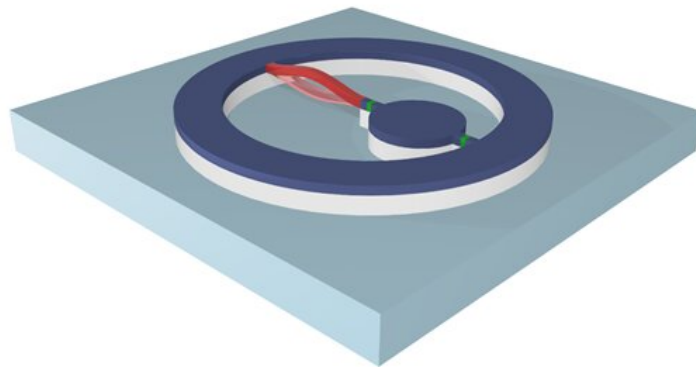


# How to test the limits of quantum mechanics

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The displacemom device consists of a mechanical resonator (red) which is coupled to a superconducting qubit (dark blue). As the resonator sweeps up and down it modifies the state of the superconducting qubit. Credit: Edward Laird

Researchers from Imperial College London and Lancaster University have suggested a new approach to test the limits of applicability of quantum mechanics.

Quantum physics has long provided humanity with an elegant framework for understanding the microscopic world. However, [quantum phenomena](#) do not exist in our everyday lives.

Many factors contribute to the transition between the quantum and classical regimes, but is there a fundamental mechanism that results in this transition? And how exactly does a wavefunction consisting of

multiple possibilities collapse into one definite outcome?

Numerous models, collectively referred to as objective-collapse theories, have been suggested in the hope of addressing these outstanding fundamental questions. But testing these theories remains experimentally challenging.

Now a group of researchers have published a paper about a new way to investigate these objective-collapse theories in the lab.

The proposal is published in *AVS Quantum Science*.

The researchers' method takes advantage of the "displacemon," an electro-mechanical device consisting of a mechanical resonator connected to superconducting qubit. By manipulating the qubit, they propose a technique to probe for deviations from standard quantum theory in a way that could be explained by objective collapse.

Dr Edward Laird who leads a research group in quantum [electronic devices](#) at Lancaster University says that "the displacemon is not only a tool for testing fundamental quantum mechanics but may also be the basis of new sensing technologies. It will be tremendously exciting to do the first experiments with this device."

While there has been much progress in constraining the strength of these models, further experiments are needed to illuminate the quantum-to-classical boundary.

"Indeed, these future experiments offer exciting promise to probe quantum mechanics at bigger and bigger scales," says Michael Vanner, Principal Investigator of the Quantum Measurement Lab at Imperial College London.

The displacemon provides a new route to testing collapse models by leveraging experimental advances made in cryogenics and superconducting technologies. Central to the displacemon device is a mechanical resonator which oscillates up and down like a miniature guitar string and is incorporated into a superconducting qubit. This sweeping motion interacts with a [magnetic field](#) in a way that links the properties of the qubit device and the resonator, with the action of one affecting the other. The architecture of the device lends itself well to creating a quantum superposition of the string vibrations.

**More information:** Lydia A. Kanari-Naish et al, Can the displacemon device test objective collapse models?, *AVS Quantum Science* (2021).  
[DOI: 10.1116/5.0073626](https://doi.org/10.1116/5.0073626)

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