waves travel along any vortex, including much larger flows in ordinary water. To observe the effect, the researchers continuously pumped water into a cylindrical tank and let it drain through a small hole in its base, creating a long, steady vortex.

Using a ring positioned at the top of the vortex, they gently shook its upper end in a random pattern. Meanwhile, they used a high-speed camera to film the vortex's core along much of its length, allowing them to track exactly how it moved over both space and time.

Matching Kelvin's predictions

The footage revealed that the energy supplied by the shaking ring spread from large, slow ripples into smaller, faster ones, over a range of sizes spanning roughly a factor of 100, with an energy distribution that closely matched predictions from Kelvin-wave turbulence theory. Crucially, the team also identified the mechanism behind this transfer: the ripples exchanged energy in groups of six waves at a time, just as the theory had predicted.

These results offer long-awaited experimental support for ideas that physicists have developed over several decades. Beyond this validation, the team's setup could now serve as a versatile platform for studying Kelvin waves.

With more precise experiments in the future, Falcon's team is confident that researchers could explore more complex scenarios, such as when many vortices interact with each other. This in turn could help physicists better understand turbulence in systems ranging from laboratory superfluids to the interiors of neutron stars.

More information: Jason Barckicke et al, Experimental Evidence of

Kelvin-Wave Turbulence along a Vortex Core, *Physical Review Letters* (2026). [DOI: 10.1103/t3bt-m431](https://doi.org/10.1103/t3bt-m431). On *arXiv*: arxiv.org/abs/2607.07535

© 2026 Science X Network

Citation: Whirlpool in a water tank reveals long-predicted wave turbulence (2026, September 24) retrieved 25 September 2026 from

<https://phys.org/news/2026-09-whirlpool-tank-reveals-turbulence.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
--