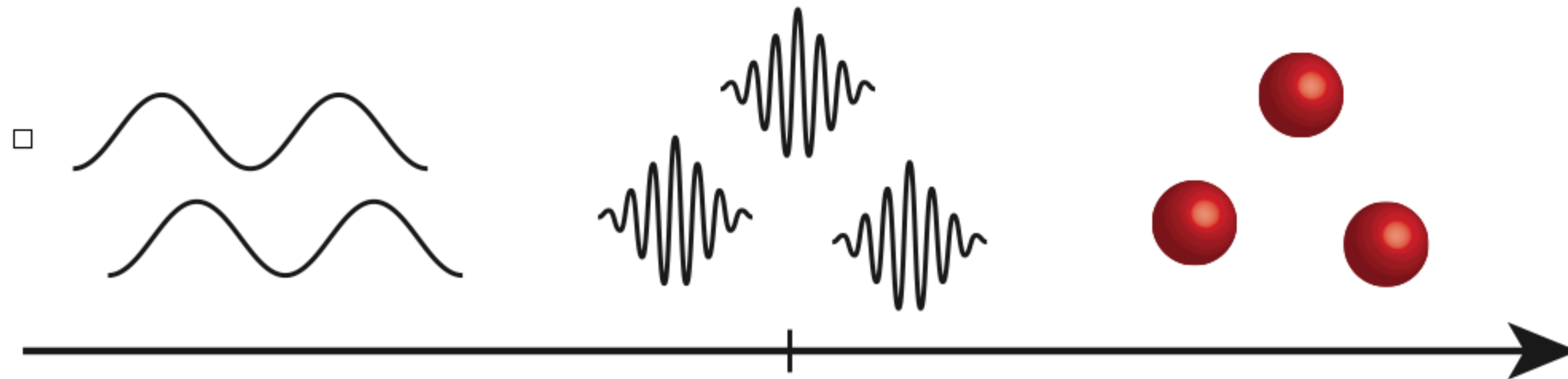


# A01: Light dark matter

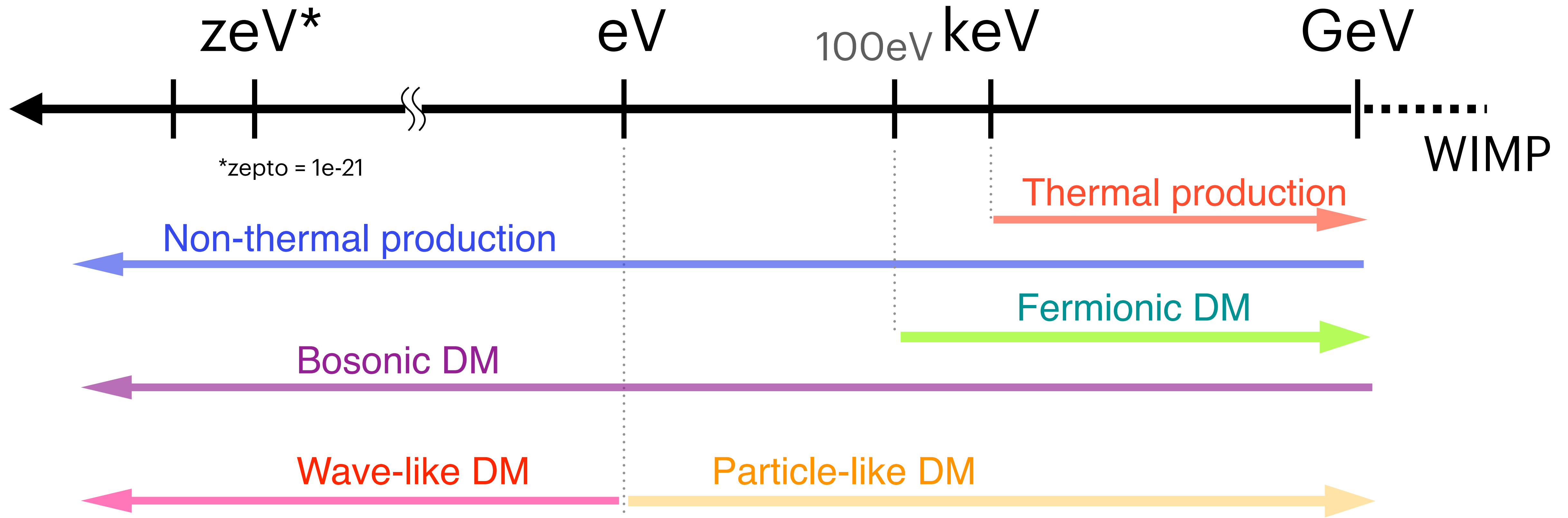


Mar. 7. 2023 @

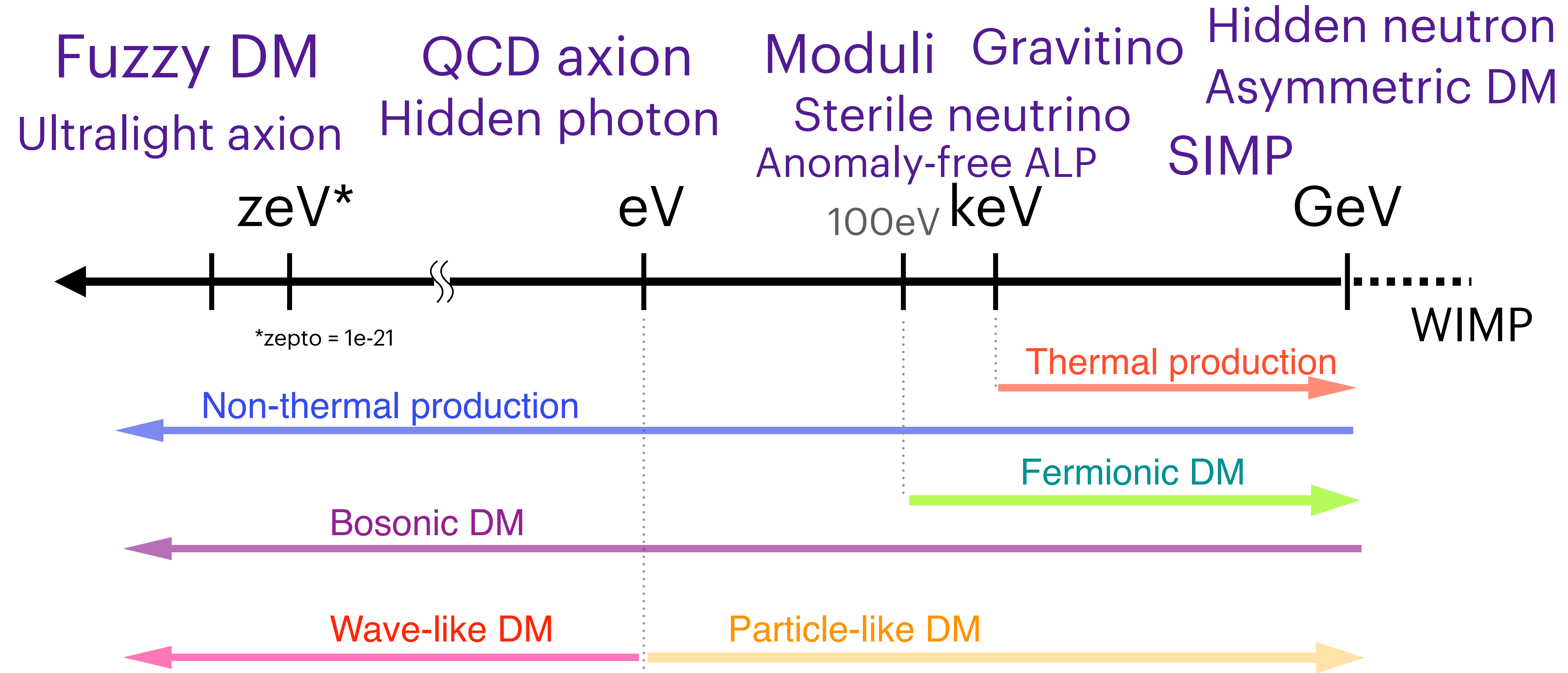
"What is dark matter? - Comprehensive study  
of the huge discovery space in dark matter"

Fumi Takahashi (Tohoku)

# Mass scale of light dark matter



# Mass scale of light dark matter



# Members

Masahiro Kawasaki

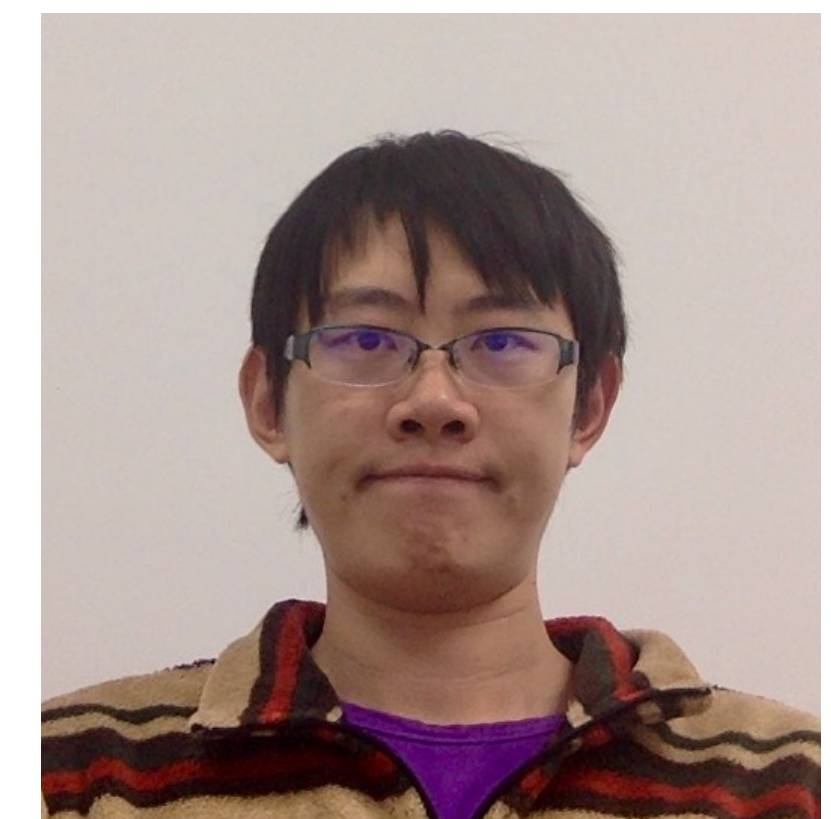
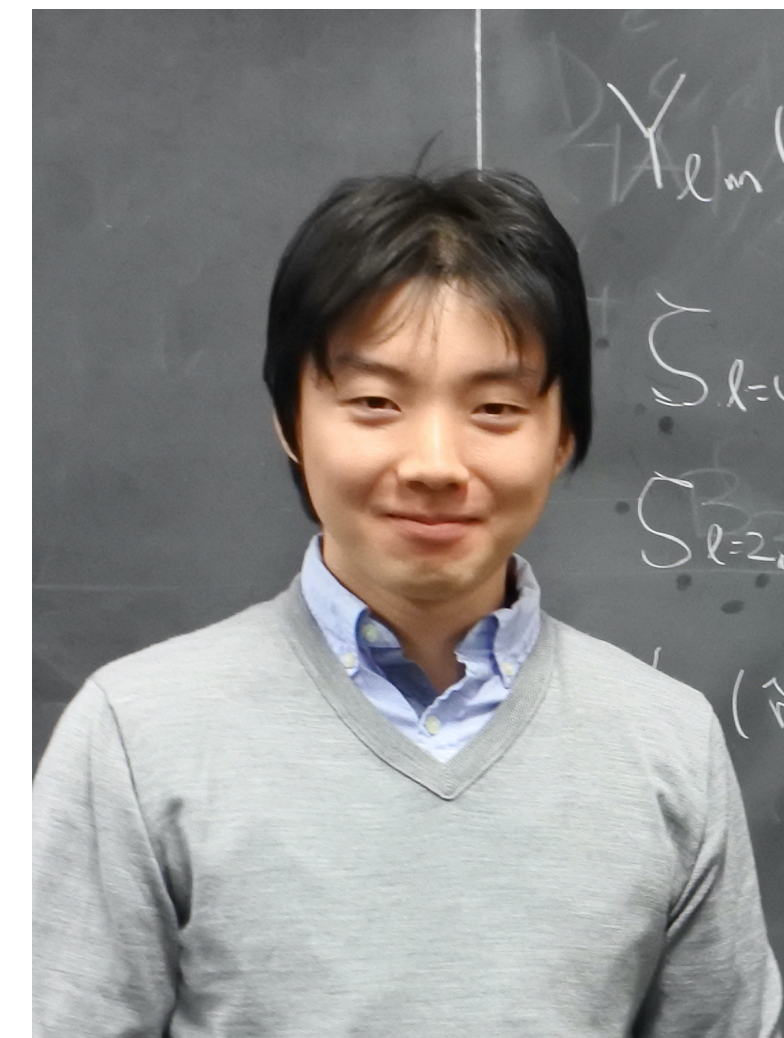
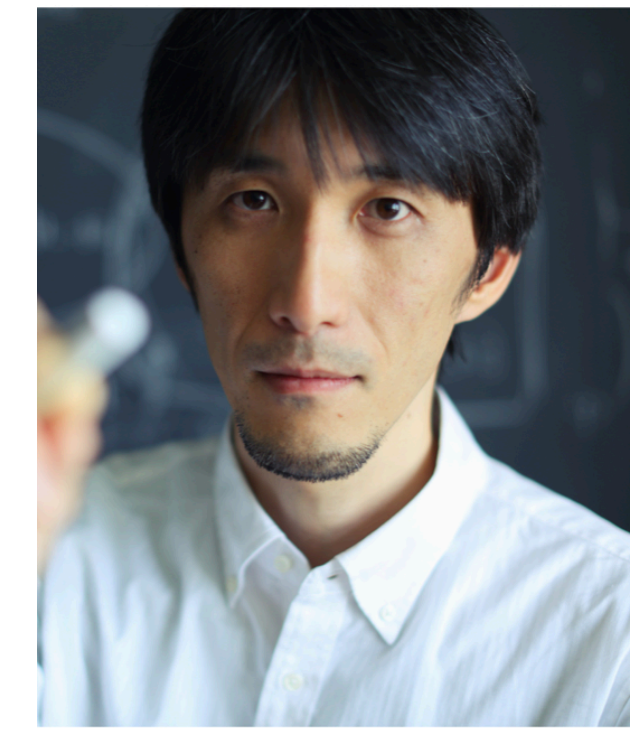
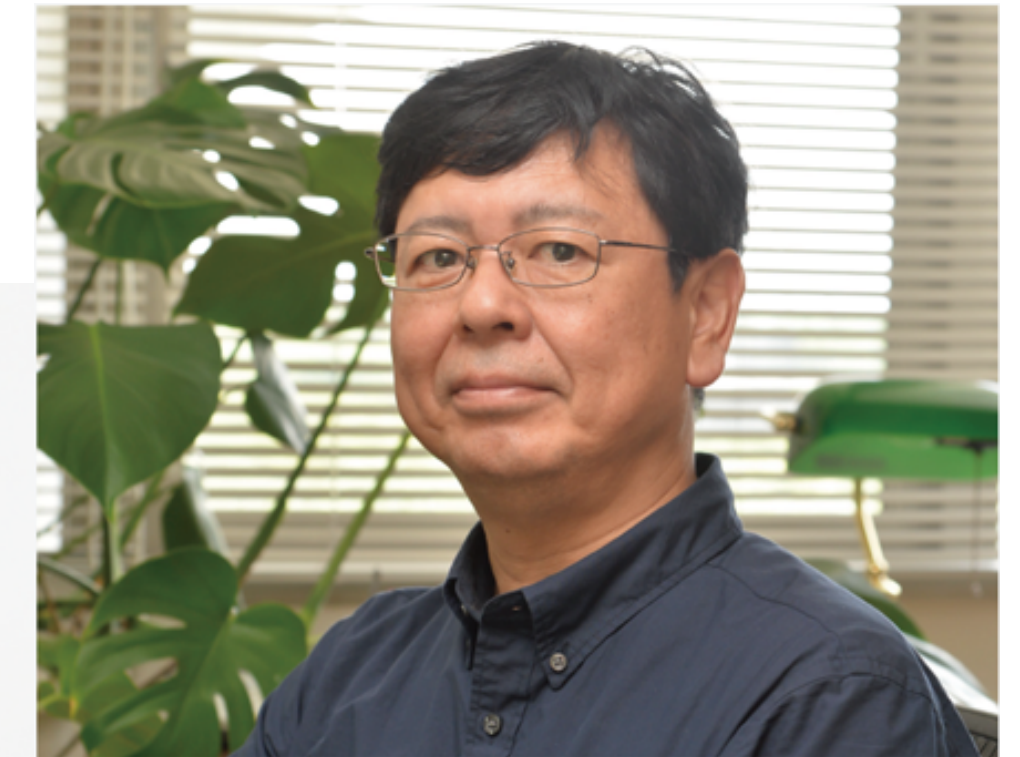
Naoya Kitajima

Fuminobu Takahashi

Masaki Yamada

Wen Yin

(Shota Nakagawa)



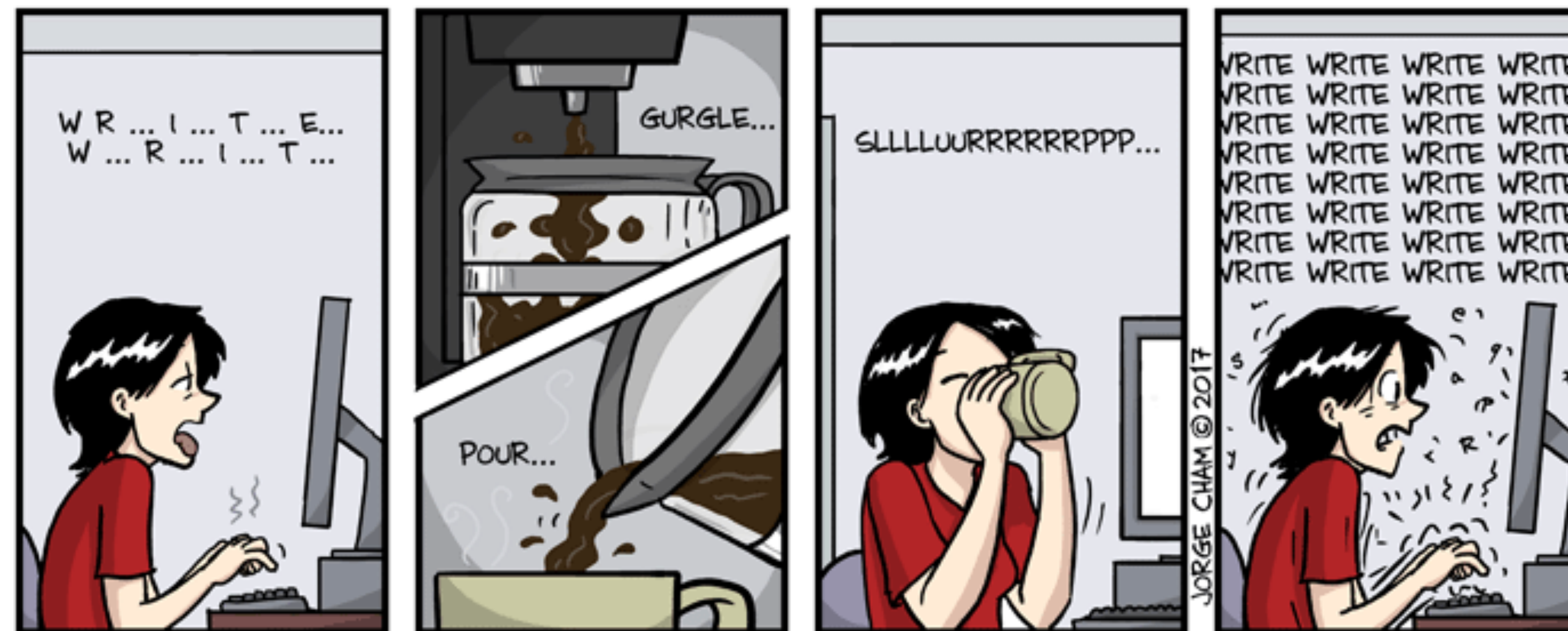
# Papers

30 papers from A01 group since Apr. 2022.

(70 papers since Oct. 2020)

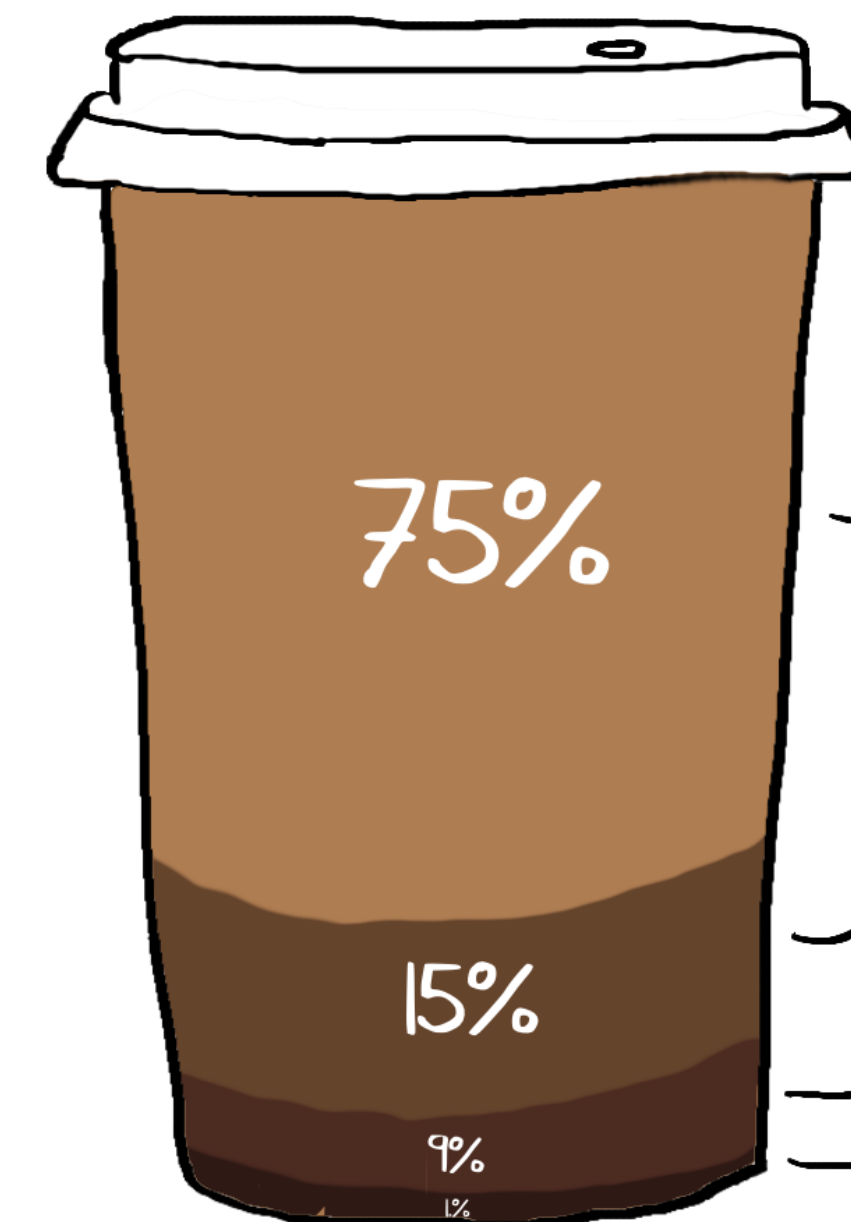
## REASONS SCIENTISTS DRINK COFFEE

ERRANTSCIENCE.COM



WRITING: JUST ADD COFFEE.

WWW.PHDCOMICS.COM



### CAFFEINE!

"I'M GOING TO CLEAN ALL THAT GLASSWARE AND REORGANISED THE CHEMICAL STORE INTO ALPHABETICAL CROSS REFERENCED WITH THE COLOUR OF THE LABEL. ALSO TO LIVE..."

### PROCRASTINATION

"FANCY A COFFEE BREAK?"

### ALTERNATIVE TO EATING

"MORE SUGAR!"

### TASTE

"YOU KNOW WHAT I WANT RIGHT NOW A REALLY BITTER DRINK THAT STAINS MY TEETH."

<https://errantscience.com/>

# Highlights

- Cascades of high-energy SM particles in the primordial thermal plasma  
K. Mukaida and M. Yamada, [2208.11708](#) See talk by Yamada
- Production of dark photon dark matter  
N. Kitajima and K. Nakayama, [2212.13573](#) N. Kitajima and FT, to appear See talk by Kitajima
- Dark Higgs early dark energy S. Nakagawa, FT, W. Yin, [2209.01107](#) See talk by Nakagawa (also Murai-san's talk)
- Precise calculation of the effect of dark matter annihilation on CMB  
M. Kawasaki et al, [2105.08334](#), M. Kawasaki, H. Nakatsuka, and K. Nakayama [2110.12620](#)
- Primordial black holes from QCD axion bubbles N. Kitajima and FT, [JCAP 11 \(2020\) 060](#)
- Indirect detection technique for eV-scale dark matter near with a high-resolution infrared spectroscopy T. Bessho, Y. Ikeda, W. Yin [2208.05975](#)
- Axion dark matter from the trapped misalignment mechanism  
K.S. Jeong, K. Matsukawa, S. Nakagawa, FT, [2201.00681](#)
- Isotropic and anisotropic cosmic birefringence from axion domain walls  
FT and W. Yin, [2012.11576](#), S. Nakagawa, FT, and M. Yamada, [2103.08153](#), N. Kitajima et al, [2205.05083](#), D. Gonzalez et al, [2211.06849](#)



# Highlights

- Cascades of high-energy SM particles in the primordial thermal plasma  
K. Mukaida and M. Yamada, 2208.11708 **See talk by Yamada**
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N. Kitajima and K. Nakayama, [2212.13573](#) N. Kitajima and FT, to appear **See talk by Kitajima**
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# Isotropic CB from axion domain walls

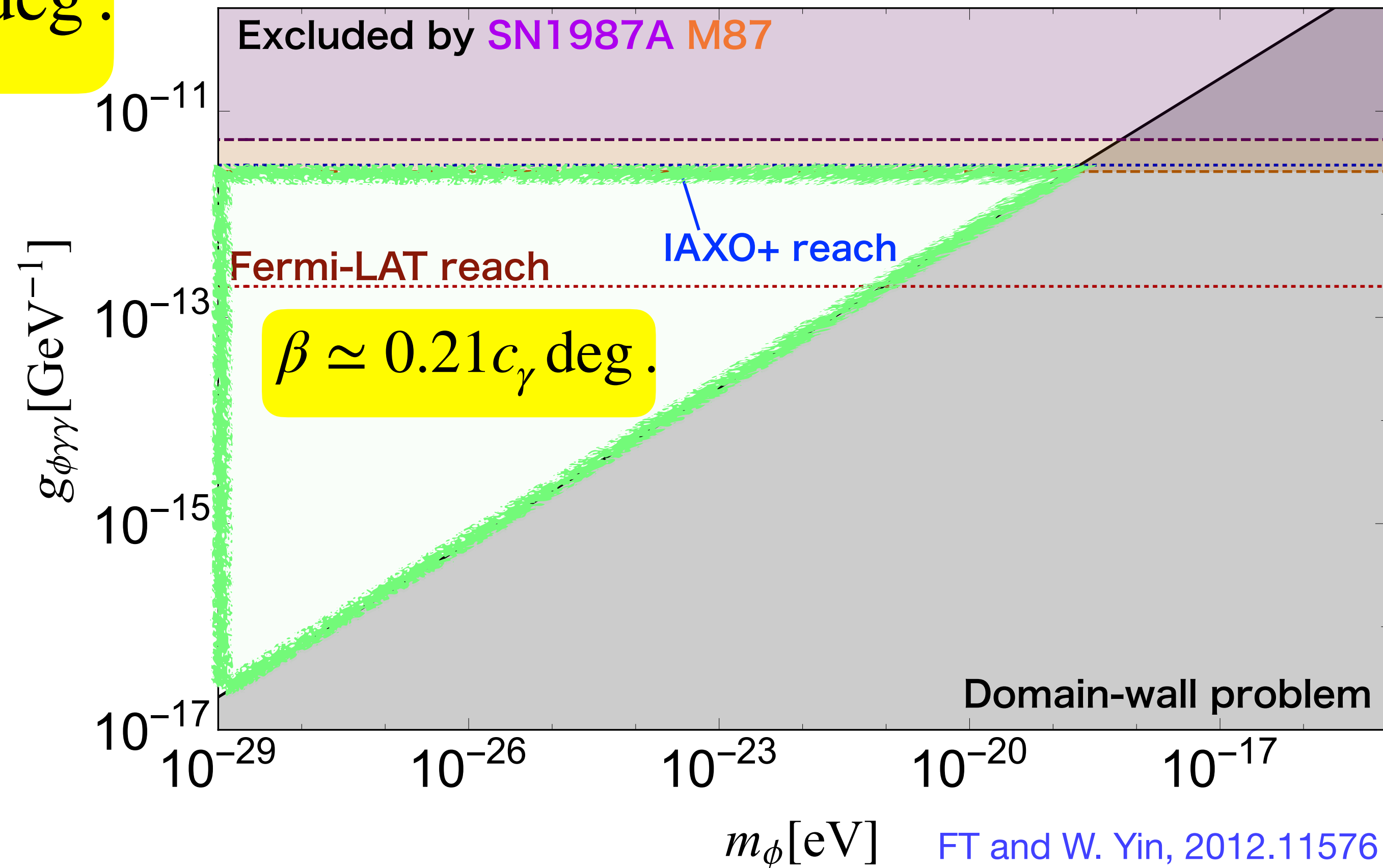
$$\beta = \frac{1}{4\pi} \int d\Omega \Phi(\Omega) = \frac{1}{2} c_\gamma \alpha \simeq 0.21 c_\gamma \text{ deg.}$$

independent of  $m_\phi$  and  $f_\phi$ .

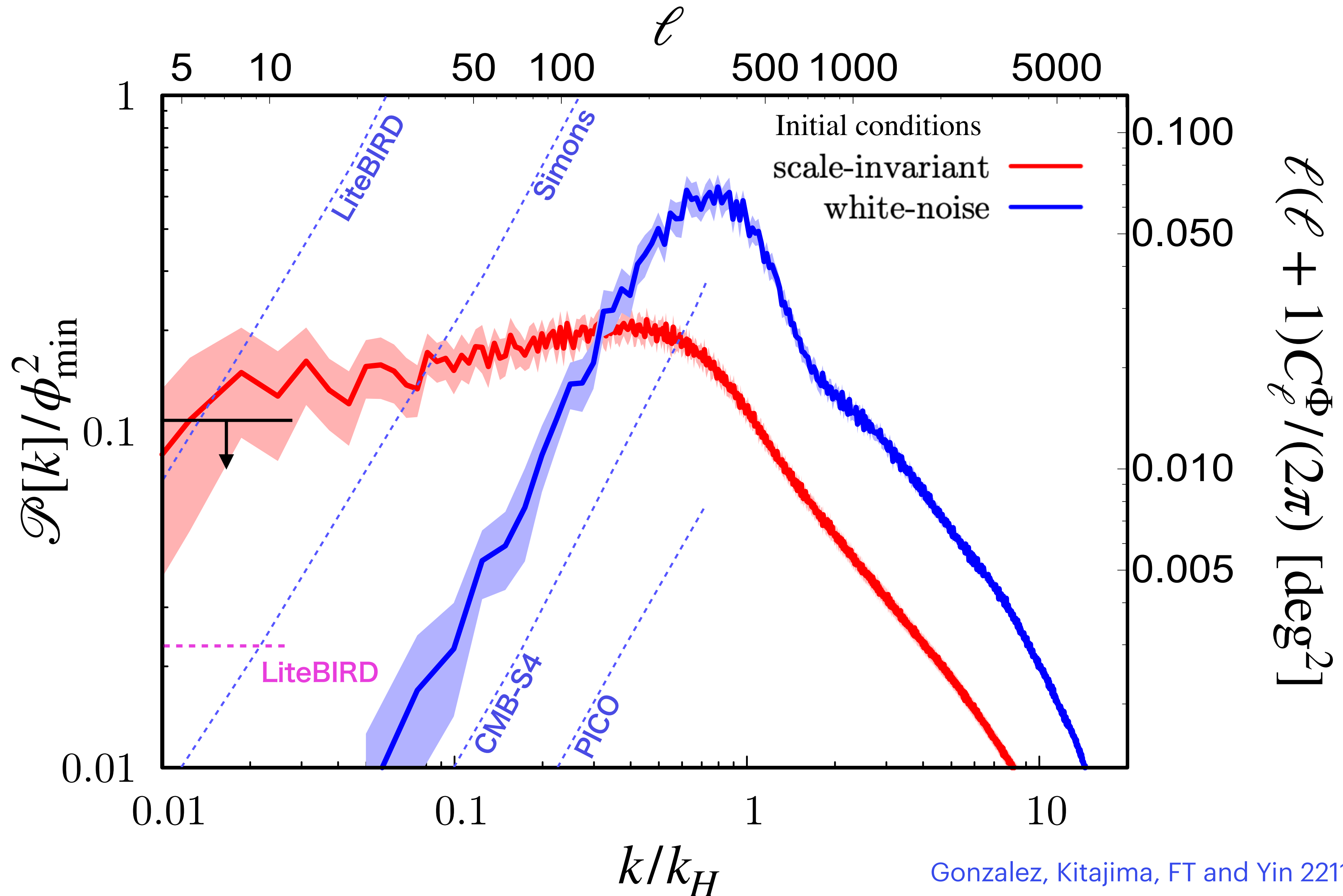
$$\alpha = 1/137 \text{ [rad]} \simeq 0.42 \text{ [deg]}$$

Naturally explains the recent hint for isotropic CB;  $\beta = 0.36^\circ \pm 0.11^\circ$

Minami, Komatsu, Phys. Rev. Lett. **125**, 221301 (2020)  
 P. Diego-Palazuelos et al, Phys. Rev. Lett. **128**, 091302 (2022)



# Anisotropic CB from axion domain walls



# Workshops

• Workshop on Very Light Dark Matter 2021 27-29 Sep. 2021

A01+B01

• Workshop on Very Light Dark Matter 2023 28-30 Mar. 2023

<https://indico.ipmu.jp/event/416/>

A01+A02+B01+B06



Workshop on Very Light Dark Matter 2021

27-29 September 2021  
Online  
Asia/Tokyo timezone

Overview
Instructions
Important dates
Registration and abstract submission
Timetable
Contribution List

Contact  
✉ [vidm2021@phys.s.u-tok...](mailto:vidm2021@phys.s.u-tokyo.ac.jp)

## Workshop on Very Light Dark Matter 2021

**Date:** September 27-29, 2021

**Venue:** Online (Zoom)

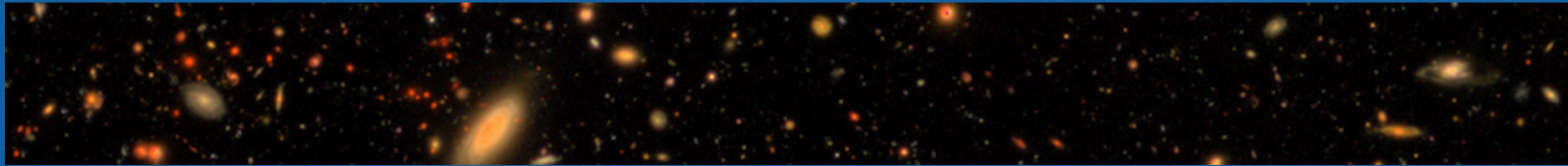
### Overview:

The present universe is filled with dark matter. Although it is still unclear what dark matter is made of, it is known to have played an extremely important role in the formation of the structure of the universe such as galaxies and galaxy clusters. Recently, dark matter with extremely low mass has attracted much attention. In this workshop, recent experimental results as well as future prospects, and theoretical progress of very light dark matter will be discussed. We will have invited talks by experts in the related fields, as well as contributed talks. One of the aims of this workshop is to deepen the understanding of recent developments and future prospects in this field through discussions among the participants. The following is a list of representative topics.

- Axion and axion like particles
- Dark photon and other light dark matter
- Light dark matter search experiments
- Black hole superradiance
- Cosmic birefringence
- Structure formation
- Weak gravity conjecture

### Invited Speakers:

Silvia Gasparotto (Max Planck Institut für Astrophysik)  
Koji Ishiwata (Kanazawa University)  
Asuka Ito (Tokyo Institute of Technology)  
Joerg Jaeckel (Universität Heidelberg)  
Sugumi Kanno (Kyushu University)  
Andrew Miller (Université catholique de Louvain)



Workshop on Very Light Dark Matter 2023

28-30 March 2023  
Mario Royal Kaikan (Chino, Nagano) + Online  
Asia/Tokyo timezone

Overview
Important dates
Timetable
Contribution List
Registration and abstract submission

Contact  
✉ [vidm2023-group@g.ecc...](mailto:vidm2023-group@g.ecc.u-tokyo.ac.jp)

## Workshop on Very Light Dark Matter 2023

**Date:** March 28-30, 2023

**Venue:** Mario Royal Kaikan (Chino, Nagano) + Online (Zoom)

### Overview:

The present universe is filled with dark matter. Although it is still unclear what dark matter is made of, it is known to have played an extremely important role in the formation of the structure of the universe such as galaxies and galaxy clusters. Recently, dark matter with extremely low mass has attracted much attention. Characteristic signatures of some candidates (e.g. axions and dark photons) in the very early universe have also been vigorously discussed.

Following the success of [VLDM2021](#), in this workshop, recent experimental results as well as future prospects, and theoretical progress of very light dark matter will be discussed. We will have invited talks by experts in the related fields, as well as contributed talks. One of the aims of this workshop is to deepen the understanding of recent developments and future prospects in this field through discussions among the participants. The following is a list of representative topics.

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## Organizers:

Elisa Ferreira (Kavli IPMU)  
Tomohiro Fujita (Waseda / RESCEU)  
Motoko Fujiwara (TUM)  
Nagisa Hiroshima (Toyama / RIKEN)  
Naoya Kitajima (Tohoku)  
Eiichiro Komatsu (MPA / Kavli IPMU)  
Yuta Michimura (Caltech / RESCEU)  
Ippei Obata (Kavli IPMU)  
Maresuke Shiraishi (SUS)  
Fuminobu Takahashi (Tohoku)  
Yuko Urakawa (KEK)  
Masaki Yamada (Tohoku)  
Wen Yin (Tohoku)