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Mass Sensors Utilizing Interacting Flexural-Torsional Modes in Nonlinear Resonators

A novel resonating mass sensor utilizes nonlinear activation voltage measurement for enhanced precision and accuracy, allowing for unprecedented sub-picogram mass detection.

Microresonator mass sensors have allowed for high sensitivity in measuring masses as small as 0.7 picograms. These sensors rely on an oscillating resonator, which has a constant natural frequency. When another object is placed on the resonator, the frequency is changed; this change can be measured and used to mass of the other object.

Researchers at Purdue University have developed a new resonating mass sensor that improves the precision of this type of sensor. Instead of measuring the change in frequency, which provides a linear measurement, this new design measures the activation voltage that is needed to return the sensor to its natural resonance. This provides a nonlinear measurement, which can be used to calculate the attached mass better than frequency shift measurements. The resonator performance is also independent of the quality factor (except in higher voltages) and improves the accuracy of the device. Simulations predict that this new type of sensor would allow sub-picogram masses to be measured, not possible until now.

Advantages:

-Nonlinear measurement improves precision

-Independent of quality factor

-Sub-picogram measurements possible

TRL: 5

Intellectual Property:

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Category

Materials Science & Nanotechnology/Nanomaterial Characterization & Imaging Tools

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