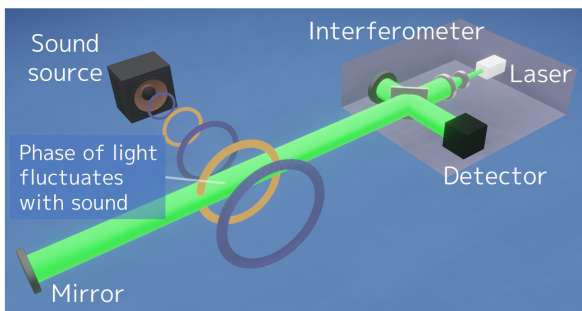


### Abstract

Optical measurement methods have been attracting attention to realize various sound measurements that are difficult to achieve with microphones. In this research, in collaboration with the Quantum Optical Physics Research Group of the NTT Basic Research Laboratories, we have developed a **sound field measurement technique with much lower noise than conventional methods using precision optical measurement technology**. Focusing on the difference in physical characteristics between sound and noise components, we proposed a sound measurement technique using a differential midfringe locked interferometer that reduces noise while maximizing sensitivity to sound. By combining this technology with high-stability laser technology, the amplitude of **measurement noise has been reduced to 1/30** compared to conventional methods. By applying the precision measurement technology cultivated in optics, we will realize the **next-generation sound measurements** such as 3D sound-field measurement, remote sensing, and ultra-high precision measurement.

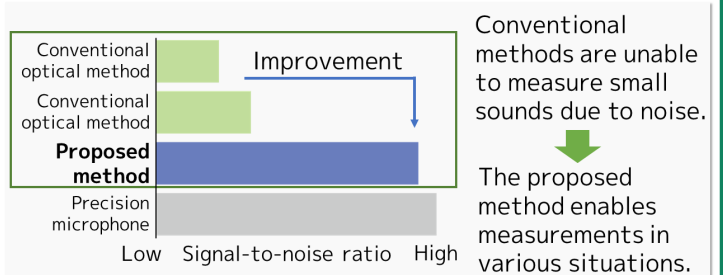
### What happens with sound and light?

Optical technology makes it possible to observe sound remotely and without contact. It is expected to be applied to high spatial resolution measurement and remote sensing.



### Proposed method

Measurement noise is reduced to **1/30** of conventional optical measurement methods.



Key points

The fluctuation of light due to sound is tiny, and it has been challenging to detect faint sounds with light. In this study, we have achieved **the world's lowest noise level** by combining a **differential midfringe locked interferometer with ultra-stable laser technology**.

### Future prospects

## We realize the next generation of acoustic measurement



Visualization of sound wave

e.g., Non-contact measurement of weak sound  
 Capable of directly capturing the sound propagation.

Features of optical measurement		
Non-contact	Precise	Highly stable
High speed	Controllable	Image sensor



Applications	
High precision measurement	Sound VR
Acoustic Phenomena	Aeroacoustic measurement
Sound-field imaging	Remote sensing
Multimodal sensing	Noise visualization

### References

- [1] K. Ishikawa, Y. Shiraki, T. Moriya, A. Ishizawa, K. Hitachi, K. Oguri, "Reducing noise of mid-fringe locked interferometer by optical differential detection," in *Proc. Acoust. Soc. Jpn.*, 2021. (in Japanese)
- [2] K. Ishikawa, Y. Shiraki, T. Moriya, A. Ishizawa, K. Hitachi, K. Oguri, "Simple and low-noise optical measurement of sound using mid-fringe locked interferometer," in *Proc. Acoust. Soc. Jpn.*, 2020. (in Japanese)

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