

Laser interferometric searches for ultralight dark matter: Summary from B01 group

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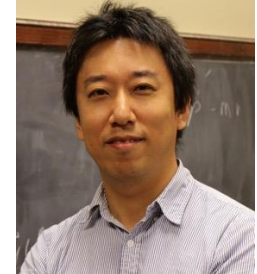
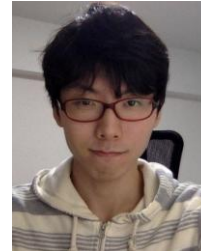
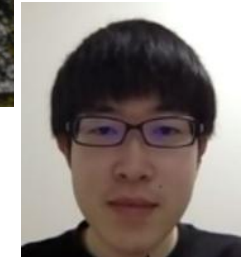


B01 Team

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Matteo Leonardi
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Shinji Miyoki
Yusuke Manita
Soichiro Morisaki
Koji Nagano
Atsushi Nishizawa
Ippei Obata
Yuka Oshima
Hinata Takidera
Haoyu Wang

All of them got either
promoted or got degrees
within this Gakuhen period
(2020.11-2025.03)

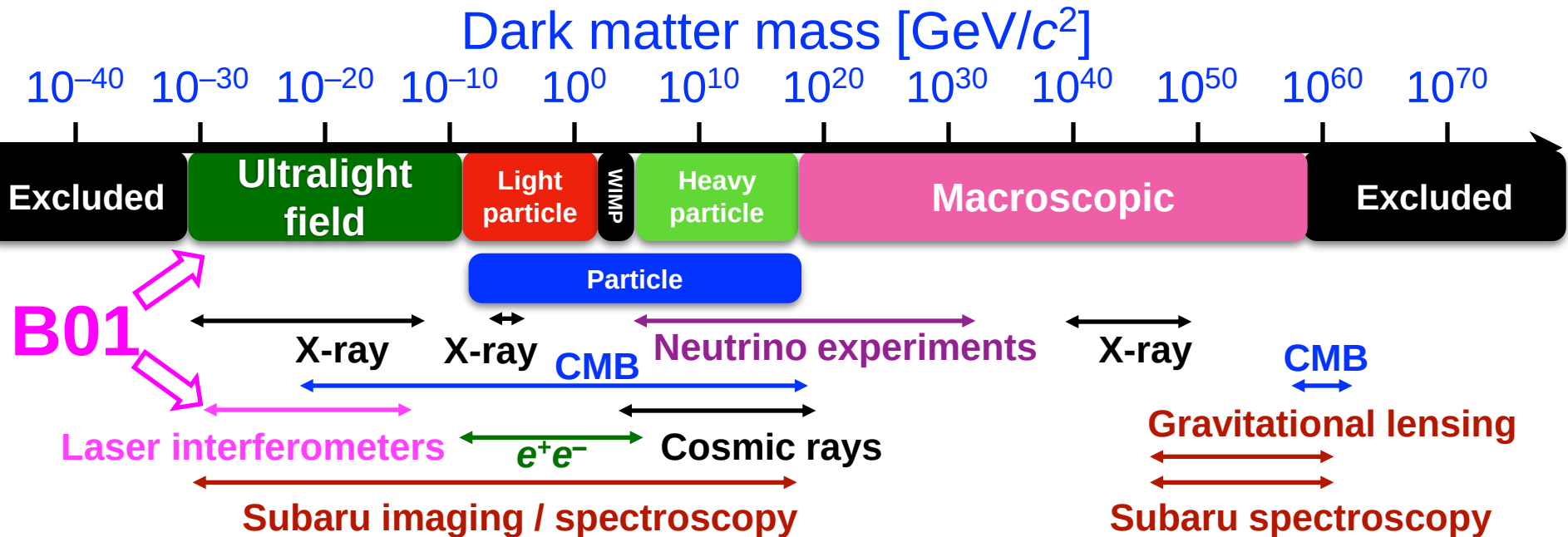
5 new PI's



Ultralight Dark Matter

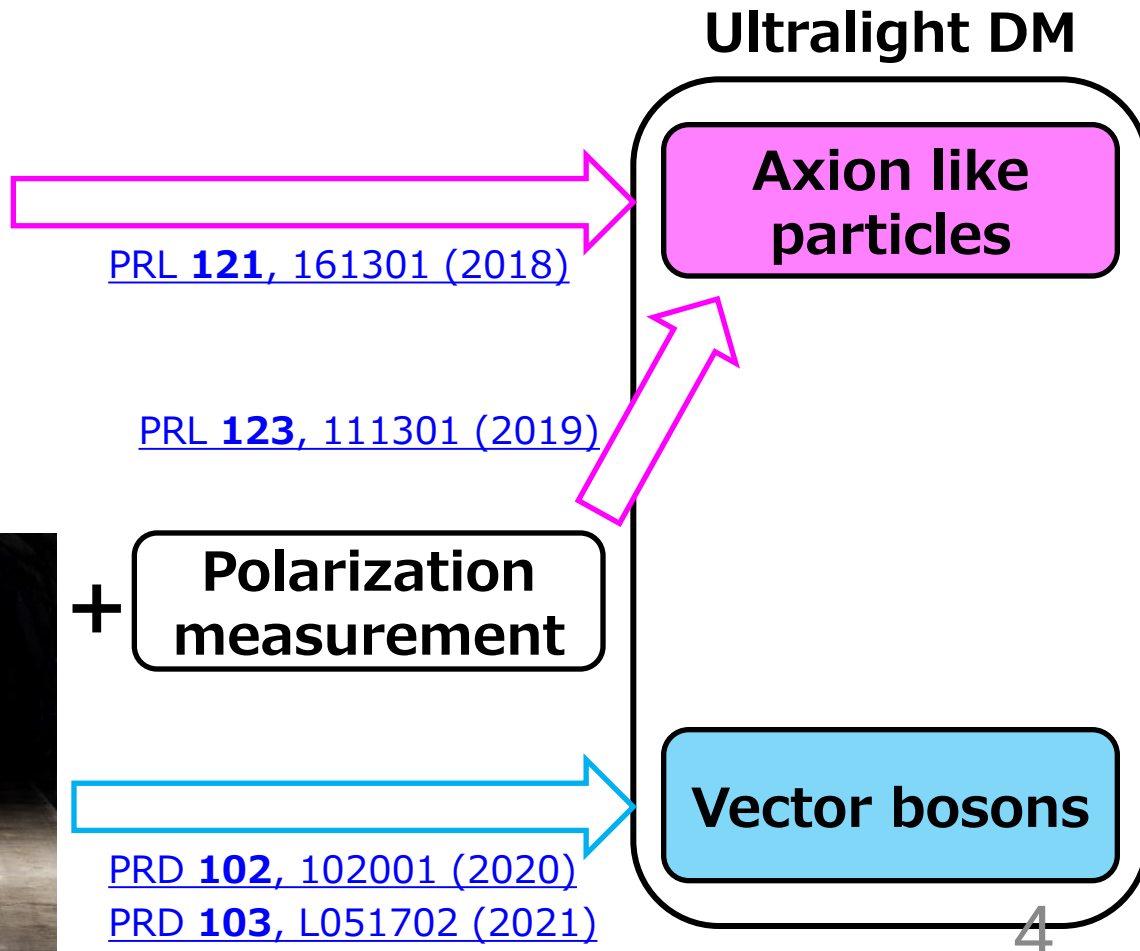
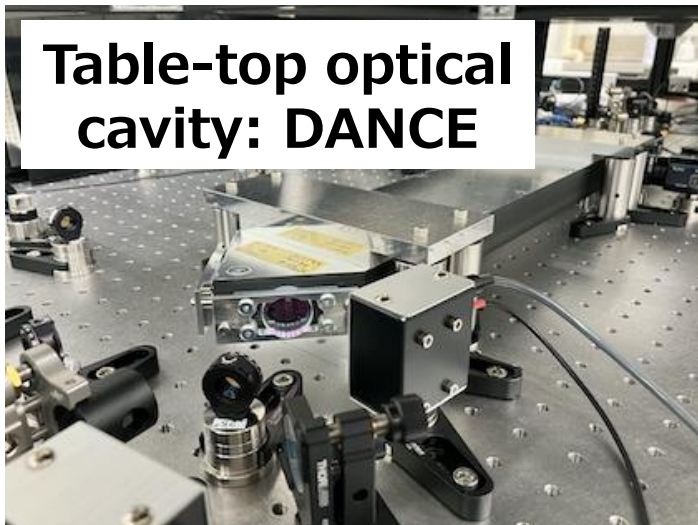
- Ultralight DM ($< \sim 1$ eV) behaves as classical wave fields

$$f = 240 \text{ Hz} \left(\frac{m_{\text{DM}}}{10^{-12} \text{ eV}} \right)$$
- Laser interferometers are sensitive to tiny length changes from such oscillations



Our Strategy

- Use both **table-top** optical cavities and **large-scale** laser interferometric gravitational wave detectors



DANCE Search for Axion DM

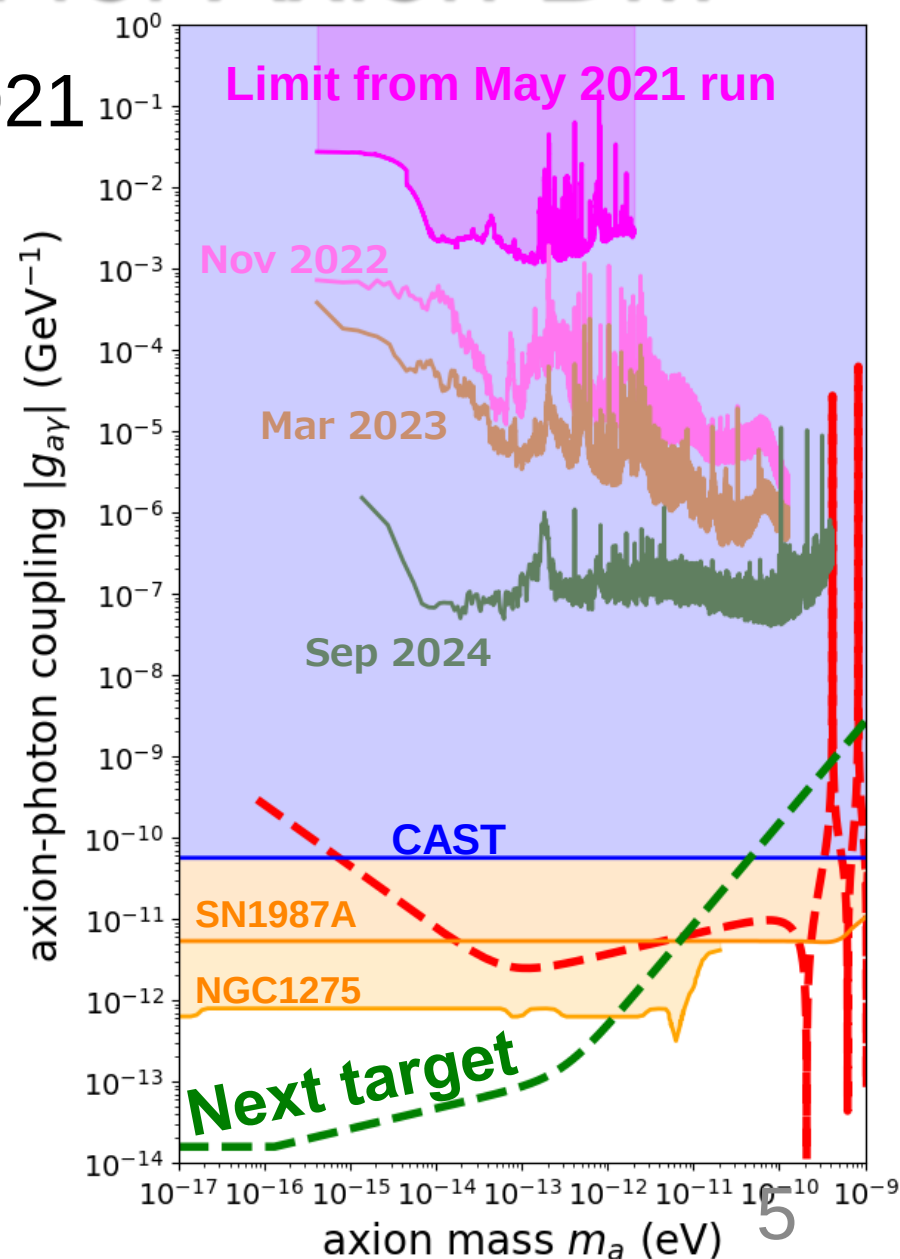
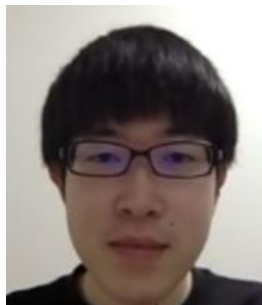
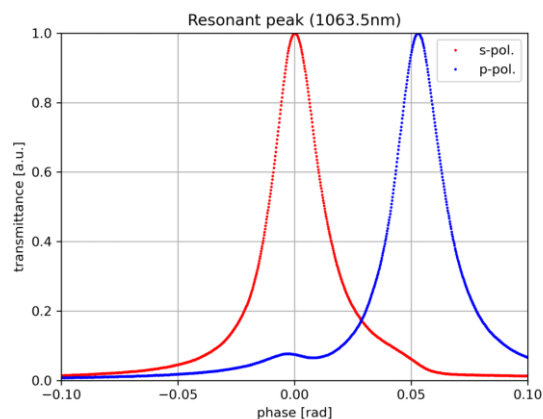
- **First demonstration** in 2021

Y. Oshima+,

[PRD **108**, 072005 \(2023\)](#)

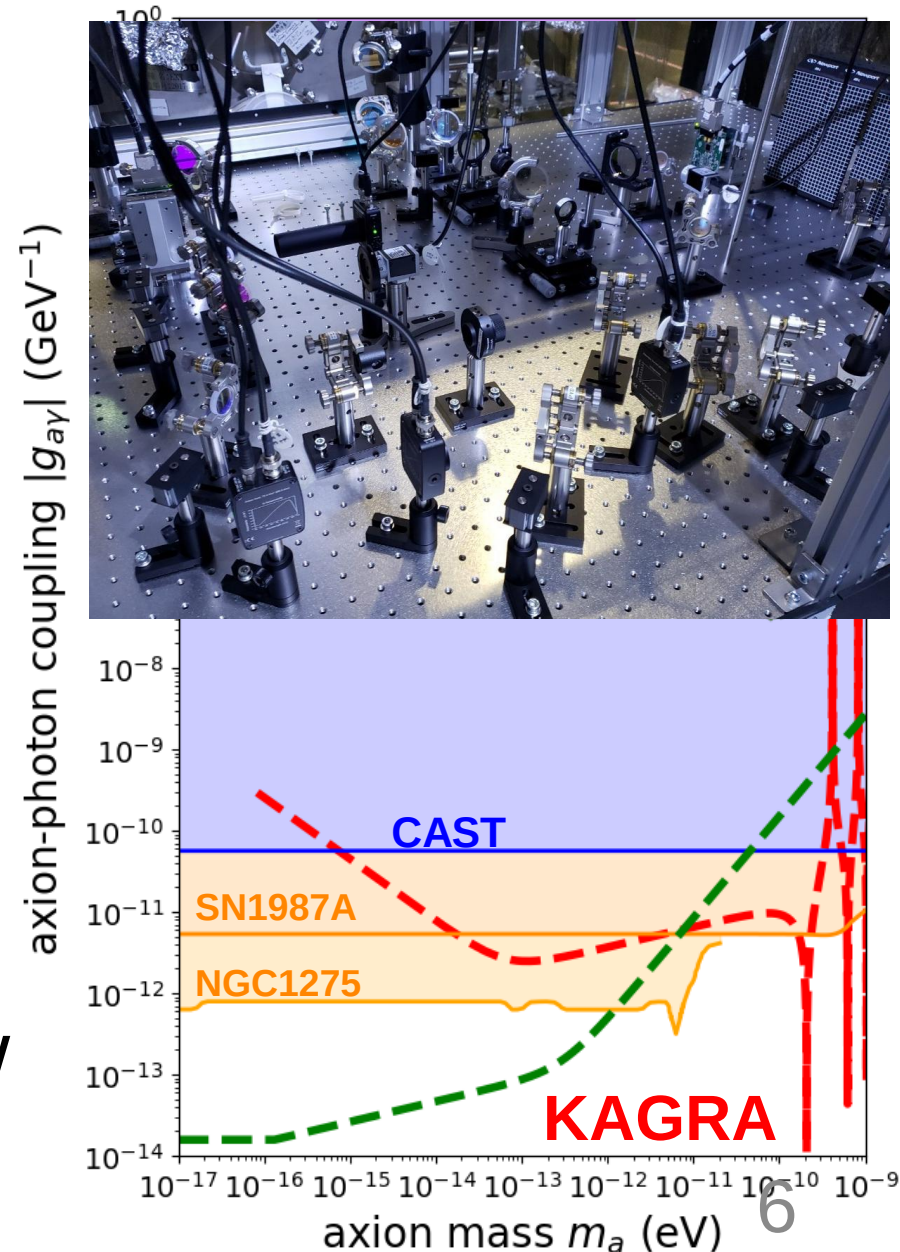
- **4 orders of magnitude** improvement over the past years

Talk by Hinata Takidera



KAGRA Search for Axion DM

- Installed polarization optics in 2021
- KAGRA damaged by Jan 2024 Noto earthquake but recovered by Sep 2024
- KAGRA trying to re-start observing run by Oct 2025
- First axion data from GW detectors **this year**



KAGRA Search for Vector DM

- **First limit** from auxiliary data from KAGRA 2020 run

LIGO-Virgo-KAGRA,

[PRD **110**, 042001 \(2024\)](#)

- Developed new data analysis methods

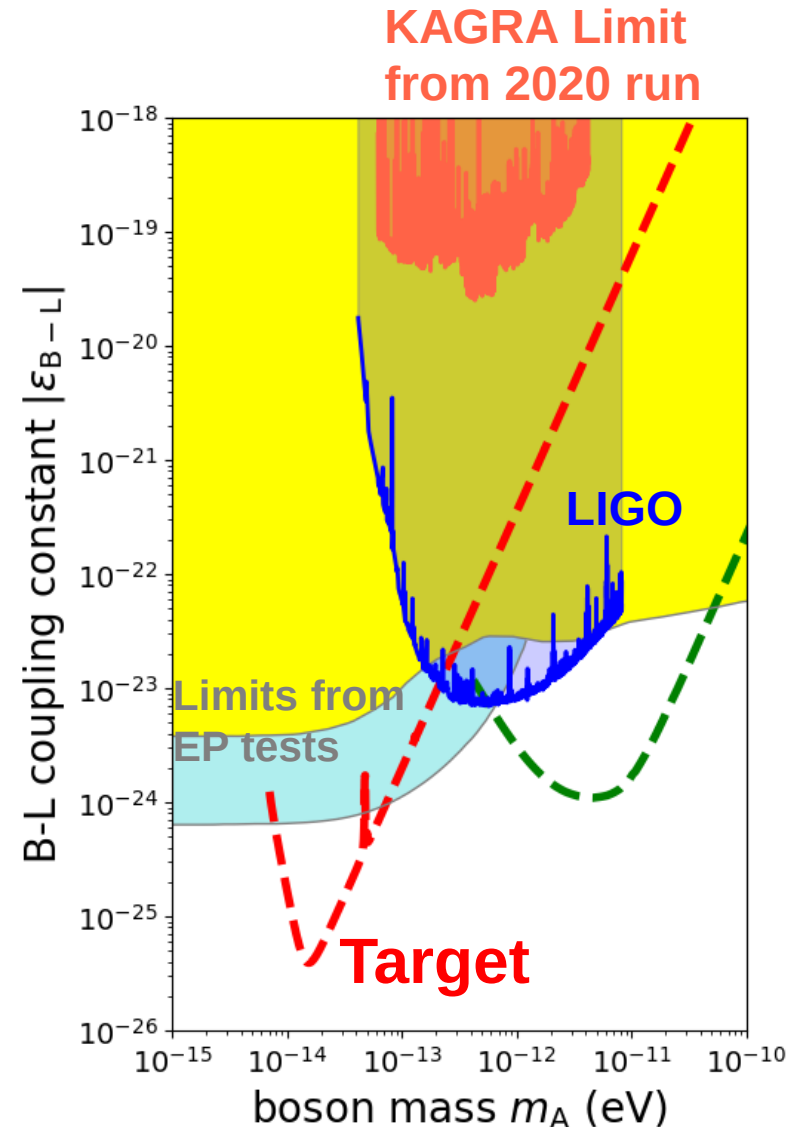
H. Nakatsuka+,

[PRD **108**, 092010 \(2023\)](#)

- Improved limits from next observing runs expected
- Improved analysis methods using **signal correlations** also developed

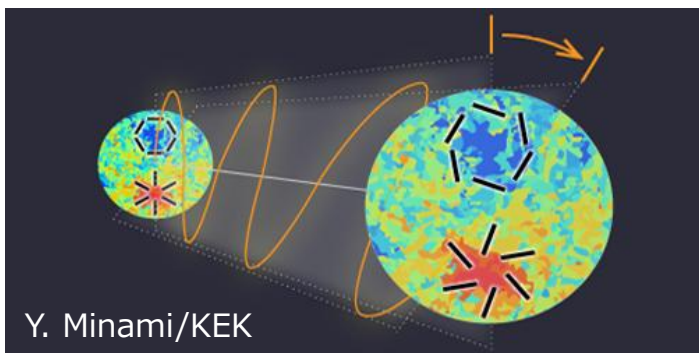
S. Morisaki, J. Kume, T. Fujimori, YM,

[arXiv:2503.04484](#)

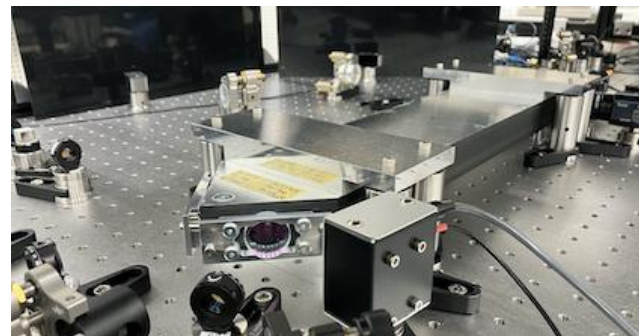


(Unplanned) Achievements

- Many papers (15+) in collaboration with A01, A03, B06 members
- Studies related to cosmic birefringence



Two axions?



I. Obata, [JCAP 09, 062 \(2022\)](#)

- **Scalar DM** limit from LIGO/Virgo O3 with D01
K. Fukusumi, S. Morisaki, T. Suyama, [PRD 108, 095054 \(2023\)](#)
- **Spin-2 DM** studies Y. Manita+, [PRD 107, 104007 \(2023\)](#)
Y. Manita+, [PRD 109, 095012 \(2024\)](#)
- Mirror birefringence fluctuations studies
Y. Michimura+, [PRD 109, 022009 \(2024\)](#)
H. Wang+, [PRD 110, 082007 \(2024\)](#)