Ryoto Inui

arXiv: 2209.13891v1

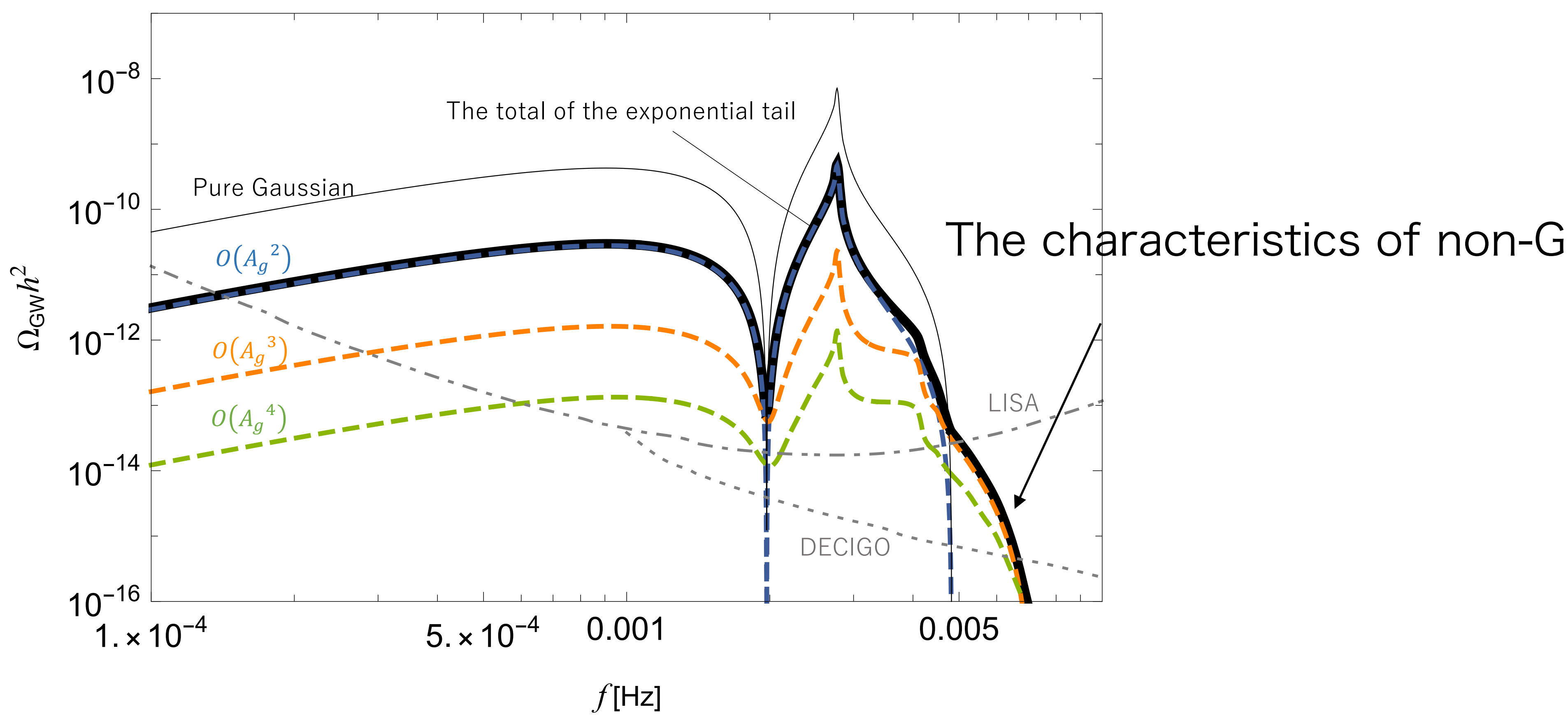
We calculated the GWs induced by the exponential tail perturbation associated with PBH = 100% DM

We computed non-G contributions up to $O(A_g^4)$ perturbatively

Exponential tail-type in LISA

GWs would be detectable

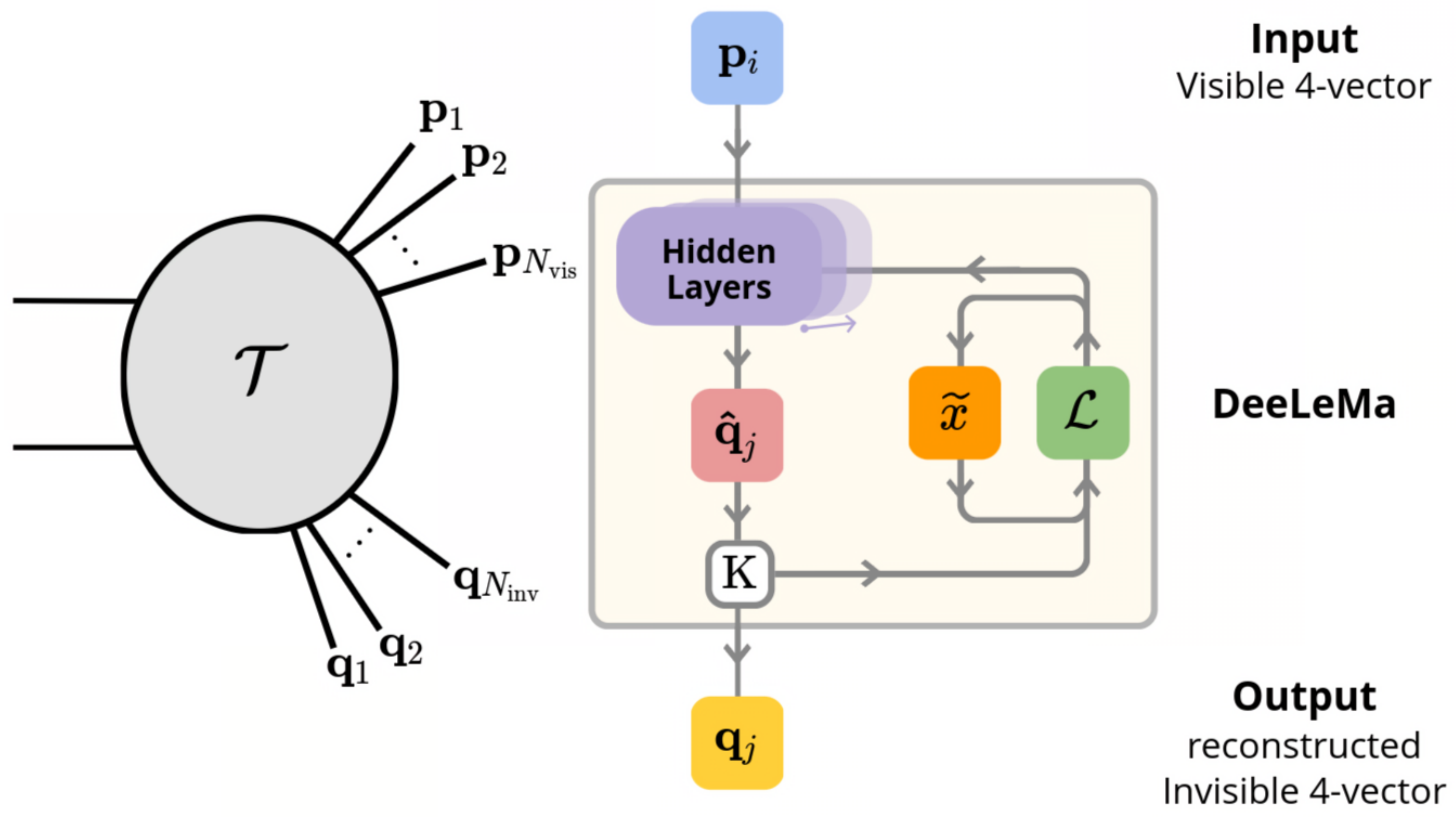
Detect the footprint of the non-G is difficult



DeeLeMa: Missing information search with Deep Learning for Mass estimation

Speaker: Kayoung Ban (Yonsei University)

$$\text{DeeLeMa} \equiv \min_{\hat{q},\tilde{x}} \mathcal{L} \quad \text{subject to } \mathbf{K}.$$



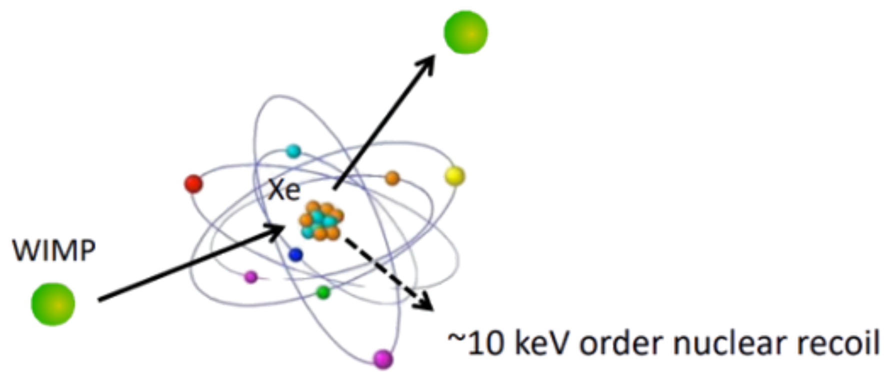
- Events with **invisible particles** are vastly intriguing but also very challenging to handle at the Large Hadron Collider (LHC).
- They might be **neutrinos** of the Standard Model (SM) or weakly interacting elusive particles in new physics produced by the particle collision, for example, **dark matter**.
- Our goal is to <u>design a kinematics-solving machine that reconstructs the invisible information of particles</u> based on kinematic properties differently from kinematic methods relying on MT2 or its variants.
- We name our kinematics-solving machine **DeeLeMa** is a DNN-based machine to reconstruct kinematic unknowns q_j, based on knowns p_i, symmetries, and conservation laws for a given event topology ($\mathscr{T}$).
- We construct $\mathscr{L}$ as a loss function and **K** as kinematics based on physical laws, i.e., the on-shell condition on topology and the missing transverse momentum constraint.
- Additionally, <u>we introduce an auxiliary parameter $\tilde{x}$</u>, which is designed as global trainable parameters based on prior knowledge that all events are of the same physics, leading the values reconstructed from the output of DNN, denoted without tilde as x, to converge into a single value.
- To be specific, we present the baseline structure that can reconstruct the invisible momenta and the particle mass spectrum of the event as ttbar like antler event topology.
- We show that **DeeLeMa** can powerfully improve the reconstruction of <u>not only the mass but also the momenta of invisible particles</u>.
- **DeeLeMa** has a sharp peak at the true mass of A and B with the same reconstructed momenta in the full event system.
- Finally, since **DeeLeMa** reconstructs masses as a very sharp peak, <u>it is robust under the combinatorial problem as well as detector smearing and off-shell effects, which is a very good advantage to apply to real experiments.</u>

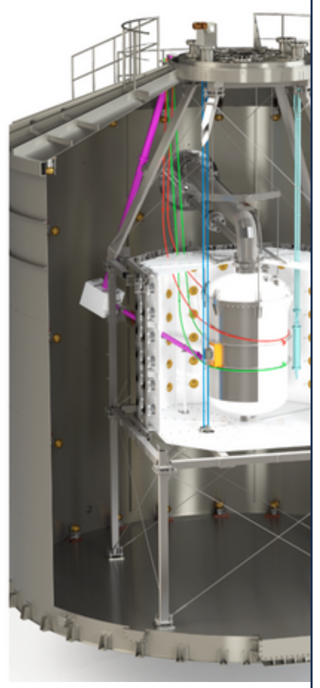
The Neutron Veto of XENONnT

The 4th KMI school
Poster Session
Andrea Mancuso – Unversity of Bologna

The XENONnT Experiment

Dark Matter direct research





The NV PMTs

Hamamatsu R5912

featuring:
- 8-inches photocathode
- Low radioactivity
- High Quantum Efficiency (40%)

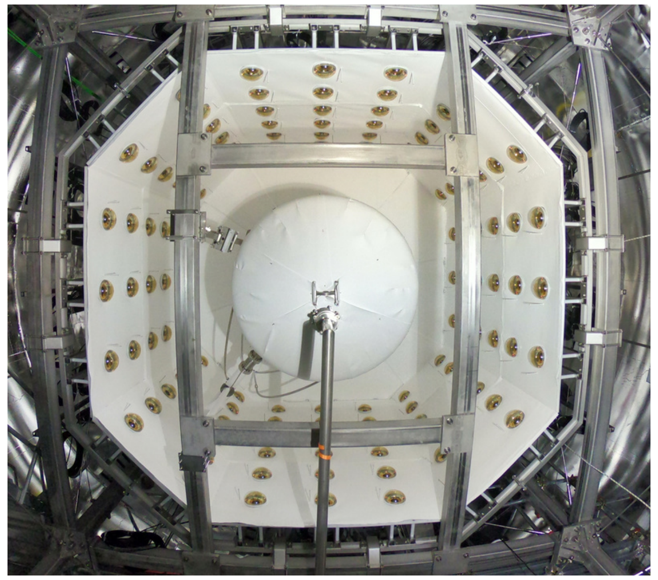
- Gain
- Dark Rate

The Neutron Veto

Gd-loaded Water Cherenkov Detector
Reduction of radiogenic neutron background

Background

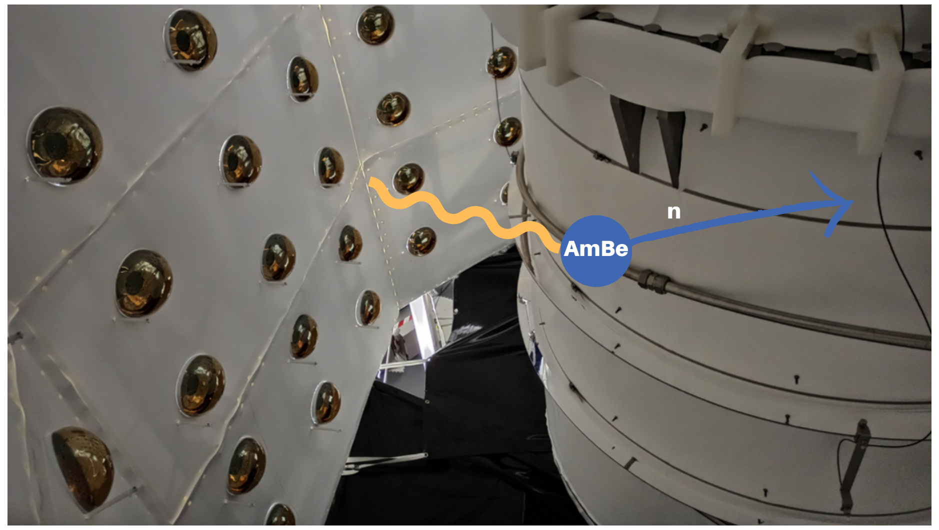
ER	γ, β, ν-e interactions
NR	Neutrons, CEνNS



The NV Performances

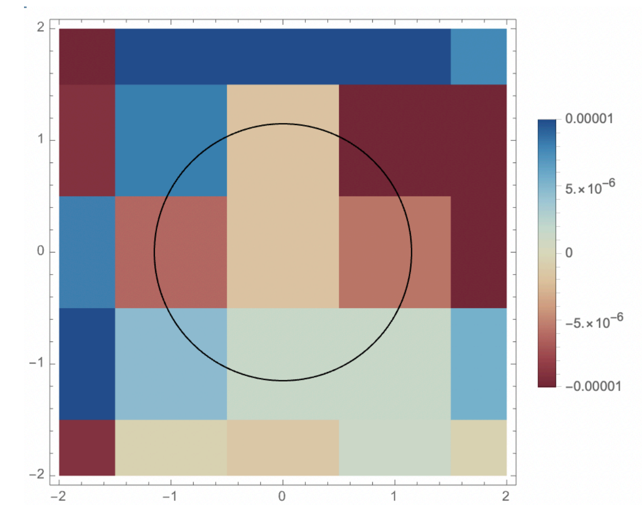
- Detection eff.
- Tagging eff.

Neutron Calibration with AmBe source



Let’s watch the inflation!

I’m Yurino MIZUGUCHI from Nagoya-university.



A part of the video

My work:
The lattice simulation of the inflation
by using stochastic formula w/ Y.Tada

The thing that we challenged at this time:

Making the video of the initial fluctuations’ evolution
in the chaotic inflation model

If you want to watch the video, please feel free to ask me!

BAO mock measurement for photometric observation

Keitaro Ishikawa

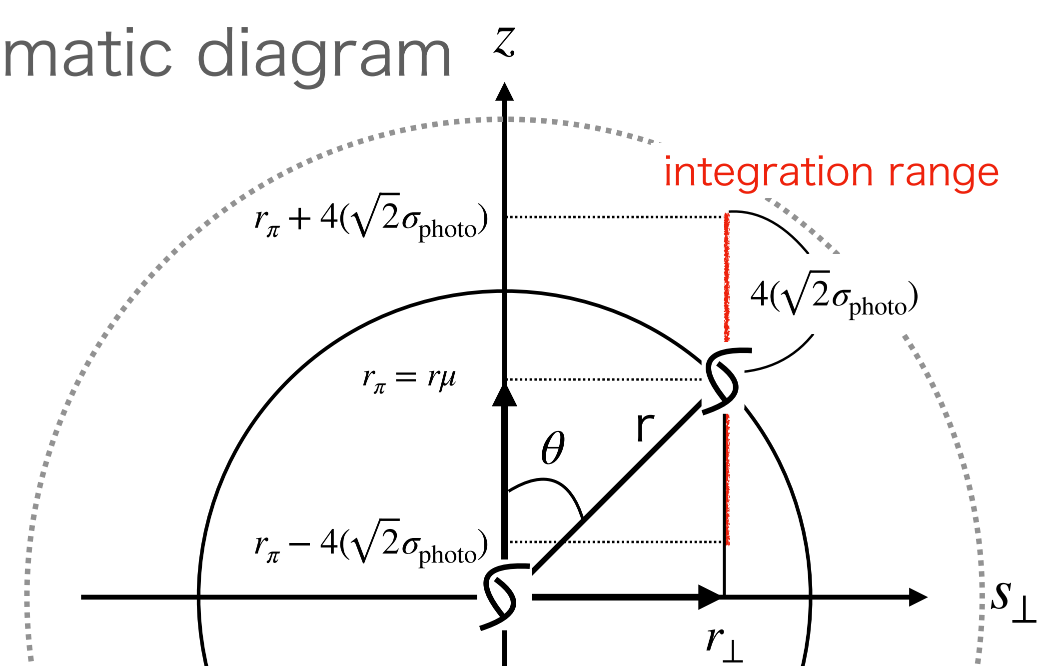
Goal: verify acceptable photo-z uncertainty

- We measure BAO using photometric mock with LoS to show the level of photo-z error.
- We check the effect if the photo-z distribution is skewed non-Gaussian.

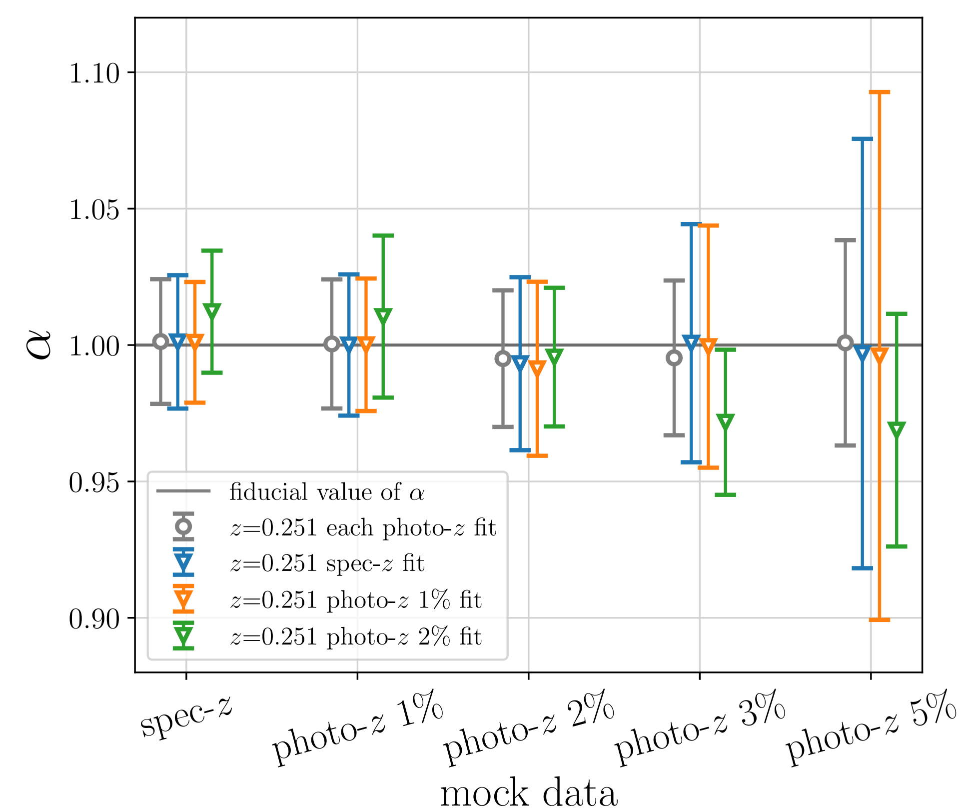
Template

$$\xi_{\rm m}^{\rm temp}(r) = \int_{-1}^{1} d\mu \int_{r\mu - 4(\sqrt{2}\sigma_{\rm photo})}^{r\mu+4(\sqrt{2}\sigma_{\rm photo})} dr_\pi G(r_\pi, \sigma_{\rm photo})\ \xi_m\left(\sqrt{r_\pi^2 + r_\perp^2}\right)$$

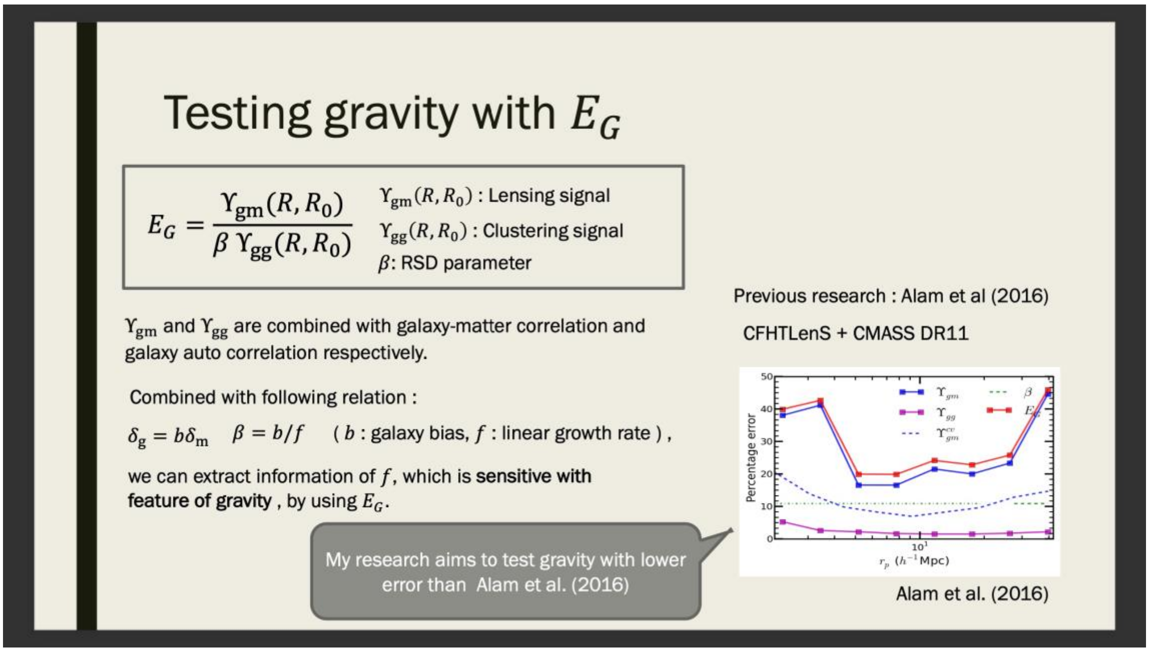
schematic diagram

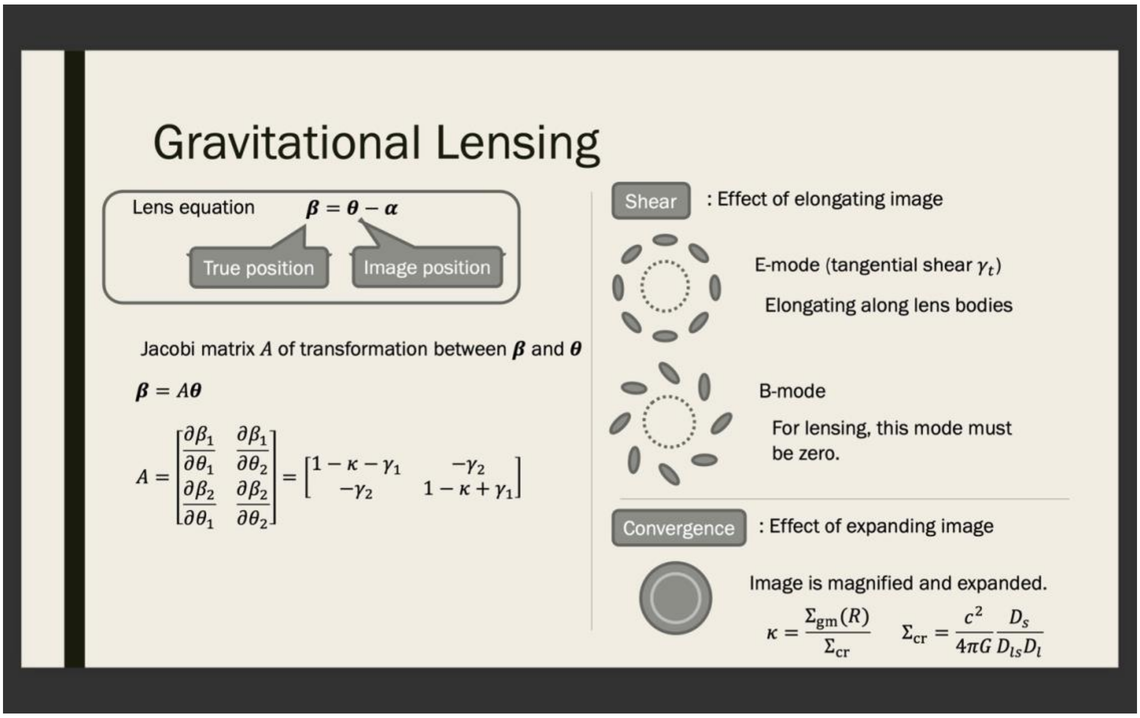


Result



Name : Noriaki NAKASAWA
(working with Hironao MIYATAKE and Tomomi SUNAYAMA)
Affiliation : Nagoya university, C-lab
Grade : M2
Title : Testing gravity by combining weak lensing, clustering and RSD





Development of a hybrid-photosensor for the DARWIN experiment

Tomoya Hasegawa(ISEE Nagoya University)

DARWIN experiment

・**A future dark matter(DM) search with** ~ 50 ton of liquid xenon

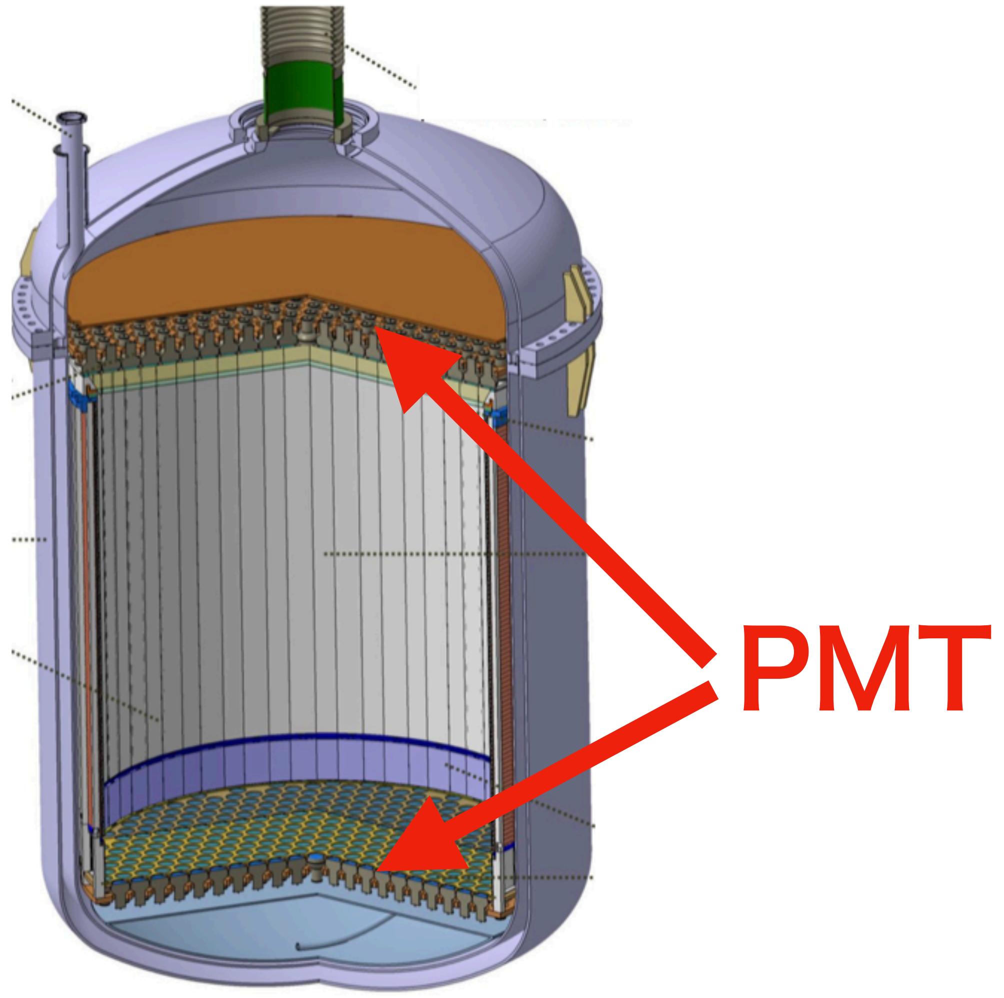
・**Neutron from radioactive material can be an irreducible background,** and it limits the discovery potential of DM

Main origins of BG :
PMT, cryostat, PTFE(reflecter)

↓

- **Need to develop a new photosensor with lower radioactivity**
- **Especially, I'm developing a hybrid photosensor with plastic scintillator** to improve the detection efficiency

DARWIN detector



from DARWIN collaboration

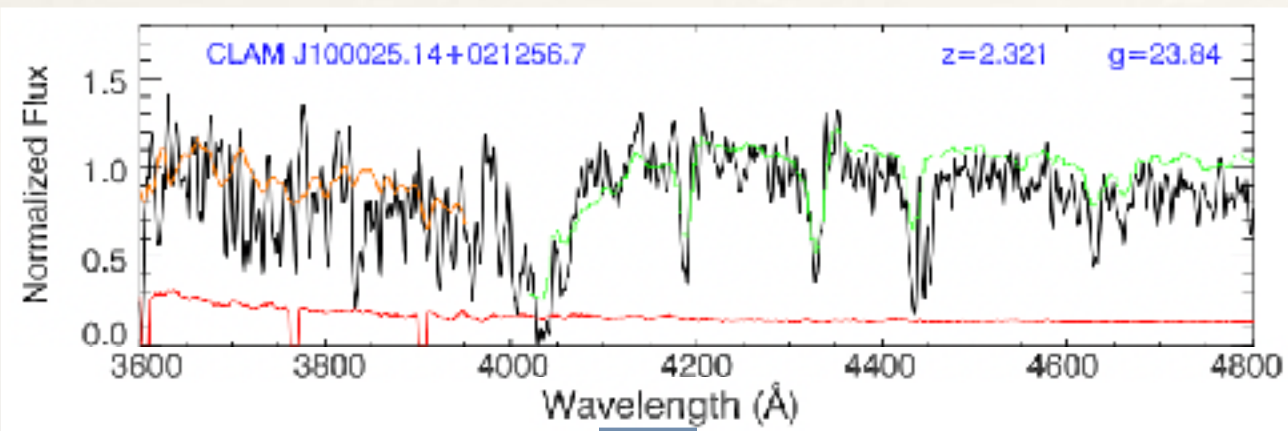
Developed device for my experiment

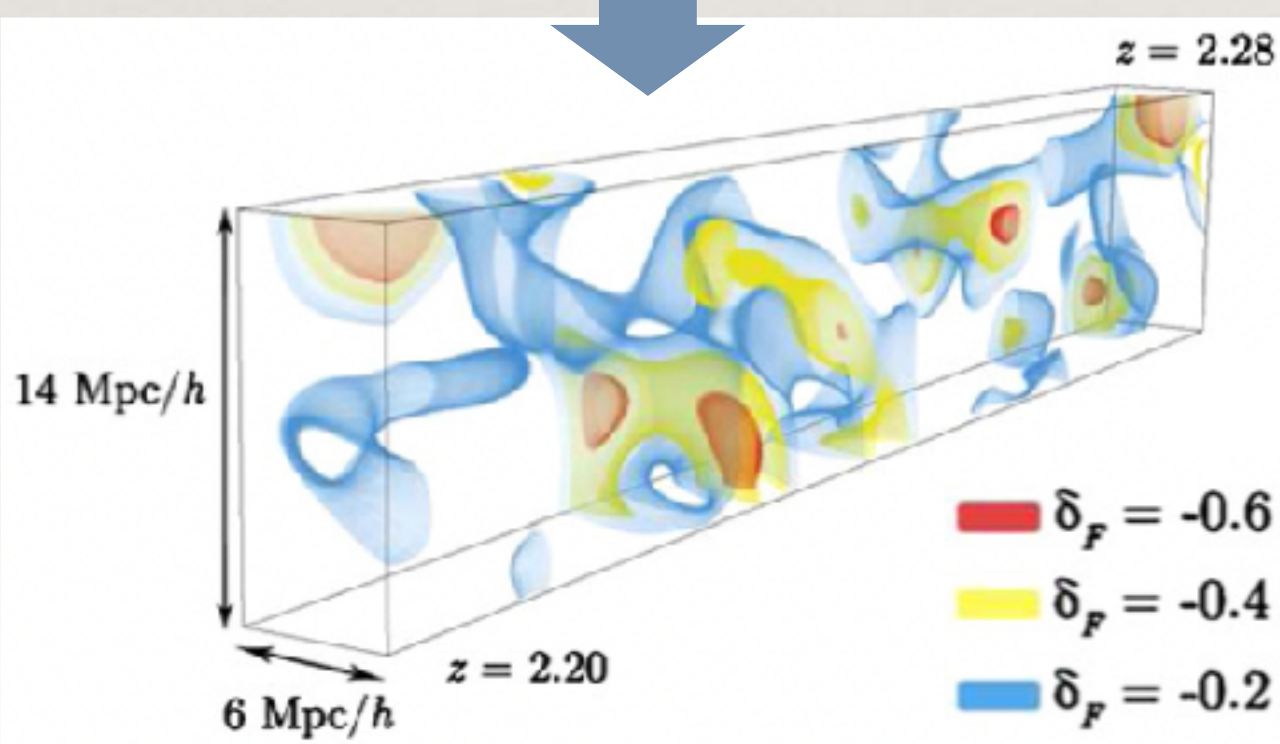
RSD analysis with Lyman alpha forest

Koichiro Nakashima (C-Lab, Nagoya U.)

Collaborator :
Atsushi J. Nishizawa (Gifu Shotoku U.), Hiroyuki Tashiro, Kenji Hasegawa, Daichi Kashino, Koya Murakami (Nagoya U.)
Kentaro Nagamine (Osaka U.), Ikkoh Shimizu(Shikoku Gakuin U.)

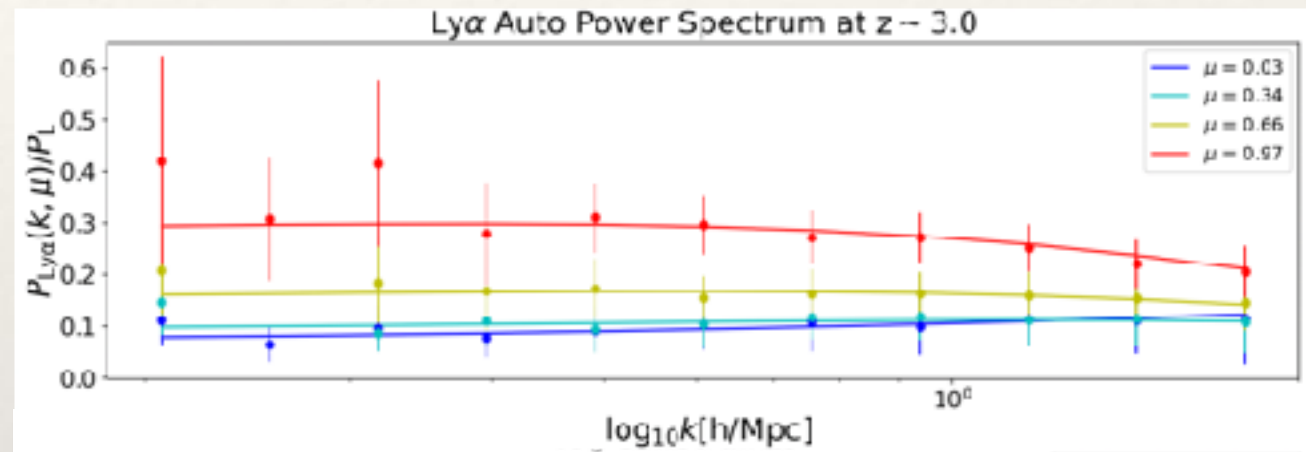
3D distribution of Gases reconstructed from Absorption Lines

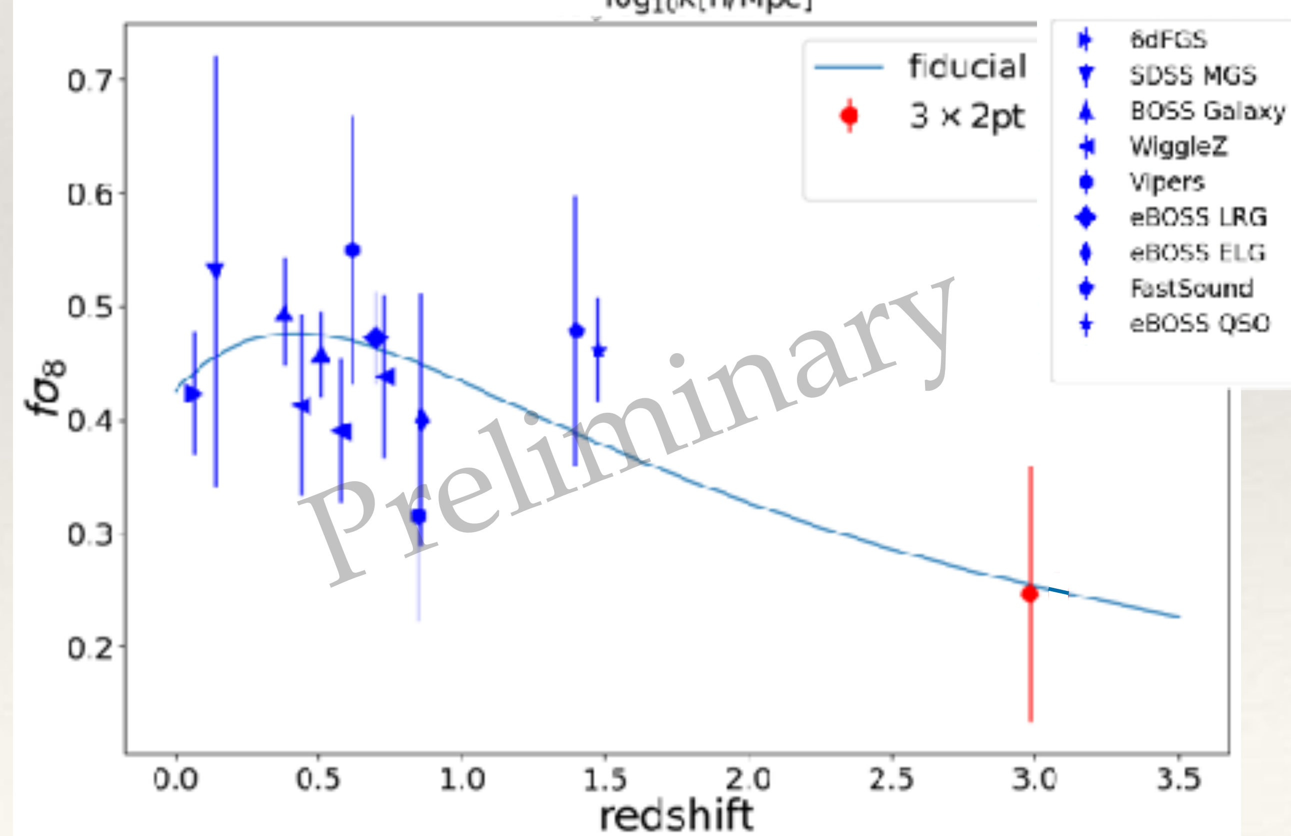




CLAMATO survey (Lee+ '14)

Power Spectrum & Cosmological Constraint





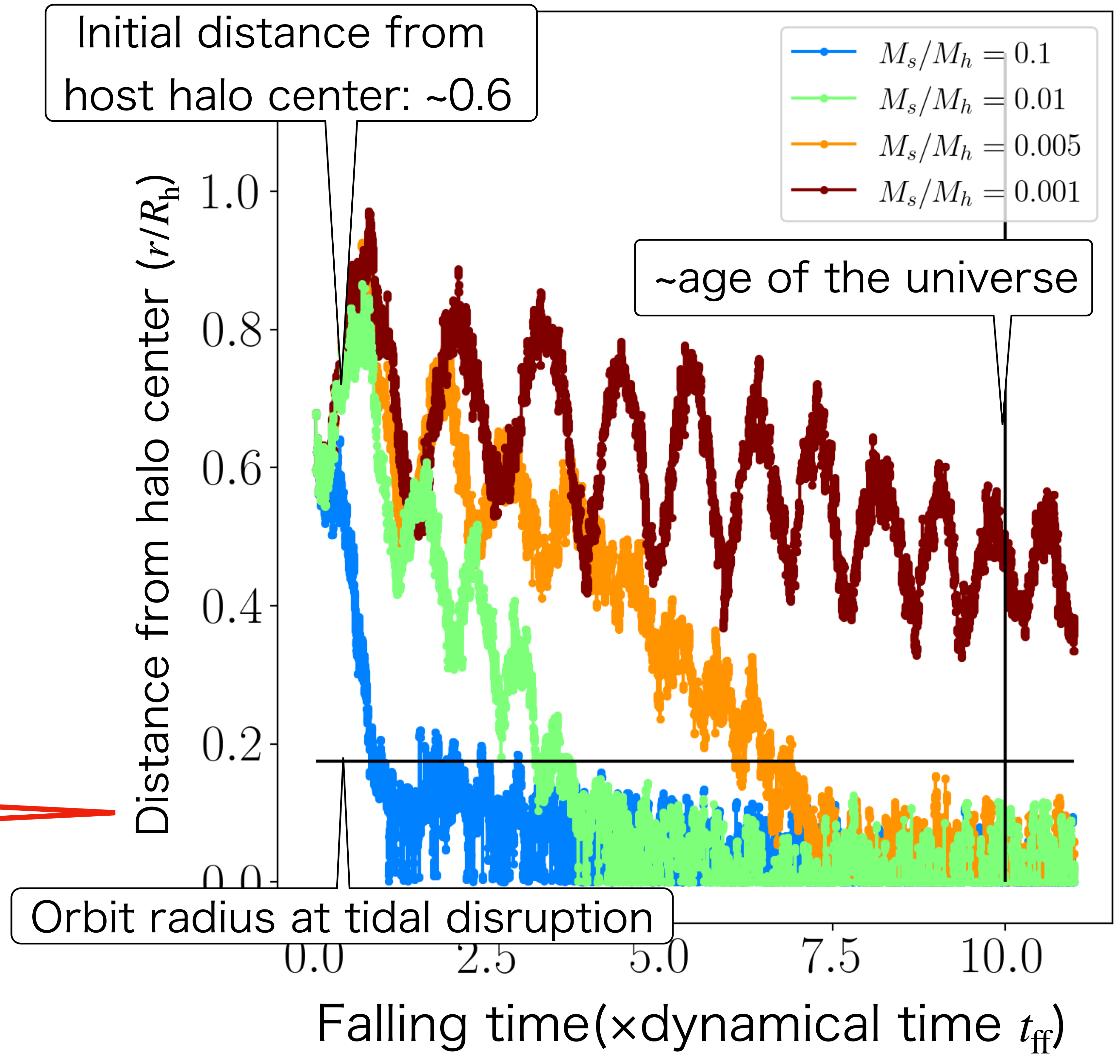
How can subhalos survive in the epoch of reionization?

By Genki NARUSE

- Minihalos have a significant role in the cosmological study and are observed as 21cm absorption lines.
- When minihalos have subhalos inside,
  21cm signals are enhanced
  (Kadota et al. 2022: arXiv: 2209.01305)
- But, how subhalos can survive in reality?
  (Thinking dynamic motion…)
  → hydro simulation!

DM+Baryon background: less than
0.5% of M_s/M_h can survive.
*this is rough estimation

Host halo: DM + Baryon



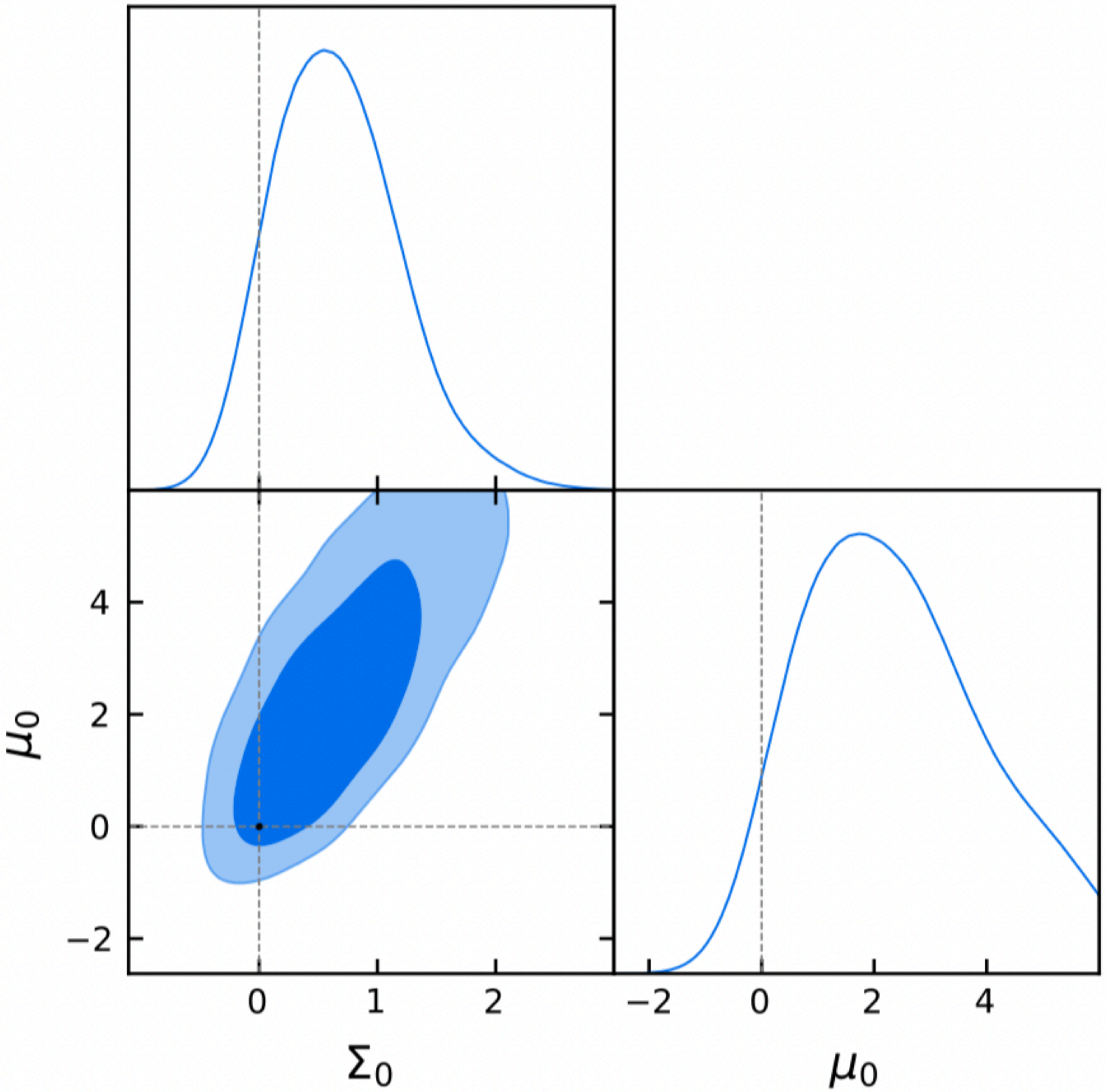
Does GR really describe gravity?

- the phenomenological parameters μ_0, Σ_0
  ($\mu_0 = \Sigma_0 = 0$ corresponds to GR without anisotropic stress)

- With "cosmic shear", GR is consistent with the observation within 1σ.

➡ **We'd like to constrain these more precisely.**

Use of two other correlation functions



Okochi

A study on the relation between formation history and observables of galaxy clusters

the 4th kmi school at Nagoya U., Dec 15-17, 2022

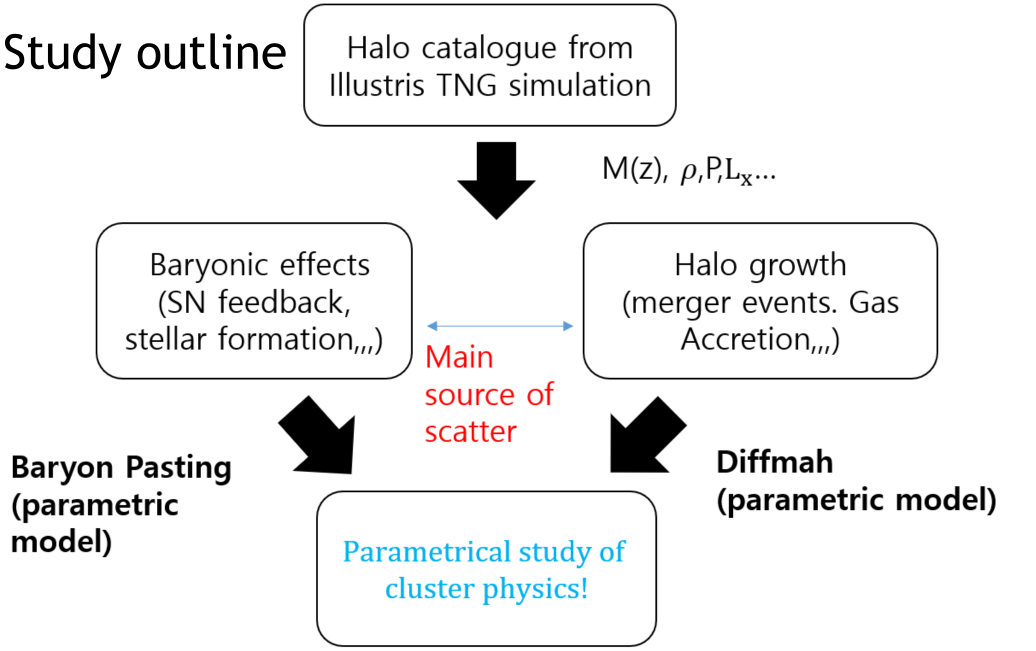
Seongwhan YOON(Nagoya U.), Hironao MIYATAKE (Nagoya U.), Daisuke NAGAI (Yale U.), Erwin Lau (Harvard U.), Andrew Hearin (Argonne National Lab.) + Baryon Pasters Collaboration

1.Motivation:

Galaxy clusters are the largest gravitationally bounded object in our universe.
Statistics of galaxy clusters depend on cosmological models.

->**<u>constrain cosmology with galaxy clusters!</u>**

2.Study outline



1.Introduce two models to describe halos
2.Find best fit model parameters for simulated halos
3.Study the relation between parameters

3.Result

1.Visualized the distribution of parameters
By using 1d histogram & 2d scatter plot

2.Wrote Machine learning code to understand mapping between parameters.

Poster #11

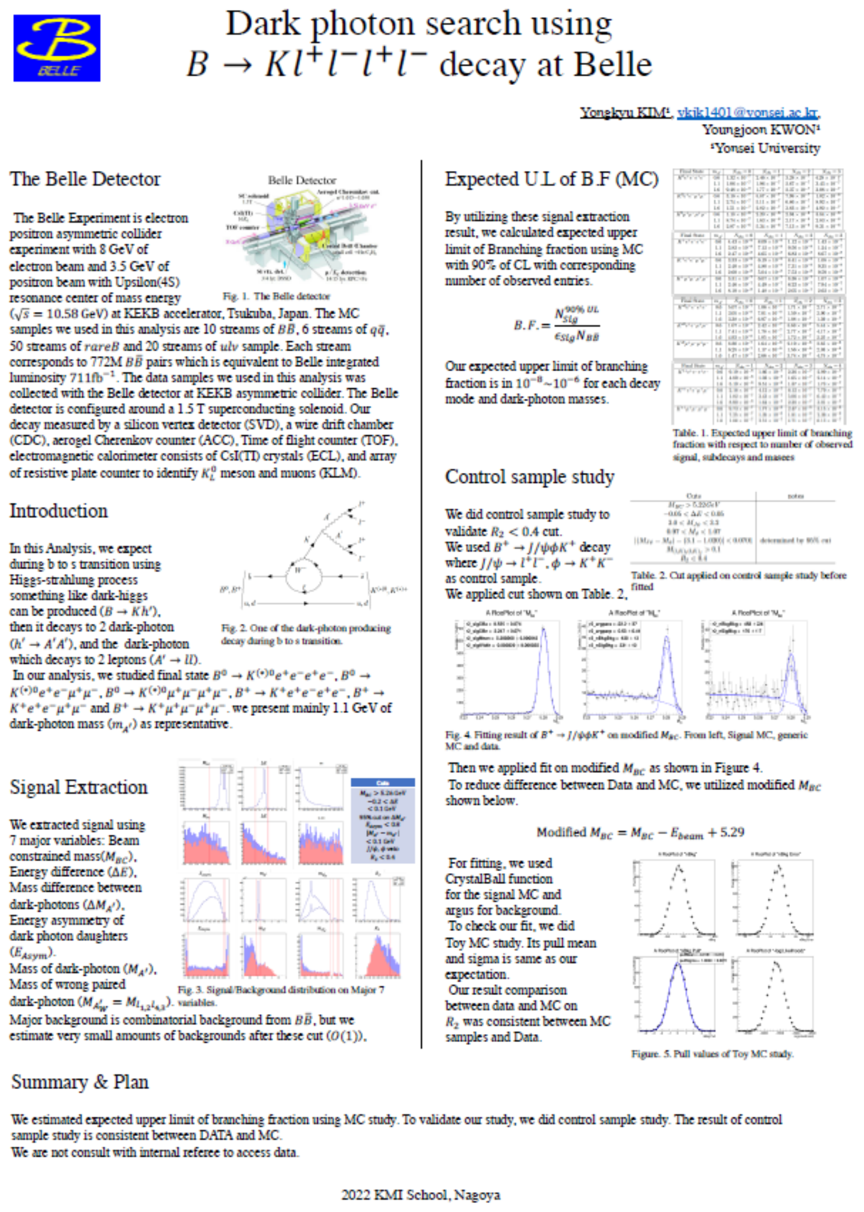
Dark-photon search using $B \rightarrow K l^+ l^+ l^- l^-$ decay at Belle

Dark photon search
on rare B decay channel.

$B \rightarrow K h'$, $h' \rightarrow A'A'$, $A' \rightarrow l^+ l^-$.

h' for arbitrary scalar particle,
A' for dark-photon.

Including signal extraction & expected upper limit estimation using Belle MC
and Control sample study using Belle MC and DATA.



Dark photon search using $B \rightarrow K l^+ l^- l^+ l^-$ decay at Belle

Yongkyu KIM[1], ykik1401@yonsei.ac.kr,
Youngjoon KWON[1]
[1]Yonsei University

The Belle Detector

The Belle Experiment is electron positron asymmetric collider experiment with 8 GeV of electron beam and 3.5 GeV of positron beam with Upsilon(4S) resonance center of mass energy ($\sqrt{s} = 10.58$ GeV) at KEKB accelerator, Tsukuba, Japan. The MC samples we used in this analysis are 10 streams of $B\bar{B}$, 6 streams of $q\bar{q}$, 50 streams of $rareB$ and 20 streams of ulv sample. Each stream corresponds to 772M $B\bar{B}$ pairs which is equivalent to Belle integrated luminosity 711fb^{-1}. The data samples we used in this analysis was collected with the Belle detector at KEKB asymmetric collider. The Belle detector is configured around a 1.5 T superconducting solenoid. Our decay measured by a silicon vertex detector (SVD), a wire drift chamber (CDC), aerogel Cherenkov counter (ACC), Time of flight counter (TOF), electromagnetic calorimeter consists of CsI(TI) crystals (ECL), and array of resistive plate counter to identify K_L^0 meson and muons (KLM).

Fig. 1. The Belle detector

Introduction

In this Analysis, we expect during b to s transition using Higgs-strahlung process something like dark-higgs can be produced ($B \rightarrow Kh'$), then it decays to 2 dark-photon ($h' \rightarrow A'A'$), and the dark-photon which decays to 2 leptons ($A' \rightarrow ll$).
In our analysis, we studied final state $B^0 \rightarrow K^{(*)0}e^+e^-e^+e^-$, $B^0 \rightarrow K^{(*)0}e^+e^-\mu^+\mu^-$, $B^0 \rightarrow K^{(*)0}\mu^+\mu^-\mu^+\mu^-$, $B^+ \rightarrow K^+e^+e^-e^+e^-$, $B^+ \rightarrow K^+e^+e^-\mu^+\mu^-$ and $B^+ \rightarrow K^+\mu^+\mu^-\mu^+\mu^-$. we present mainly 1.1 GeV of dark-photon mass ($m_{A'}$) as representative.

Fig. 2. One of the dark-photon producing decay during b to s transition.

Signal Extraction

We extracted signal using 7 major variables: Beam constrained mass(M_{BC}), Energy difference (ΔE), Mass difference between dark-photons ($\Delta M_{A'}$), Energy asymmetry of dark photon daughters (E_{Asym}), Mass of dark-photon ($M_{A'}$), Mass of wrong paired dark-photon ($M_{A'_W} = M_{l_{1,2}l_{4,3}}$).
Major background is combinatorial background from $B\bar{B}$, but we estimate very small amounts of backgrounds after these cut ($O(1)$).

Fig. 3. Signal/Background distribution on Major 7 variables.

Expected U.L of B.F (MC)

By utilizing these signal extraction result, we calculated expected upper limit of Branching fraction using MC with 90% of CL with corresponding number of observed entries.

$$B.F. = \frac{N_{Sig}^{90\%\ UL}}{\epsilon_{Sig} N_{BB}}$$

Our expected upper limit of branching fraction is in $10^{-8} \sim 10^{-6}$ for each decay mode and dark-photon masses.

Table. 1. Expected upper limit of branching fraction with respect to number of observed signal, subdecays and masees

Control sample study

We did control sample study to validate $R_2 < 0.4$ cut.
We used $B^+ \rightarrow J/\psi\phi K^+$ decay where $J/\psi \rightarrow l^+l^-$, $\phi \rightarrow K^+K^-$ as control sample.
We applied cut shown on Table. 2,

Table. 2. Cut applied on control sample study before fitted

Fig. 4. Fitting result of $B^+ \rightarrow J/\psi\phi K^+$ on modified M_{BC}. From left, Signal MC, generic MC and data.

Then we applied fit on modified M_{BC} as shown in Figure 4.
To reduce difference between Data and MC, we utilized modified M_{BC} shown below.

$$\text{Modified } M_{BC} = M_{BC} - E_{beam} + 5.29$$

For fitting, we used CrystalBall function for the signal MC and argus for background.
To check our fit, we did Toy MC study. Its pull mean and sigma is same as our expectation.
Our result comparison between data and MC on R_2 was consistent between MC samples and Data.

Figure. 5. Pull values of Toy MC study.

Summary & Plan

We estimated expected upper limit of branching fraction using MC study. To validate our study, we did control sample study. The result of control sample study is consistent between DATA and MC.
We are not consult with internal referee to access data.

2022 KMI School, Nagoya