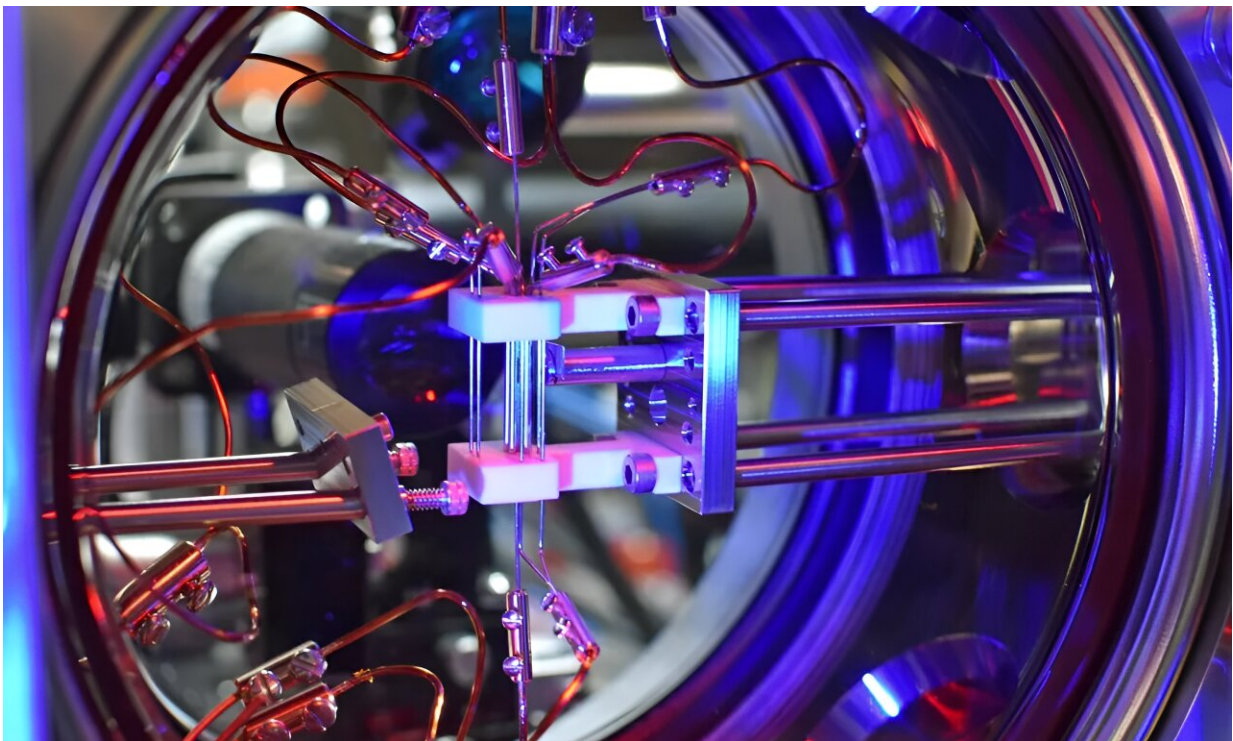


Nano-oscillator hits record quality factor

March 29 2024



The team achieved this new milestone in an environment with extremely low pressure, a critical factor in reducing interactions with the surrounding air.
Credit: University of Innsbruck

In their latest study, a team led by Tracy Northup at the Department of Experimental Physics unveils the successful creation of a levitated

nanomechanical oscillator with an ultra-high quality factor, significantly surpassing previous experimental achievements. [The study has been published in *Physical Review Letters*.](#)

The team managed to levitate a silica nanoparticle in a linear Paul trap under ultra-high vacuum conditions. What makes this achievement particularly notable is the exceptionally low dissipation rate recorded, with a quality factor exceeding 10 billion. This is more than a hundred-fold improvement compared to prior attempts, marking a [milestone](#) in the exploration of nanomechanical systems.

The team achieved this in an environment with extremely low pressure, a critical factor in reducing [interactions](#) with the surrounding air, which would otherwise damp the oscillator's motion.

The ultra-high quality factor—a measure of how little energy is lost to the surroundings—was calculated based on the damping rate and the frequency of the nanoparticle's [oscillations](#).

The oscillator's unprecedented stability and low noise levels make it an ideal platform for the development of ultrasensitive detectors and for conducting fundamental tests in [quantum physics](#). It opens up exciting possibilities for exploring quantum phenomena in macroscopic systems, which has been a long-standing challenge in the field.

More information: Lorenzo Dania et al, Ultrahigh Quality Factor of a Levitated Nanomechanical Oscillator, *Physical Review Letters* (2024). [DOI: 10.1103/PhysRevLett.132.133602](https://doi.org/10.1103/PhysRevLett.132.133602). On *arXiv*: [DOI: 10.48550/arxiv.2304.02408](https://doi.org/10.48550/arxiv.2304.02408)

Provided by University of Innsbruck

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