**Docket #:** S23-437

# High-Throughput Single-Molecule Photoacoustic Absorption Spectroscopy with Nanomechanical Oscillators

The Stanford team developed a groundbreaking approach to measure single molecules by precisely measuring the forces induced by the absorption of electromagnetic radiation. This invention enables rapid and high-throughput identification of molecules like proteins by their signature absorption spectrum, which could be a game-changer for biomolecular analysis and drug discovery.

The system utilizes highly sensitive nanomechanical resonators upon which the molecules are deposited. By modulating the illumination light at the mechanical resonance frequency, the molecule's absorption spectrum is translated into a measurable coherent force that drives the resonator's motion. This innovative approach fundamentally improves the Signal-to-Noise Ratio (SNR) scaling and allows for operation at cryogenic temperatures (below 4 K), which is impossible with prior art.

The invention has achieved unparalleled single-molecule sensitivity and inherent scalability for high-throughput protein identification. The system's ability to operate at cryogenic temperatures drastically reduces thermal noise, and its compatibility with the resonator's intrinsic mass-sensing capabilities offers a powerful, multi-modal platform for highly accurate, rapid identification of individual molecules.

**Stage of Development**: Proof of Concept

## Applications

- **Single molecules identification**

- **Protein identification**
- **Drug discovery**
- **Biomolecular analysis**

## Advantages

- **High throughput**
- **Rapid identification**
- **High Signal-to-Noise**
- **Scalable**

## Patents

- Published Application: 20250180467

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