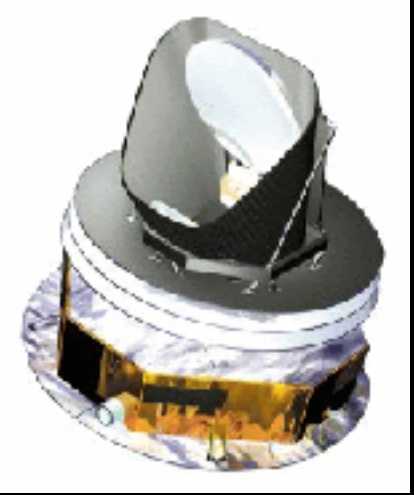


# **B06: DM–CMB**

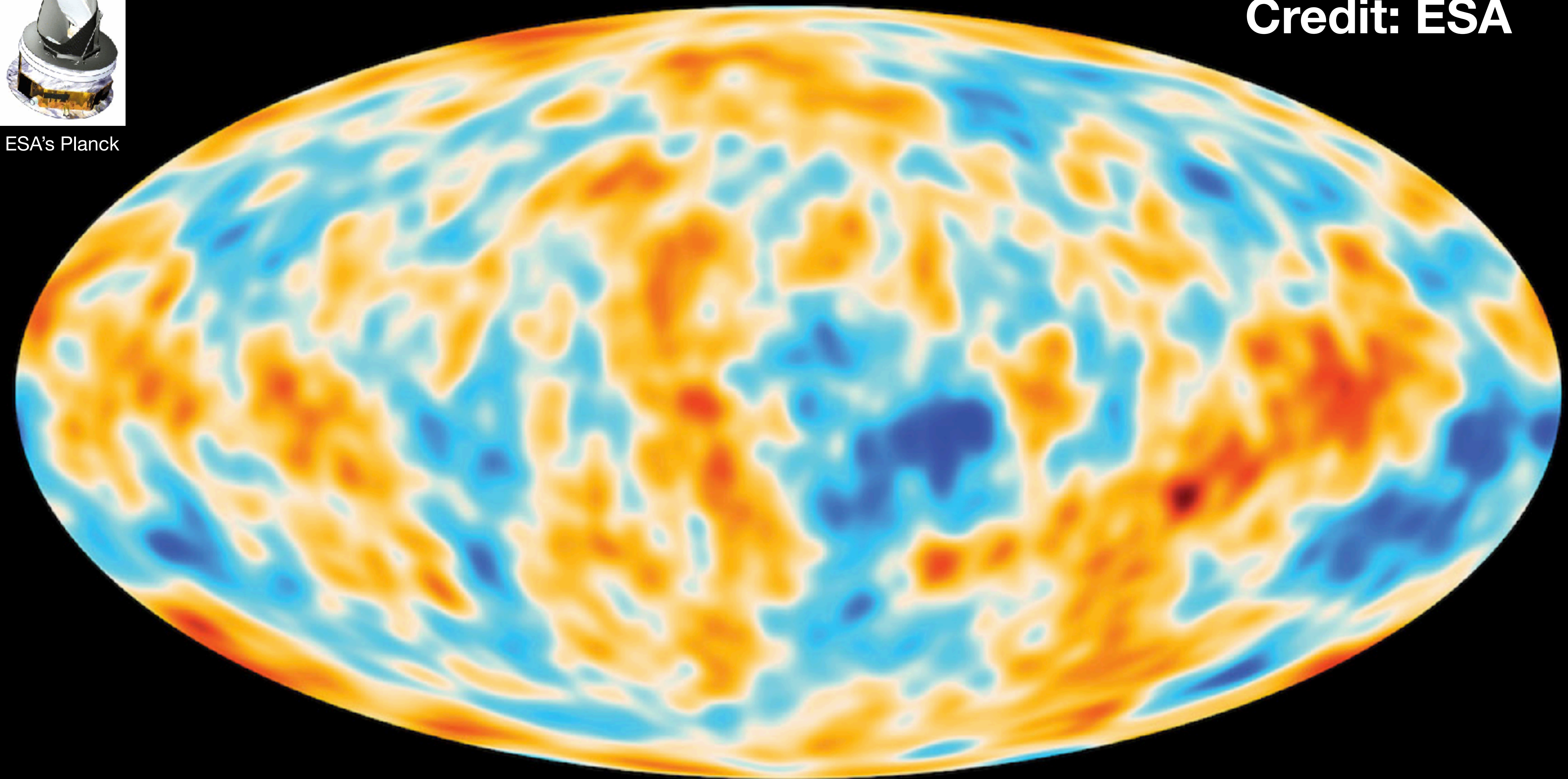
**The Dark Matter (DM) Search using the  
Cosmic Microwave Background (CMB)**

**Eiichiro Komatsu (Max Planck Institute for Astrophysics / Kavli IPMU)  
Symposium, March 7, 2024**

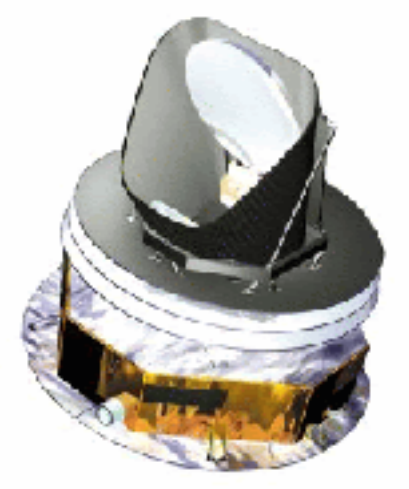


ESA's Planck

Credit: ESA

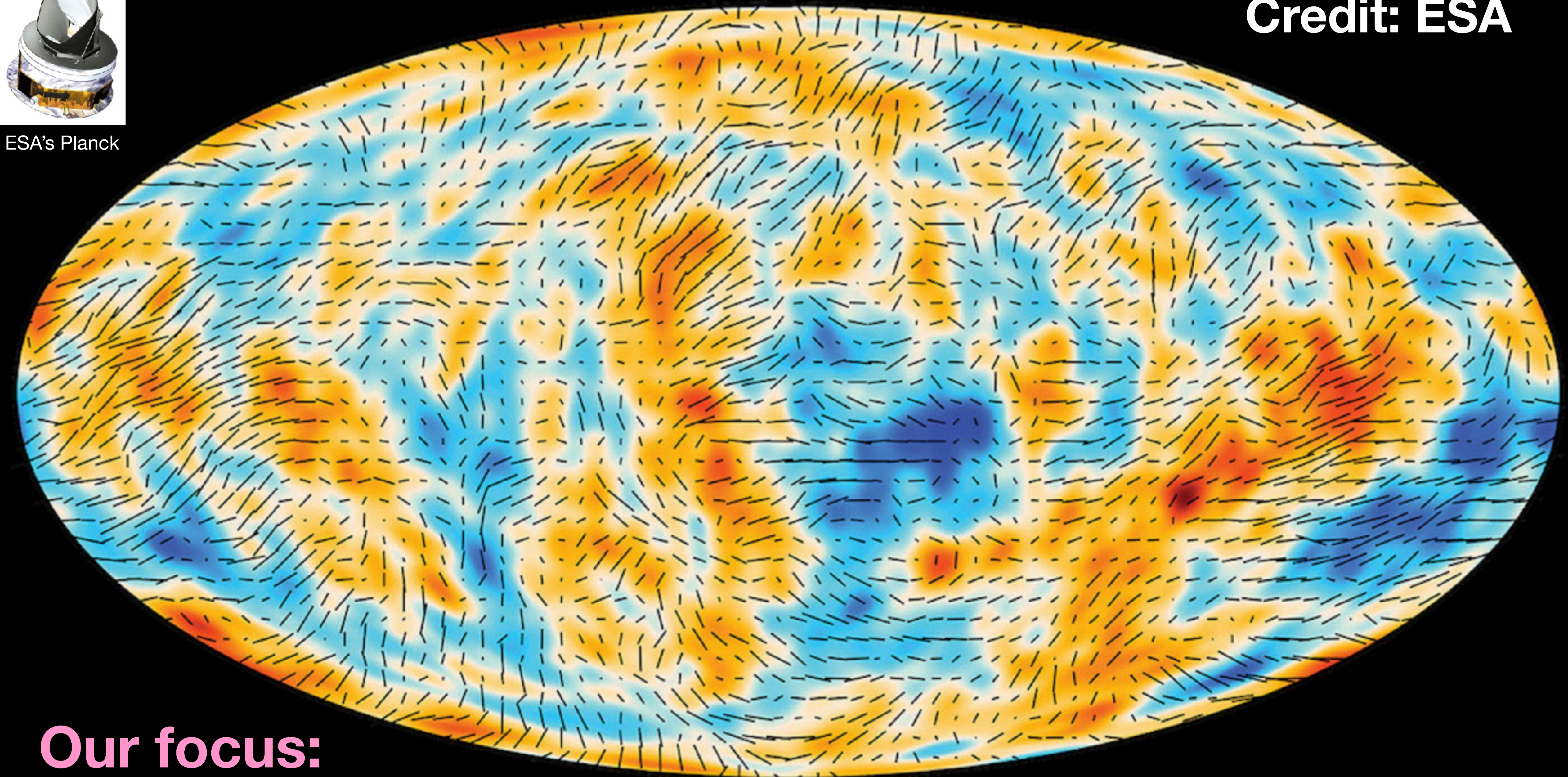


Temperature (smoothed)



ESA's Planck

Credit: ESA



**Our focus:  
Polarisation!**

Temperature (smoothed) + Polarisation

# The Science Targets: Examples

## How can we use the CMB polarisation to learn about the DM?

- **Do the DM fields violate parity symmetry?**
  - Why not? The weak interaction violates parity symmetry.
  - E.g., axionlike fields.
  - **Example project:** *How does the parity-violating DM field affect the propagation of polarised light of the CMB (Cosmic Birefringence). **A lot of progress thanks to this grant.***
- **Do the DM fields have a higher spin?**
  - Why not? The Higgs field is the only known field of elementary particles with zero spin.
  - **Example project:** *Do higher-spin fields generate new features in the gravitational waves which can be observed in the CMB polarisation?*

# The Team

A small yet “dream team”



Eiichiro Komatsu  
(MPA / Kavli IPMU)

- **研究代表者**

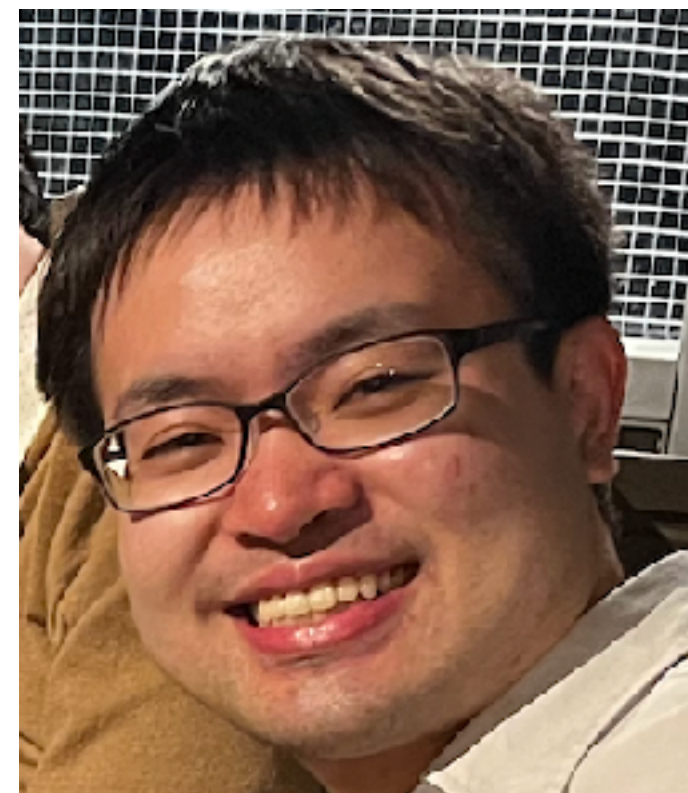


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- **研究分担者**

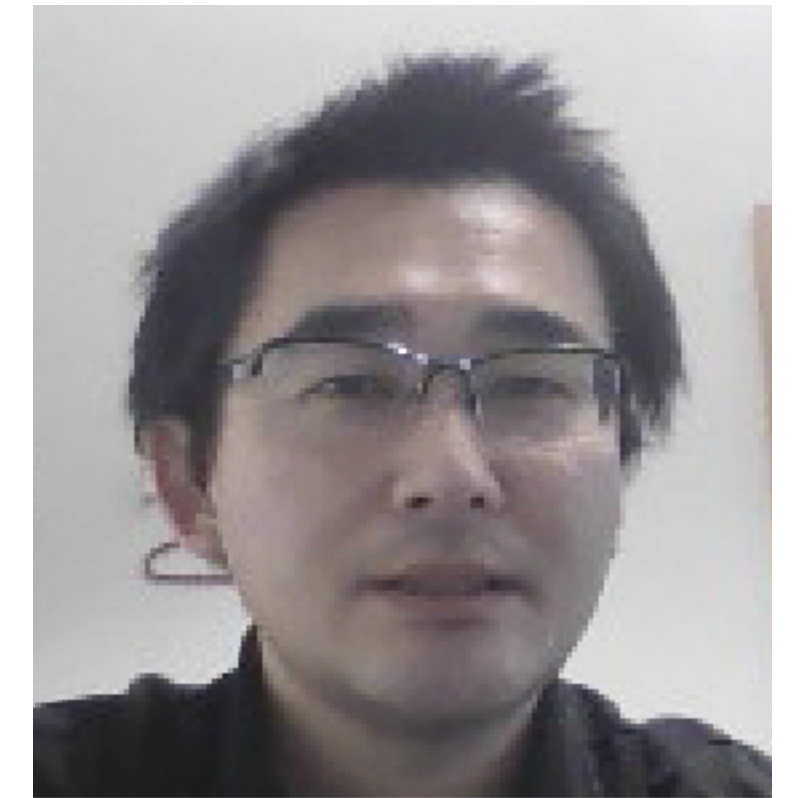


Ippei Obata  
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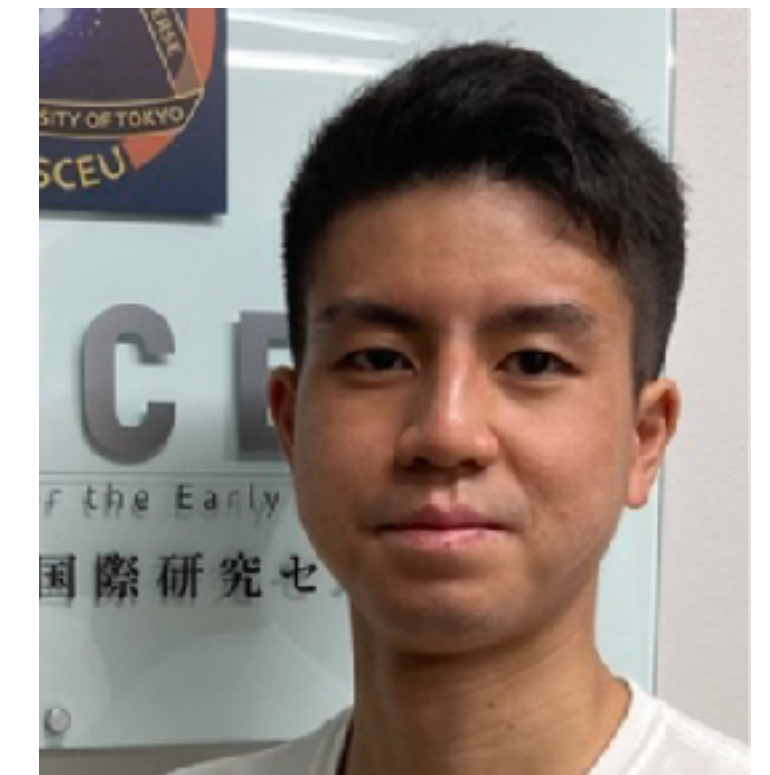


Kai Murai  
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- **研究協力者**



Toshiya Namikawa  
(Kavli IPMU)



Fumihiro Naokawa  
(Univ. Tokyo)

- **研究協力者**

# Achievements: Highlight (4.2023 – 3.2024)

## *Do the DM fields violate parity symmetry?*

- **New measurement and interpretation of “cosmic birefringence”**

- Eskilt, Herold, **EK, Murai, Namikawa, Naokawa**, “*Constraint on Early Dark Energy from Isotropic Cosmic Birefringence*”, published in PRL.

- **Naokawa, Namikawa**, “*Gravitational lensing effect on cosmic birefringence*”, published in PRD [presented at the last symposium]

- Nakai, Namba, **Obata**, Qiu, Saito, “*Can we explain cosmic birefringence without a new light field beyond Standard Model?*”, published in JHEP.

C01xB06

- **New idea for vector DM from SU(2) gauge fields**

- Fujita, **Murai**, Nakayama, Yin, “*Misalignment production of vector boson dark matter from axion-SU(2) inflation*”, arXiv:2312.06889

A01xB01  
xB06

