

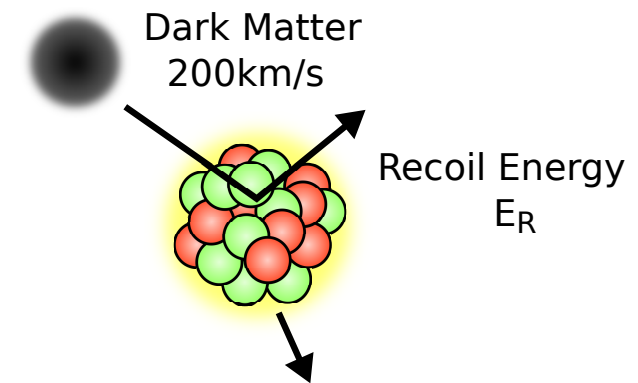
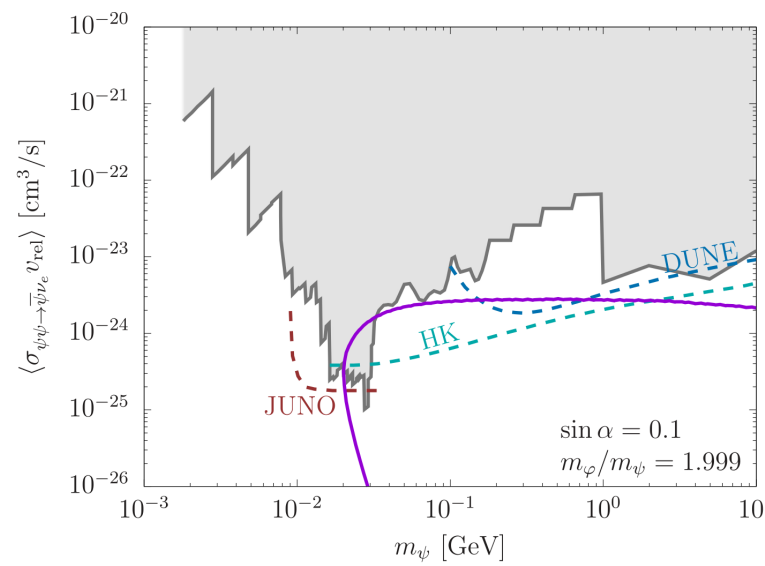
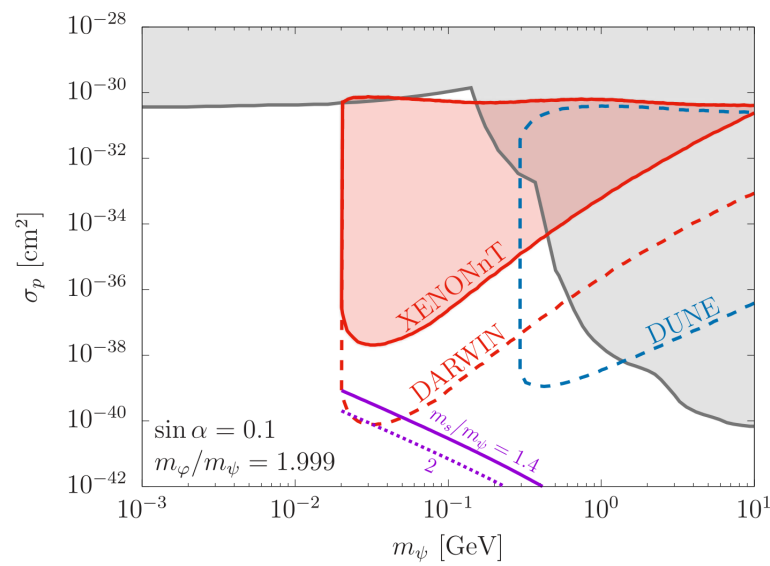
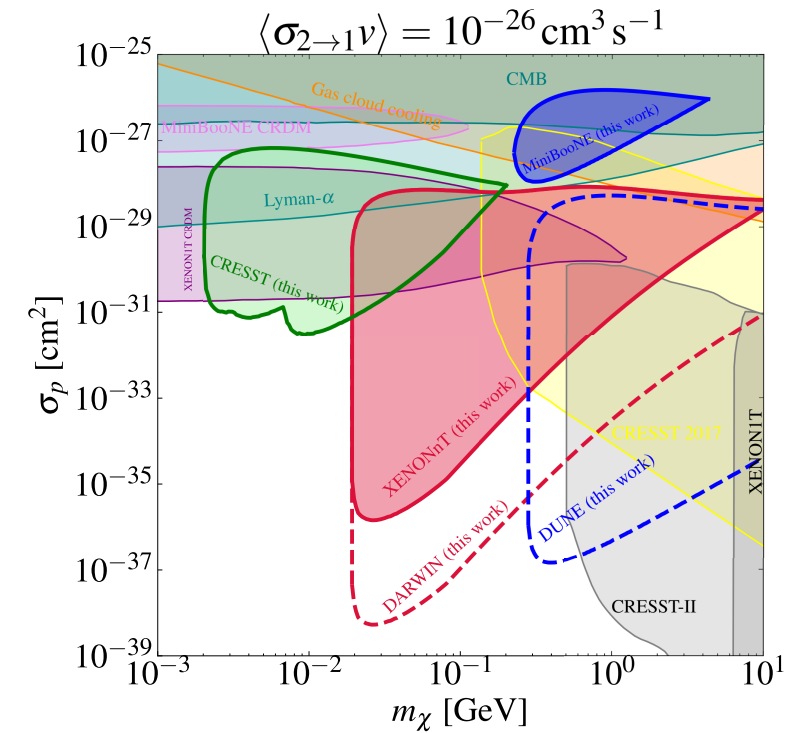
P1

Takashi Toma

A Radiative Neutrino Mass Model with Semi-annihilating Boosted Dark
Matter

Model building for Boosted DM

- Semi-annihilation: $\psi\psi \rightarrow \bar{\psi}\nu$ (ψ : DM)
- Boosted dark matter (BDM) can be detected through direct detection and neutrino experiments if $\sigma_p \gtrsim 10^{-38} \text{ cm}^2$.
- We embed BDM in a model with radiative neutrino masses.



- Both BDM and monochromatic ν can be detected at the same time.

P2

Yuki Honda

A Hodge-like Approach to Gauge Field Mode Expansion and Its
Relation to the CSDR Method in Non-Abelian Gauge Theory with an S^2
Extra Dimension

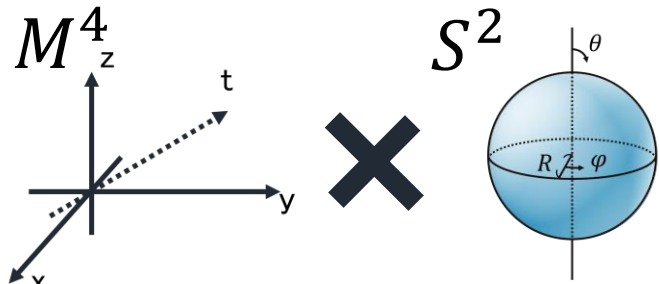
A Hodge-like Approach to Gauge Field Mode Expansion and Its Relation to the CSDR Method in Non-Abelian Gauge Theory with an S^2 Extra Dimension

Kento Asai^(a), Yuki Honda^(b), Joe Sato^(b), Kotraro Tanaka^(b), Yujiro Tuchiya^(b) (a)YITP, Kyoto Univ. (b)Yokohama Natl. Univ.

► Gauge theory on $M^4 \times S^2$ with a background field

- Setup: Six-dimensional spacetime

- Method: Hodge-”like” decomposition



- Gauge theory in the presence of Background:

$$A_M(X) \rightarrow A_M(X) + \langle A_M \rangle$$

$$= (A_\mu(X), A_\theta(X), A_\varphi(X) + \underline{\mu \cos \theta})$$

$$A = \underset{\substack{\text{1-form} \\ \text{gauge}}}{\tilde{D}^\dagger \Phi} + \underset{\substack{\text{0-form} \\ \text{physical scalar}}}{\tilde{D} \chi} + \underset{\substack{\text{0-form} \\ \text{NG boson}}}{h} + \underset{\substack{\text{1-form} \\ \text{Harmonic} \\ (\ni \text{CSDR solution})}}{\quad}$$



$$S_{\text{YM+gf}}|_{\text{quad}} = \int \Omega \text{Tr} \left[A_\mu (G^{\mu\nu} (\square - \mathbf{J}^2) + (1 - \frac{1}{\xi}) \partial^\mu \partial_\nu) A_\nu \right. \\
\left. \phi \square (\mathbf{J}^2 - \mathbf{J}^{2+} \hat{\mu}^2) \phi + (\mathbf{J}^2 \phi) (\mathbf{J}^2 \phi) - \phi (\hat{\mu}^2 \phi) \right. \\
\left. - \chi \square \mathbf{J}^2 \chi - \xi (\mathbf{J}^2 \chi) (\mathbf{J}^2 \chi) \right. \\
\left. - G^{\alpha\beta} h_\alpha \square h_\beta + i\mu \varepsilon^{\alpha\beta} [h_\alpha, h_\beta] \right]$$

P4

Sora Taniguchi

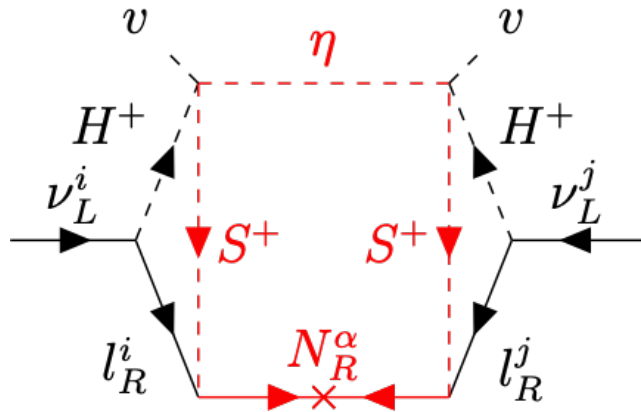
A three-loop radiative seesaw model for dark matter and baryon asymmetry

A three-loop radiative seesaw model for dark matter and baryon asymmetry

Sora Taniguchi (U. of Osaka)

Collaborator : M. Aoki(Kanazawa U.), K. Enomoto(NTU),
S. Kanemura(U. of Osaka)

13:40~ Meeting room P2



3-loop radiative seesaw

$$M_{ij} \sim \underbrace{\left(\frac{1}{16\pi^2}\right)^3}_{\sim 10^{-6}} \times \underbrace{\left(\frac{m_l}{v}\right)^2}_{\sim 10^{-4}} \times \frac{v^2}{m_N} < \text{eV}$$

Q. Can we explain ν mass, DM, BAU simultaneously at TeV scale?

→ We find the viable scenario on the 3-loop radiative seesaw model

ν mass	→	3-loop radiative seesaw
DM	→	WIMP ($m = 250 \text{ GeV}$)
BAU	→	Electroweak baryogenesis

We also discuss GW, collider signal in the model

P5

Min Gi Park

Beyond the Starobinsky model after ACT



YONSEI HEP-COSMO
High Energy Physics and Cosmology

Beyond the Starobinsky model after ACT

Min Gi Park · Dong Yeon Cheong · Seong Chan Park | Yonsei University

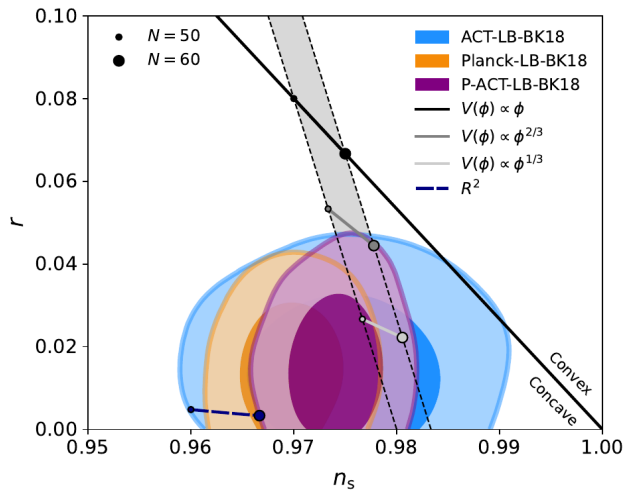
01 · NEW TARGET

ACT prefers a higher tilt

Starobinsky: $n_s \approx 0.965$

ACT DR6: $n_s = 0.975 \pm 0.005$

$\approx 2\sigma$ tension with pure R^2 inflation



ACT shifts the preferred region toward larger n_s .

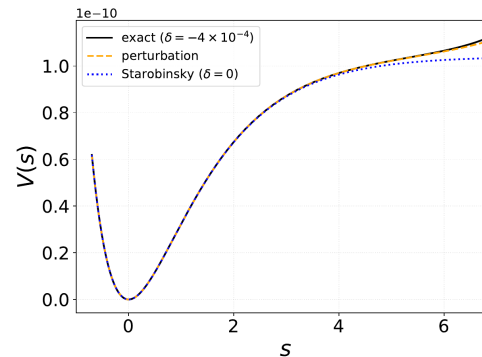
02 · MINIMAL DEFORMATION

Add a tiny R^3 correction

$$f(R) = R + \beta R^2/2 + \gamma R^3/3$$

$$\delta \equiv \gamma/\beta^2 \approx -10^{-4}$$

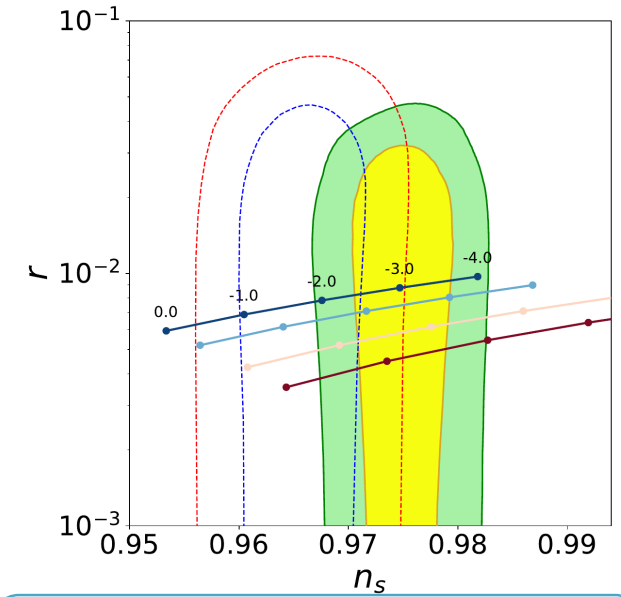
A small negative deformation gently tilts the Einstein-frame plateau: n_s moves upward while r remains small.



R^2 plateau (black) $\rightarrow$ slightly deformed R^2+R^3 plateau (blue)

03 · RESULT

ACT agreement restored



$$n_s \approx 0.975 \cdot r \approx 3 \times 10^{-3}$$

$$T_{\text{re}} \approx 5 \times 10^9 \text{ GeV} (w_{\text{eff}} = 0)$$

Negative δ restores the ACT-preferred spectral tilt.

A tiny negative R^3 correction reconciles Starobinsky inflation with ACT

P6

Ryusei Sato

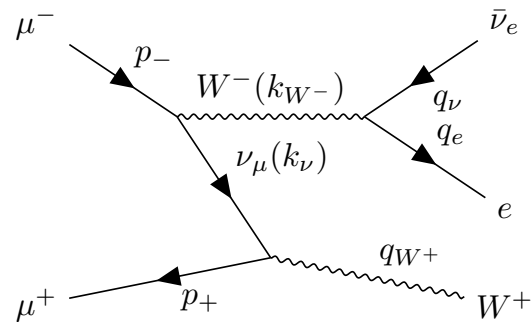
An Analytic Prescription for t-channel Singularities

An Analytic Prescription for t-channel Singularities

Ryusei Sato (Yokohama National University(YNU), RIKEN Nishina Center)

1. Problem

At a muon collider, the exchanged neutrino in the t-channel can go on-shell.



2. Why it's hard

s-channel

$$\frac{1}{p^2 - m^2 - im\Gamma}$$

Regularized by Γ

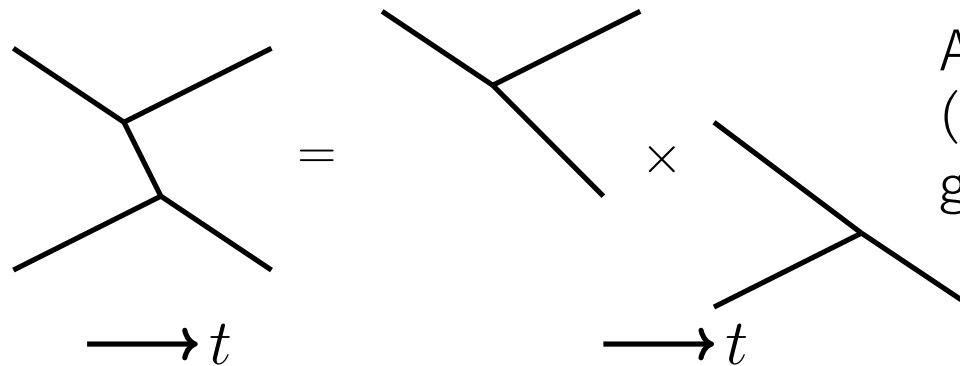
t-channel

$$\frac{1}{t^2}$$

$$\Gamma = 0$$

Can't be Regularized

3. Our idea



Analytically separate the on-shell (inverse decay) part from the genuine scattering part.

P7

Haruto Nakayama

Completely Natural SO(10) GUT

Completely Natural $SO(10)$ GUT

- Natural GUT[Maekawa, 2002] is the model that solves DT-splitting Problem and unrealistic GUT relations under the natural assumption that **all allowed terms in superpotential with $O(1)$ coefficients.**

Problem of Natural GUT

In Natural GUT, the conditions for

- realistic neutrino mass,
- gauge coupling unification

cannot be satisfied at the same time [Maekawa and Tanii, 2024]:

- In this work, we construct a new model that solves the above tension under the natural assumption.
- **Prediction of this model:**
 - Dim-6 proton decay is suppressed compared to the previous model.
 - While the dim-5 proton decay is enhanced.



Maekawa, N. (2002).

Gauge coupling unification with anomalous $U(1)(A)$ gauge symmetry.
Prog. Theor. Phys., 107:597–619.



Maekawa, N. and Tanii, T. (2024).

Tension between neutrino masses and gauge coupling unification in natural grand unified theories.
Phys. Rev. D, 109(9):095001.

P8

Kuan-Yen Chou

Analytic Study of Gravitational Waves from Bubble Collisions in a
Supercooled First Order Phase Transition

Analytic Study of Gravitational Waves from Bubble Collisions in a Supercooled First Order Phase Transition

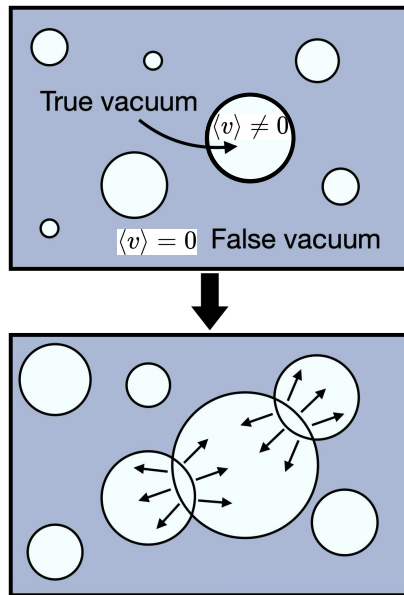
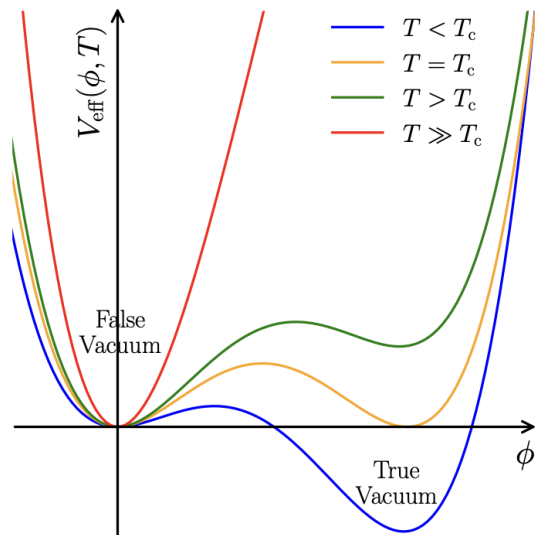


Jan Tristram Acuña^a, **Kuan-Yen Chou**^{b,*}, Po-Yan Tseng^{b,c}

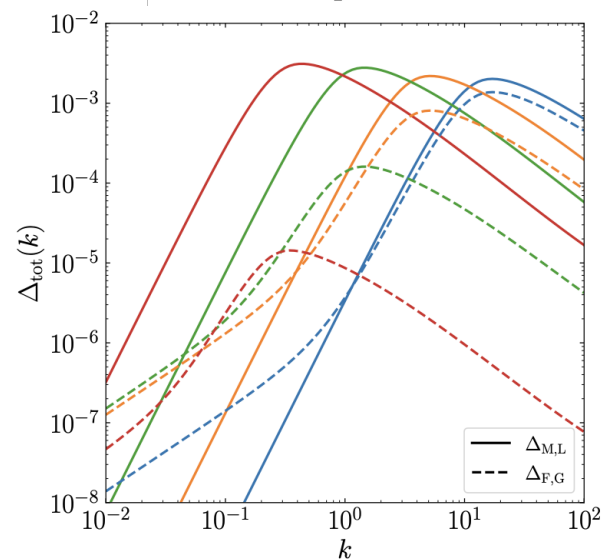
^a National Institute of Physics, University of the Philippines Diliman, Quezon City, Philippines

^b Department of Physics, National Tsing Hua University, Hsinchu, Taiwan

^c Physics Division, National Center for Theoretical Sciences, Taipei, Taiwan



This work: $\Gamma(\eta) = \Gamma_* \exp \left[\beta(\eta - \eta_*) - \frac{1}{2} \gamma^2 (\eta - \eta_*)^2 \right]$



$\Omega_{\text{GW}} \propto \Delta$

My poster number: P8

P9

Yu Min Yeh

Constraining memory-burdened primordial black holes with
graviton-photon conversion and binary mergers

Constraining memory-burdened primordial black holes with graviton-photon conversion and binary mergers

Eur. Phys. J. C (2026) 86:434, arxiv: 2511.01848

Memory burden effect: The PBH emission is suppressed to prevent significant entropy loss

We use the graviton converted photon signal to set constraint on PBH abundance, especially for mass $< 10^{15}$ g

Low mass PBH can live longer

We include the PBH merging scenarios in our analysis

Po-Yan Tseng, Yu-Min Yeh a.k.a. Corn Yeh (NTHU)

August 8, 2026

P10

Mohammad Aghaie

Anomaly-Free Axion-Like Particles

Anomaly-free Axion-like particles from Heavy Quarks

$$\mathcal{L}_{\text{eff}} = \cancel{\frac{a}{f_a} \frac{\alpha_s}{8\pi} G\tilde{G}} + \cancel{C_{a\gamma} \frac{a}{f_a} \frac{\alpha_{\text{em}}}{8\pi} F\tilde{F}} + \frac{\partial_\mu a}{2f_a} \sum_i C_i \bar{f}_i \gamma^\mu \gamma_5 f_i + \frac{\partial_\mu a}{2f_a} \sum_{i \neq j} \bar{f}_i \gamma^\mu (C_{ij}^V + C_{ij}^A \gamma_5) f_j$$

At $\Lambda_{EWSB} \ll E \ll \Lambda_{PQ}$, on the other hand, the Lagrangian can be written as

$$\mathcal{L} \supset \frac{\partial_\mu a}{f_a} \bar{\psi} \gamma^\mu X_\psi \psi$$

misalignment between the PQ basis and flavor basis

$$C_u^{V,A} = U_{u_R}^\dagger X_{u_R} U_{u_R} \pm U_{u_L}^\dagger X_{Q_L} U_{u_L},$$

$$C_d^{V,A} = U_{d_R}^\dagger X_{d_R} U_{d_R} \pm U_{d_L}^\dagger X_{Q_L} U_{d_L},$$

axions in SM decays

- Relic Abundance
 $b \rightarrow s(d) + a, \quad t \rightarrow c(u) + a$
- Precision Flavor Experiments
 $K \rightarrow \pi + a, \quad B \rightarrow K + a$
- SN1987A bound
 $\Lambda \rightarrow na, \quad N + N' \rightarrow N + N' + a$

I'm **Mohammad Aghaie** and I am a postdoc at **the University of Osaka**
 Please come find me in **room no.2, poster no. 10** if you are interested in the
 story of this family of DM candidates.

P11

Seishi Enomoto

Cosmological Constraints on a Scotogenic Model with an Asymmetric
Mediator

Cosmological Constraints on a Scotogenic Model with an Asymmetric Mediator

Poster: Seishi Enomoto (Kyu-san U.)

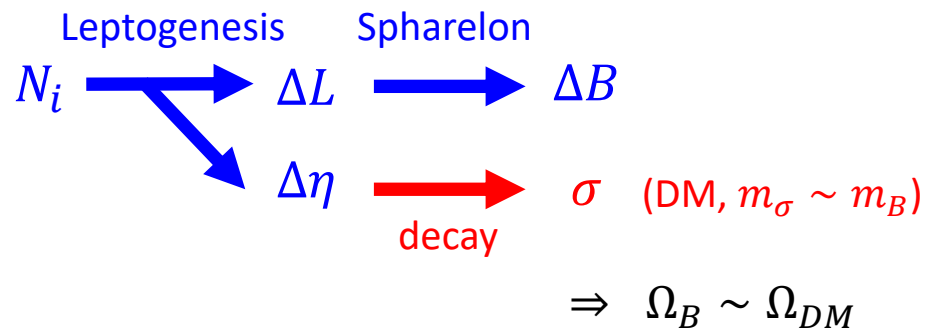


Collaborators: Kento Asai (YTIP), Takuya Hirose (Kyu-san U.), Masato Yamanaka (Hiroshima Inst. of Tech.)

Scotogenic Model with Asymmetric Mediator

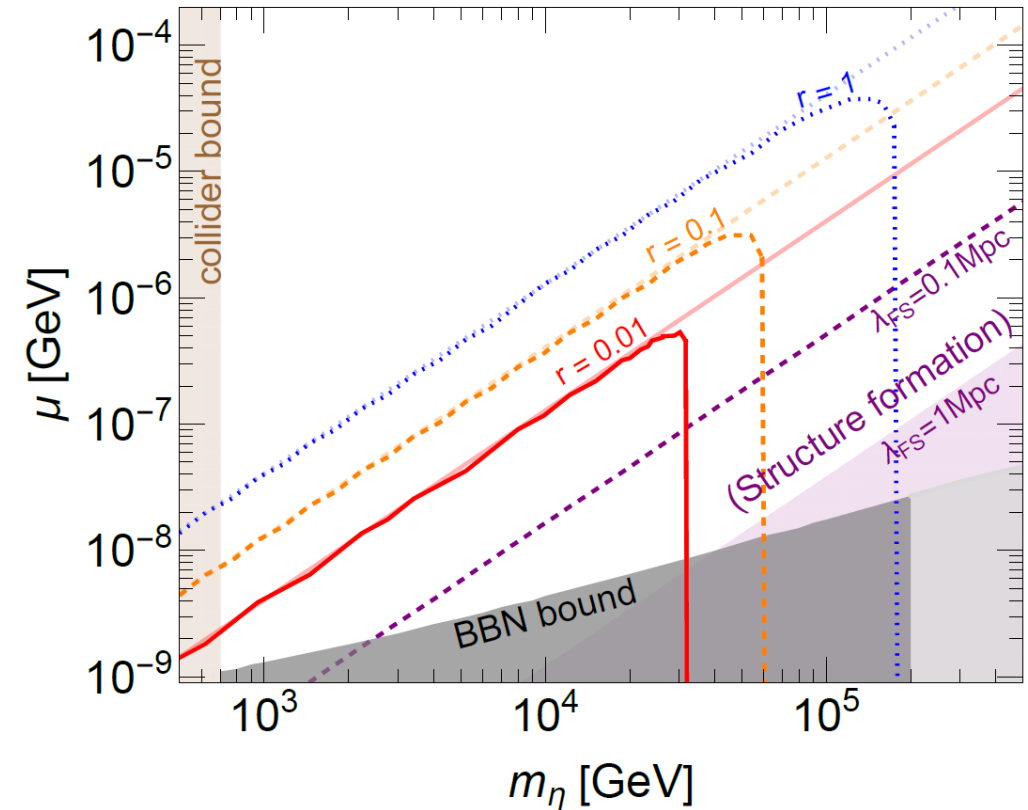
$$\boxed{\text{SM} + N_i + \eta + \sigma}$$

“RH ν ” “Asymmetric mediator” “DM”



Aim: Cosmological constraint on the parameter space

Cosmological Constraints



P12

Jeonghwan Park

Aspects of Sommerfeld Enhancement in the light of Halo gamma-ray
excess

Aspects of Sommerfeld Enhancement in the light of Halo gamma-ray excess



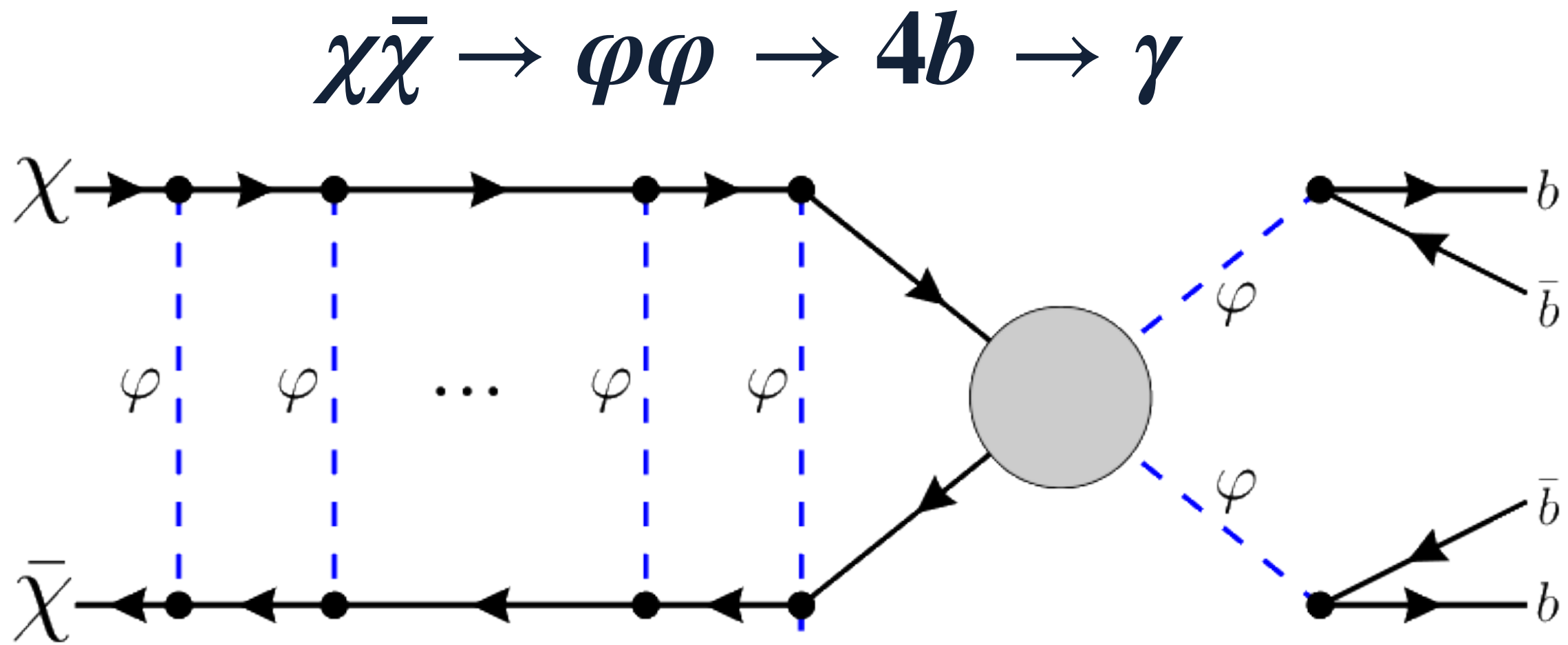
Y. Jho • J. Park • M. G. Park • S. C. Park

THE PUZZLE

The **20 GeV halo excess** requires: **HALO** $\sim 10^{-24} \text{cm}^3/\text{s}$

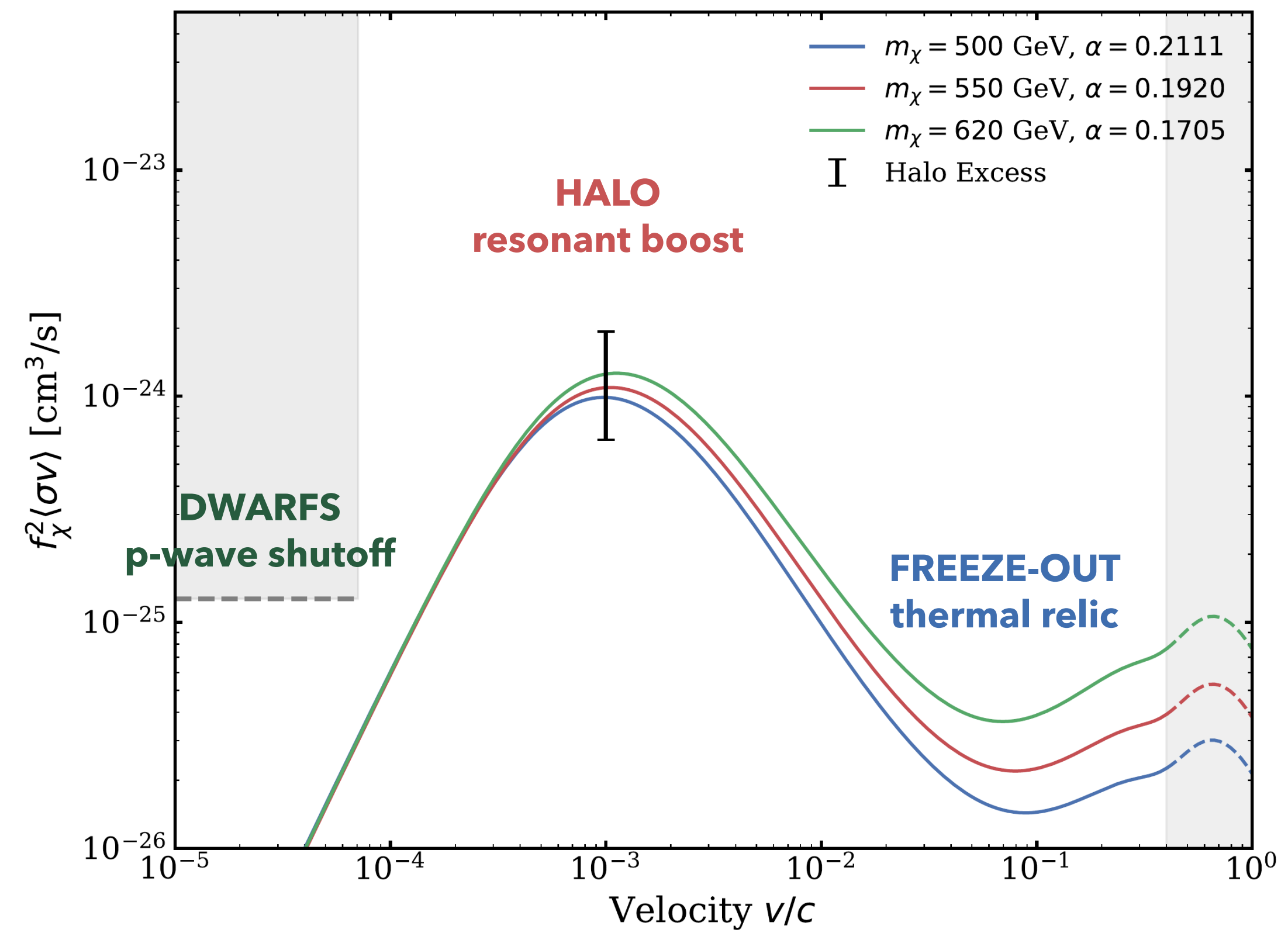
While, **Freeze-Out** requires: **FO** $\sim 10^{-26} \text{cm}^3/\text{s}$

THE MECHANISM



“p-wave suppression” $\times$ “resonant Sommerfeld enhancement” $\Rightarrow v^{-1}$ **Halo Boost** & v^2 **Dwarf Shutoff**

ONE CROSS-SECTION, THREE VELOCITY REGIMES



P13

Alice Savona

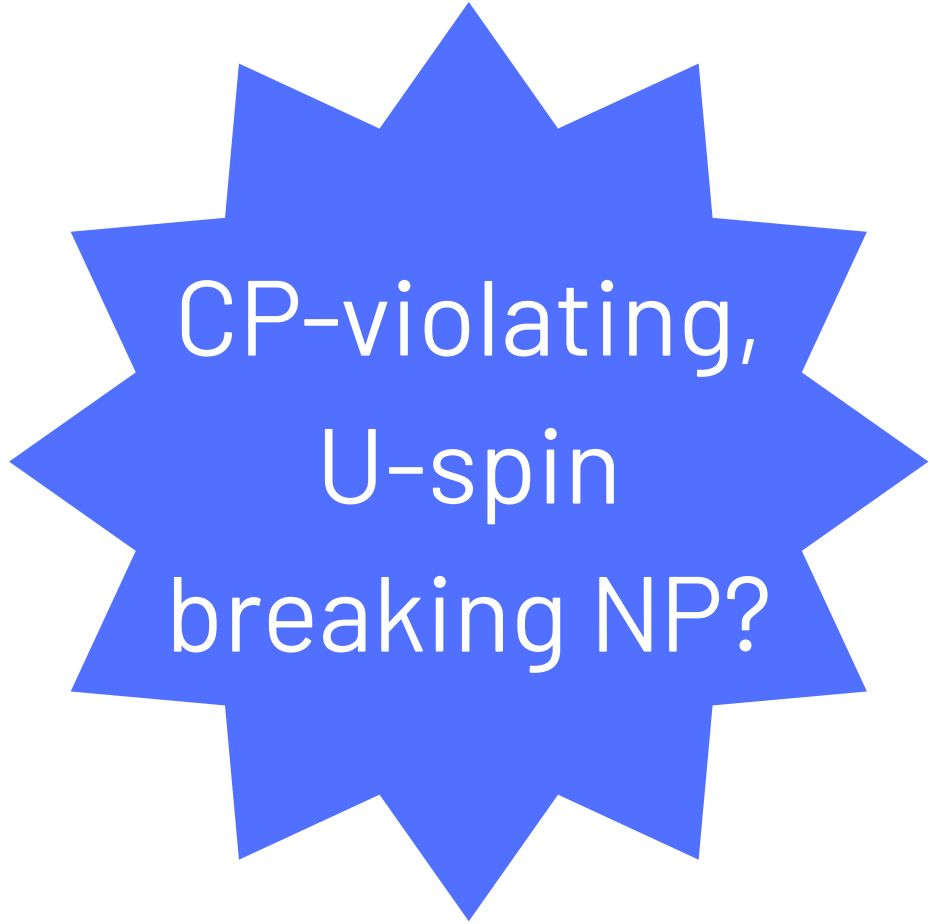
CP-violation in charm decays in BSM Models

CPV & charm physics in the 2HDM

Charm meson decays: $D^0 \rightarrow \pi^+ \pi^-$ & $D^0 \rightarrow K^+ K^-$

2019 LHCb: $\Delta A_{CP} \sim 10 \times \text{larger}$ than SM predictions

2023 Update: **U-spin violation** at 1.9σ



CP-violating,
U-spin
breaking NP?

Can a Toy 2HDM explain this AND evade
constraints from other flavor observables?

Alice Savona
EPFL & UTokyo

P14

Sean Patrick Kemp

Decaying MeV Scale Dark Matter, Gamma ray decays at e^-e^+ threshold.

Decaying MeV Scale Dark Matter

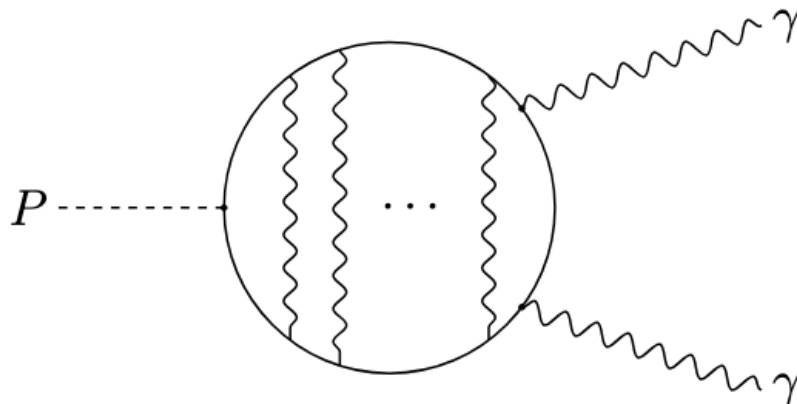
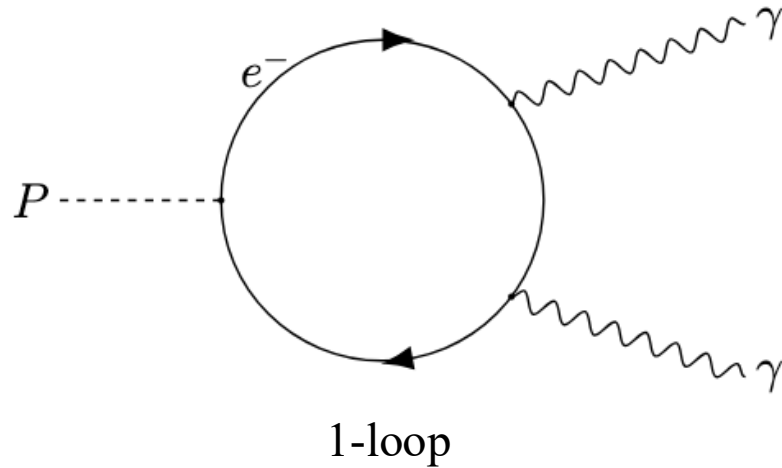
Gamma-ray decays at e^-e^+ threshold

poster
no.14

Sean Patrick Kemp (M2) at Kavli iPMU

Future MeV gamma-ray searches (e.g. **COSI**)
→ precision prediction of loop-induced DM decay

- Loop induced dark matter decay to photons
- DM mass is close to twice the electron mass ($m_P \sim 2m_e$)
→ repeated Coulomb interaction is non-negligible
- Coulomb ladder resummation
⇒ $\Gamma_{\text{ladder}} / \Gamma_{\text{1-loop}} \sim 1.1 !!$



ladder resummation

P15

Tamon Suehiro

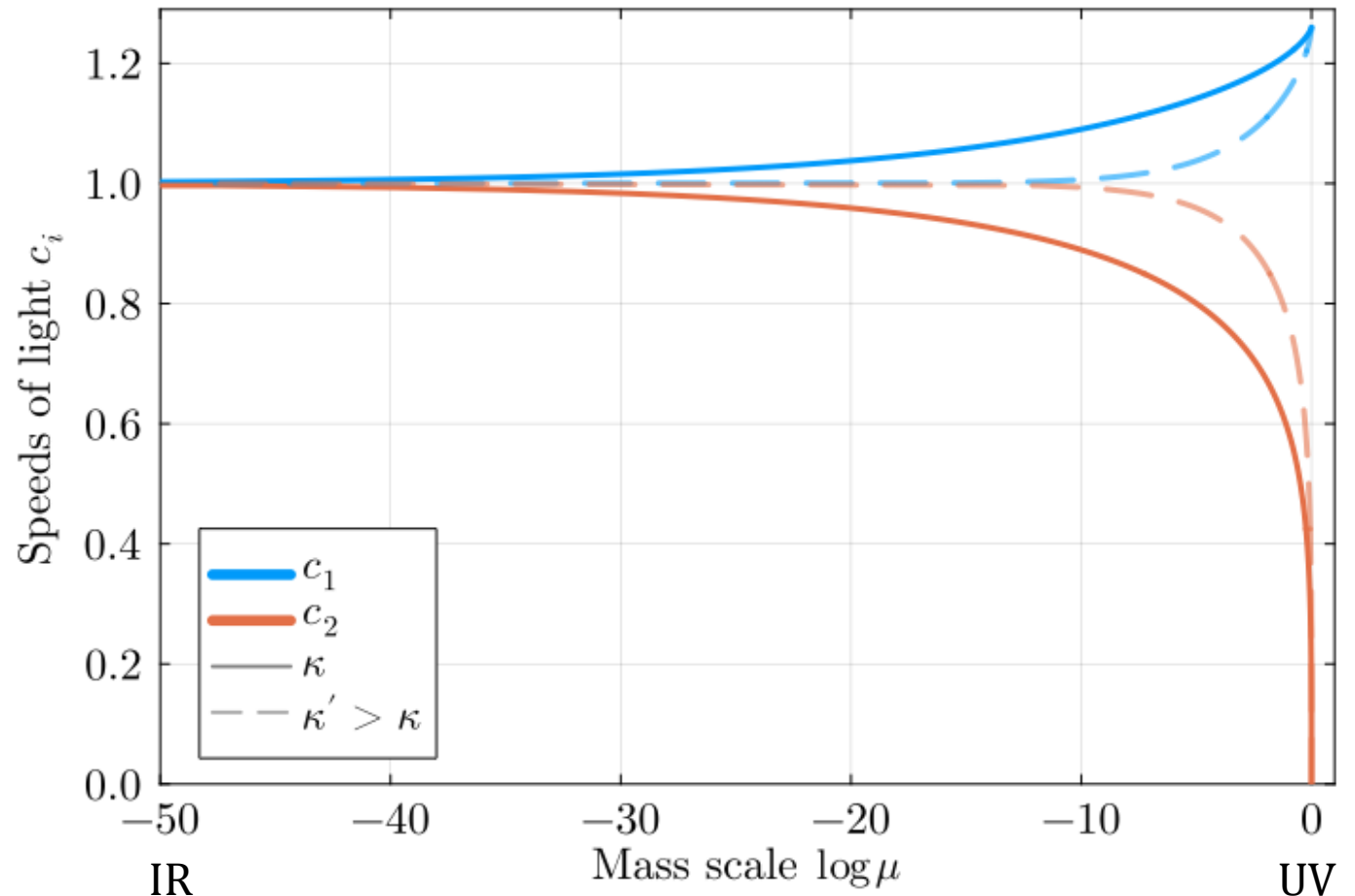
Different Speeds of Light and the Emergence of the Lorentz symmetry

Different Speeds of Light and the Emergence of the Lorentz symmetry

Tamon Suehiro (末広 多聞) Collaborators: Qiuyue Liang, Tom Melia



- Lorentz symmetry might not be fundamental
- Even if UV theory violates Lorentz symmetry, it can emerge in IR by RG equations.

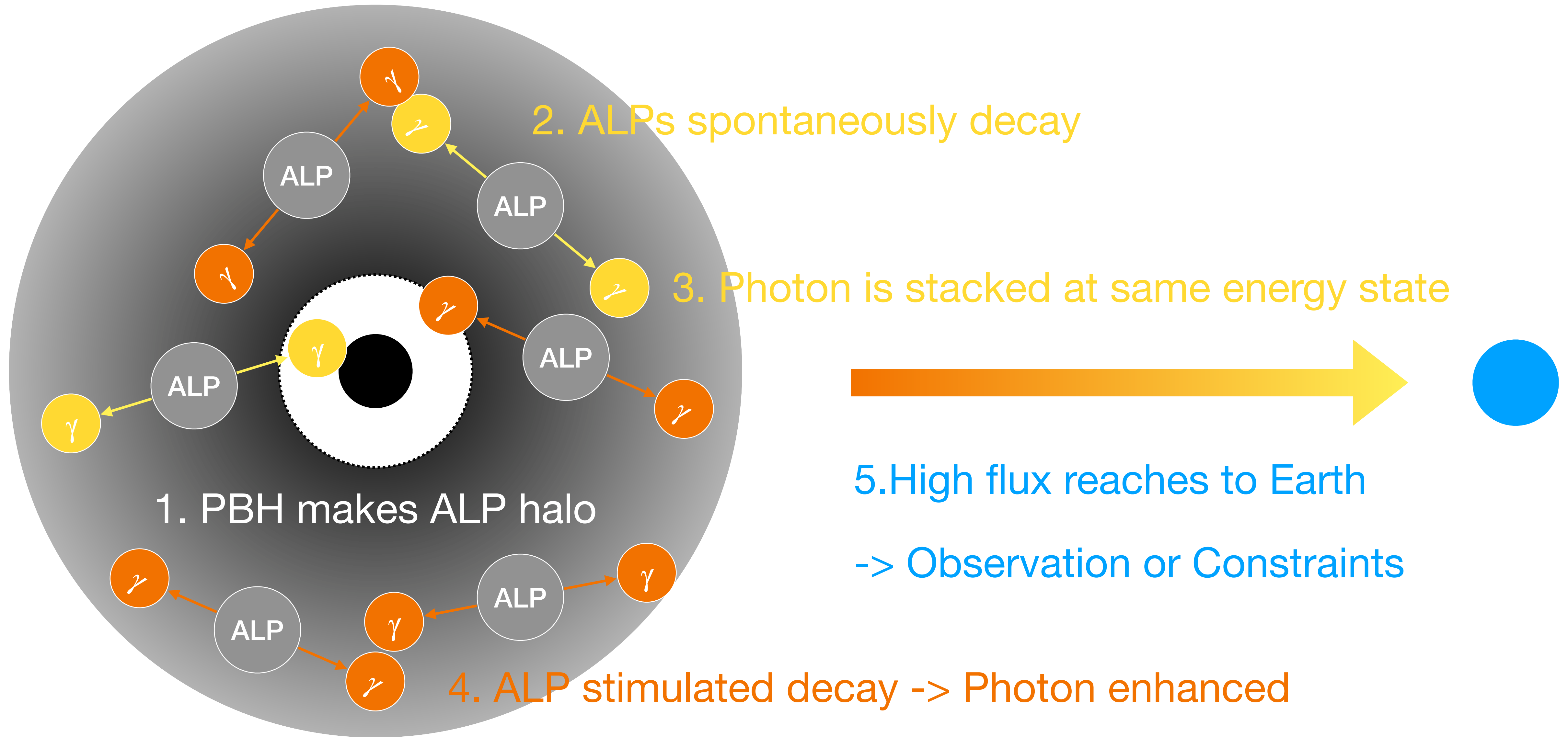


P16

Junghoon Joh

Electromagnetic signatures of axion dark matter halos around
primordial black holes

0. DM is PBH and ALP / ALPs interact with photon



P17

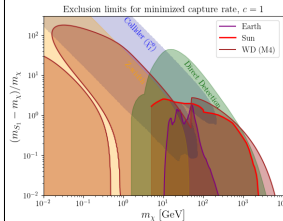
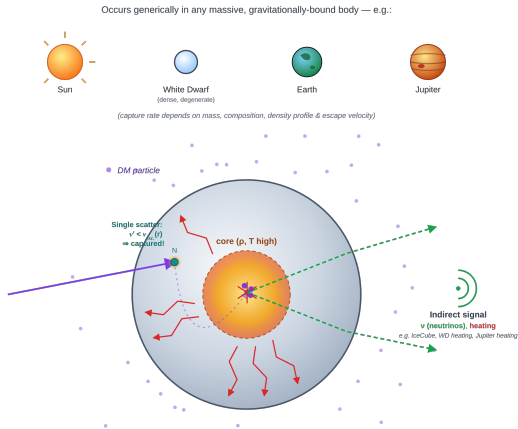
Merlin Reichard

Experimental signatures of dark matter electromagnetic interactions

Experimental signatures of dark matter electromagnetic interactions

spin-1/2 DM can have

1. millicharge
2. MDM
3. EDM
4. charge radius
5. anapole moment



P19

Jiayi Wu

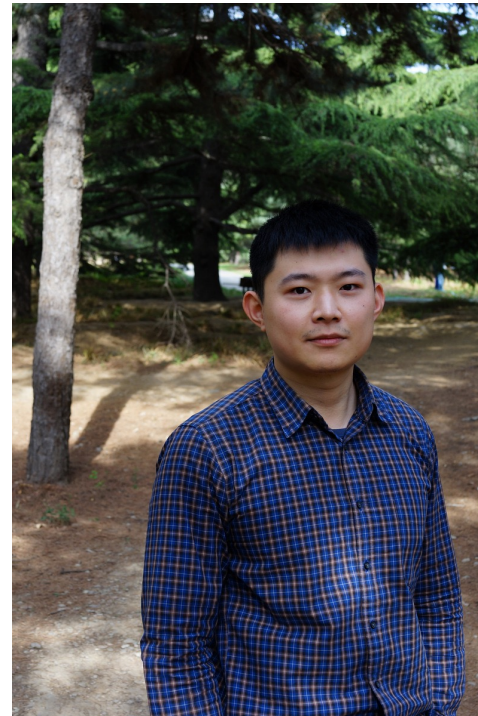
Fast and accurate AI-powered templates for the cosmological
bispectrum



Fast and accurate AI-powered templates for the cosmological bispectrum

Jiayi Wu^{1,2} (吴家毅) and Zhong-Zhi Xianyu^{1,3} (鲜于中之)

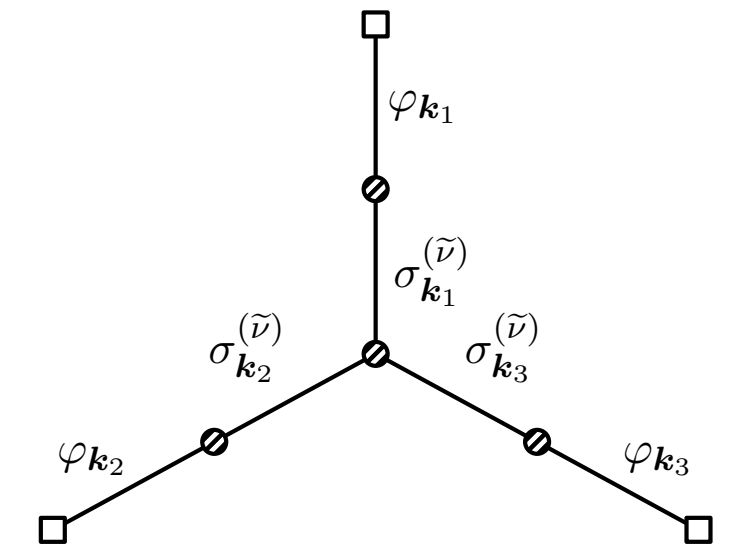
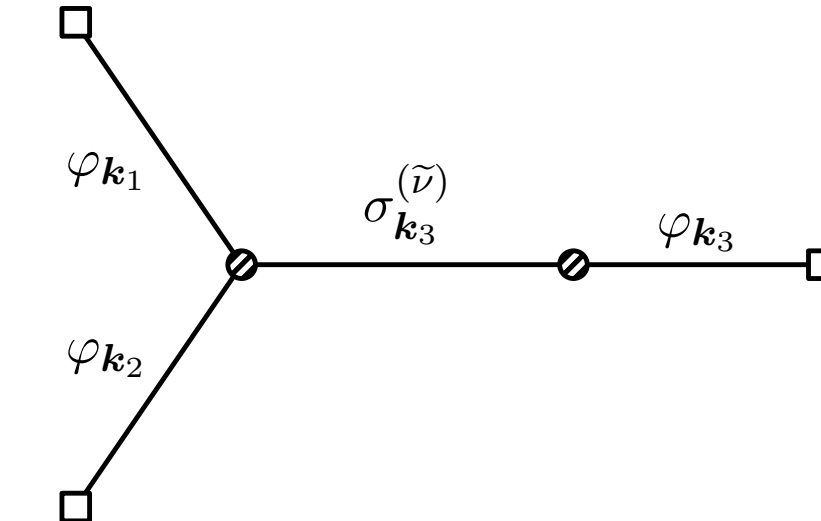
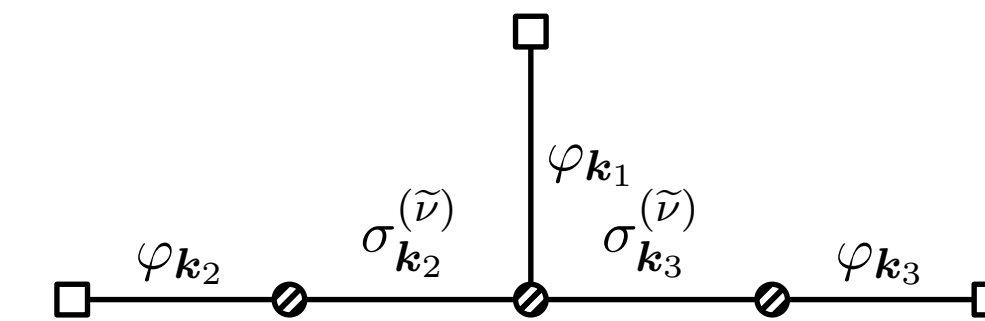
¹ Department of Physics, Tsinghua University, Beijing, China ² IBS CTPU-CGA, Daejeon, Korea ³ Peng Huanwu Center for Fundamental Theory, Hefei, Anhui, China



primordial bispectrum

Short analytical templates

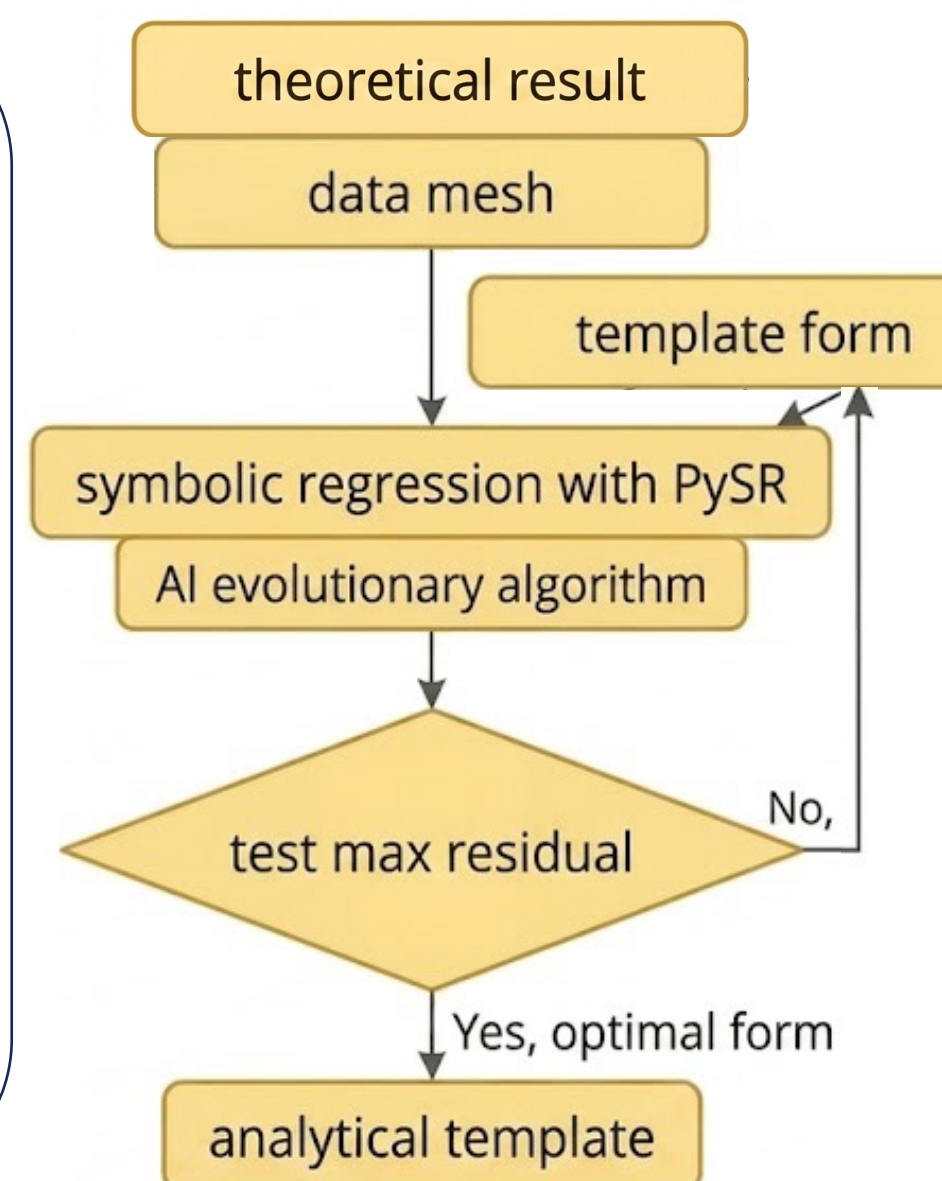
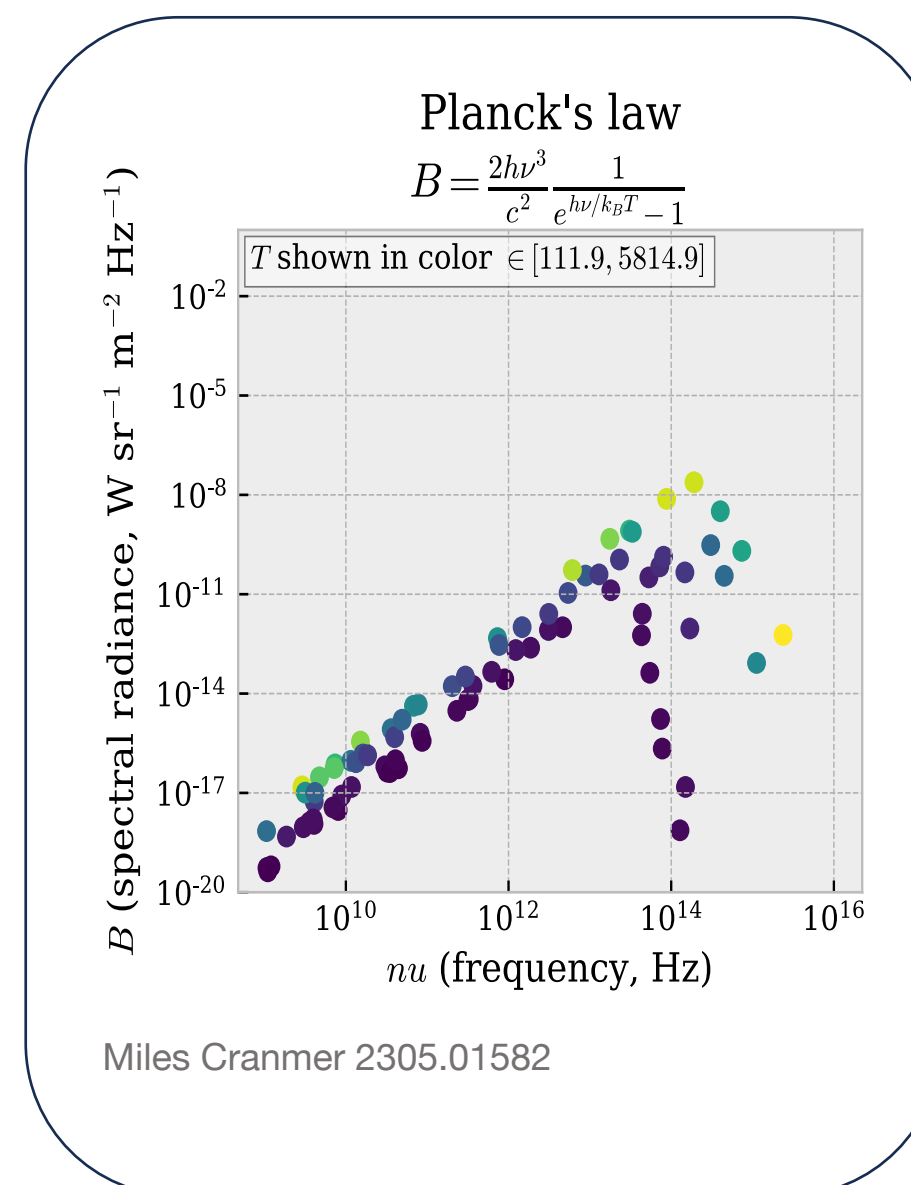
Elementary functions only



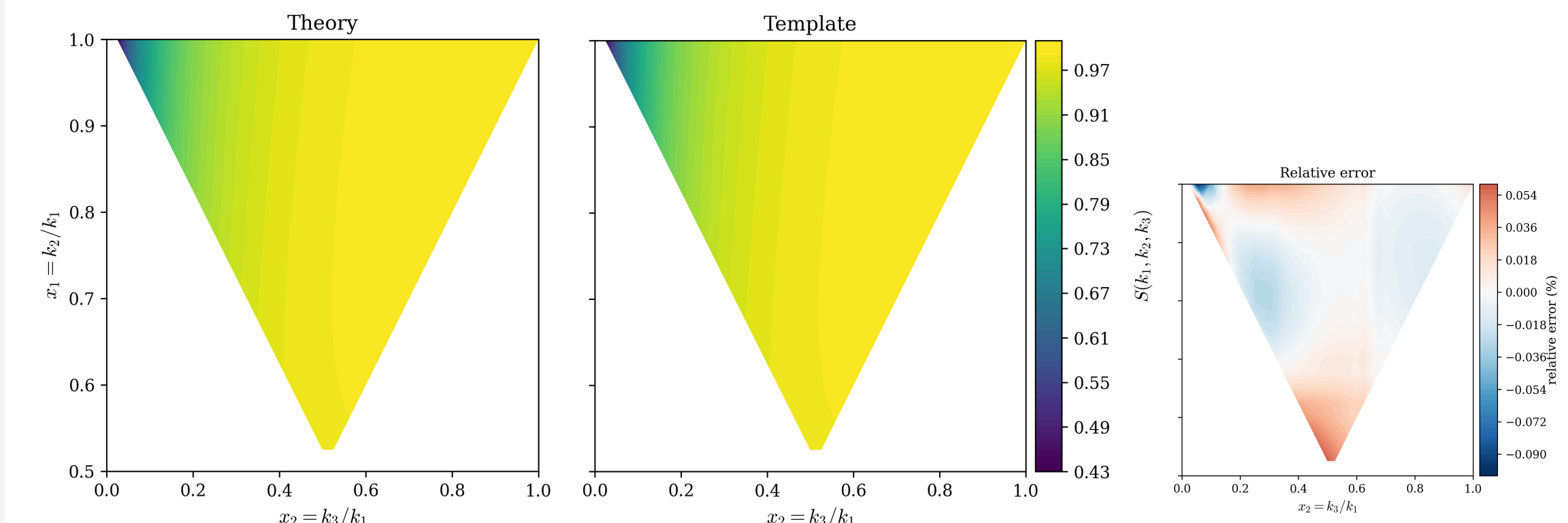
Current bottleneck

- Special functions everywhere.
- The $\mathcal{O}(l_{\max}^5)$ complexity.
 9.7×10^{16} operations for Planck.
- $N \sim 5000$ terms templates.

PySR AI



Analytical templates



Example for triple exchange

$$f_1(x) = (\sqrt{x} \cdot (\tan((((x + ((x^2) \cdot 0.89286))/(x + 0.68367)) \cdot x)/(x + 0.125786)) - 0.812811) \cdot 0.203843)/x,$$

$$f_2(x) = \sqrt{((x + (x \cdot (0.89407 \cdot x)))/(x + 0.686425))/(x + 0.124606)}.$$

wu-jy22@mails.tsinghua.edu.cn
zxianyu@tsinghua.edu.cn



2 to 4 terms

$\lesssim 1\%$ error

0.1 s evaluation time

speed up signal searches

P20

Fukutaro Miya

Generalization and UV completion of Cho-Maison monopole

The Standard Model contains a **Cho–Maison monopole**

(Built from the electroweak sector, it is an electroweak monopole.)

If we regard this monopole as a physical object,
its energy diverges at the spatial origin.

$$E_0 \propto \int_L^\infty \frac{dr}{r^2}$$

$\frac{1}{L}$: cutoff scale

For $E > \frac{1}{L}$, the Standard Model is no longer valid.

 What is the Cho–Maison monopole's **high-energy theory**?

= We seek the Standard Model's **UV completion**.

Our work: We propose **a concrete UV completion for the Cho–Maison monopole**.

P21

Takumu Yamanaka

Forbidden Dark Matter with Sommerfeld Enhancement

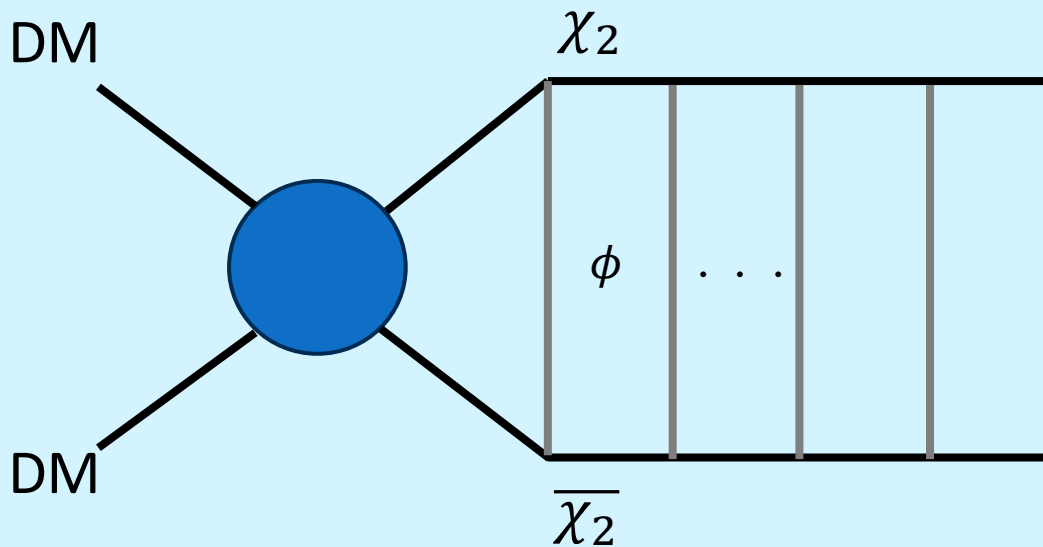
Forbidden Dark Matter with Sommerfeld Enhancement

Takumu Yamanaka



THE UNIVERSITY OF OSAKA

Collaboration with Tomohiro Abe (Tokyo U. Sci.) and Ryosuke Sato (UOsaka) [[arXiv: 2603.02647](#)]



Come to my poster **P21!**

- **Sommerfeld enhancement (SE)** plays an important role for DM annihilation.
- If annihilation products $\chi_2, \bar{\chi}_2$ are heavier than DM (forbidden DM), SE can also arise from the final-state particles.
→ **Final-state SE**
- We formulate the final-state SE with the decay width of $\chi_2, \bar{\chi}_2$.
- Resonances of bound states of $\chi_2, \bar{\chi}_2$.

P22

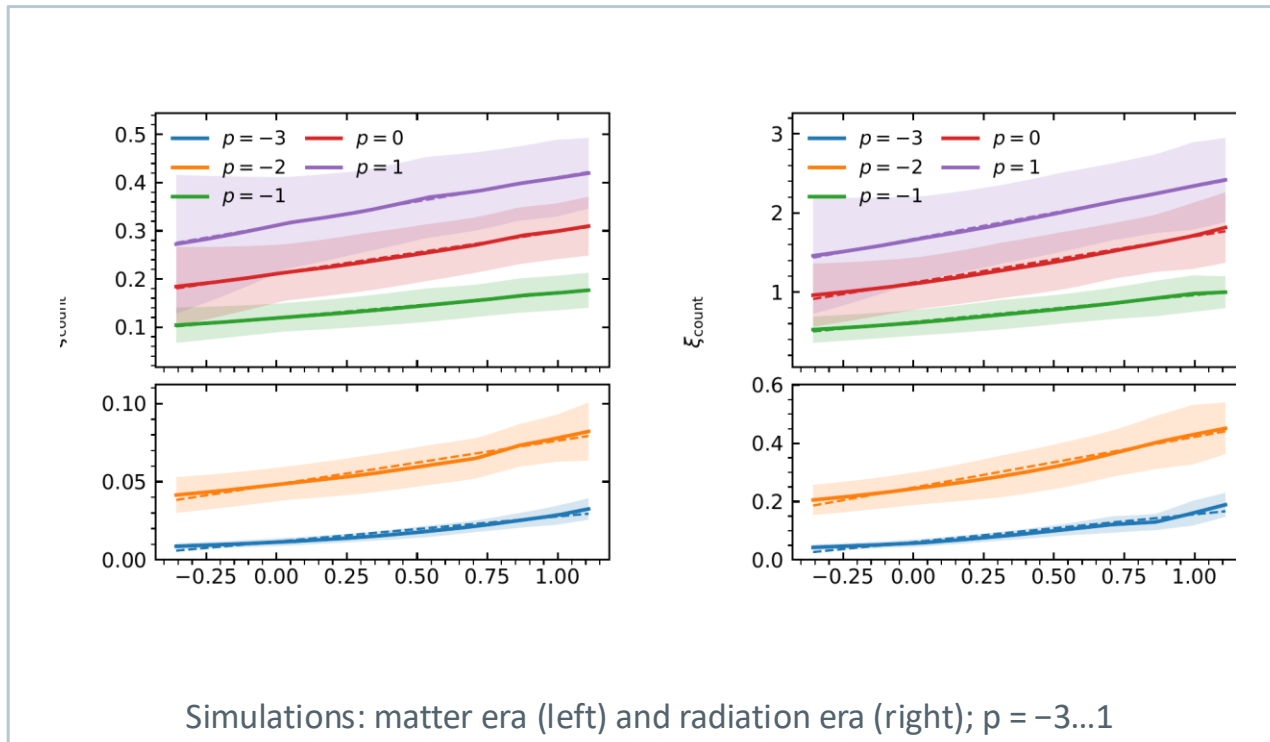
Wakutaka Nakano

Hidden monopoles

Monopole Scaling Is Not Constant

A slow abundance drift strengthens PBH and GW signals

Wakutaka Nakano · Daiki Aburatani · Wen Yin | Tokyo Metropolitan University



Monopoles per Hubble volume keep growing.

$$\xi_{\text{count}}(\eta) = A_{30} + B \log(\eta/30)$$

$$\gamma \approx 0.5$$

fractional
response
for blue spectra

$$v \gtrsim 0.1 M_{\text{pl}}$$

rare Hubble patches
can collapse into PBHs

Same formation epoch $\Rightarrow$ broad PBH masses + correlated GW frequencies

SMOKING GUN

If gauge screening ends scaling, O(10)% of the PBHs may retain magnetic charge — and the magnetic force can rival gravity.

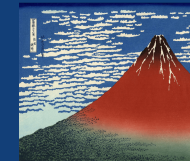
P23

Ui Min

Geometric searches for displaced vertices

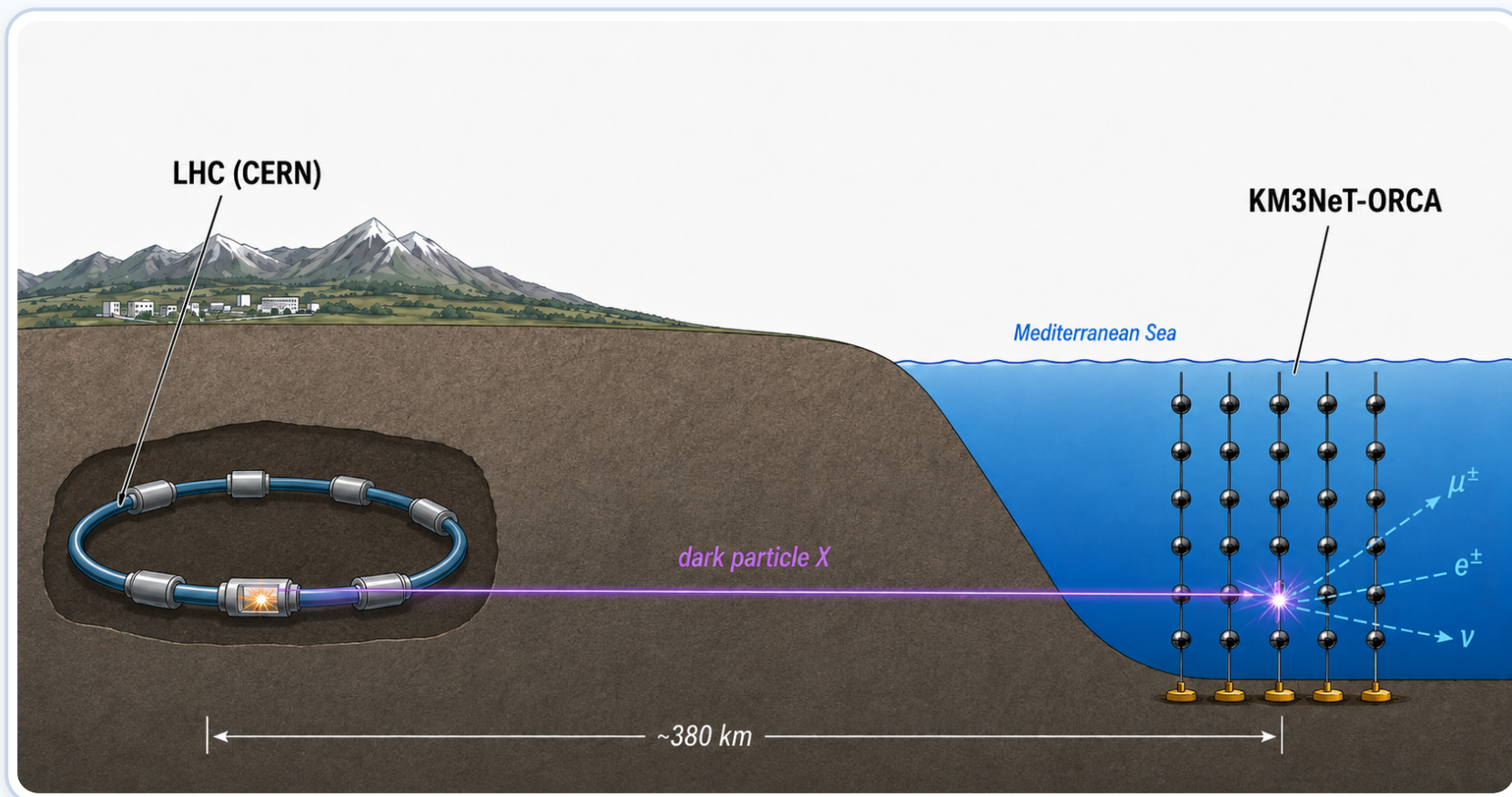
Geometric Search for Displaced Vertices: KM3Net meets the LHC

UI MIN | TOKYO METROPOLITAN UNIVERSITY



Introduction

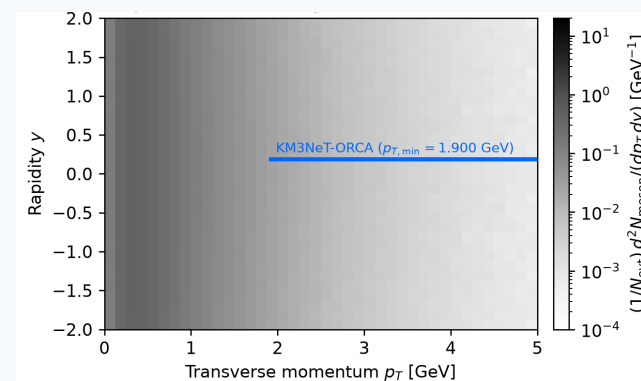
- Long-lived particles (LLP) produced from rare meson decays in the LHC with decay lengths of $\lambda_X = 10^2 - 10^3$ km decay inside a far-away large volume detector (KM3NeT-ORCA).
- With timing and directional information, this displaced vertex can probe currently unexplored regions of parameter space.



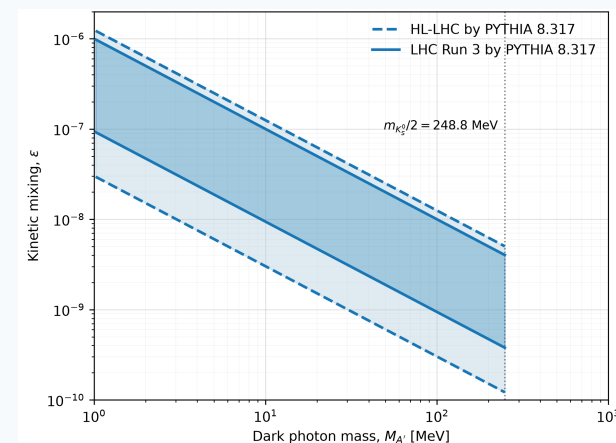
Observed N in the ORCA

$$N_{\text{meson}}^{\text{LHC}} \times \text{BR}_{\text{inv}} \times \frac{V_{\text{eff}}^{\text{ORCA}}}{\Delta\Omega e L^3} \times \text{BR}_{X \rightarrow \text{vis}} \epsilon_{\text{rec}}^{\text{ORCA}}$$

K_S^0 Benchmark, $\text{BR}_{\text{inv}} \simeq 8 \times 10^{-4}$



Ex) dark photon scenario



P24

Jeonghak Han

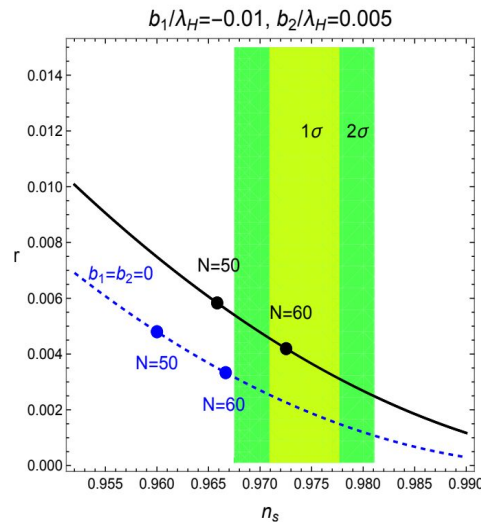
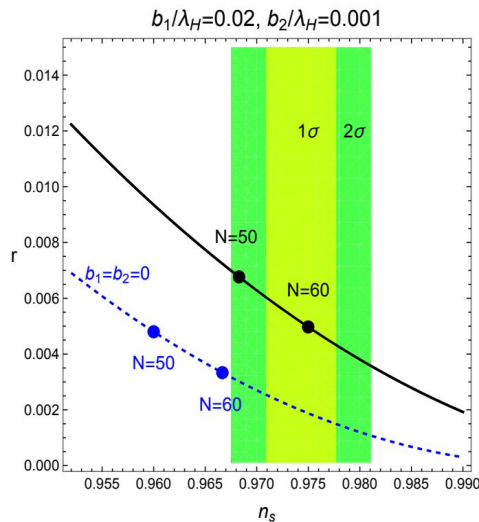
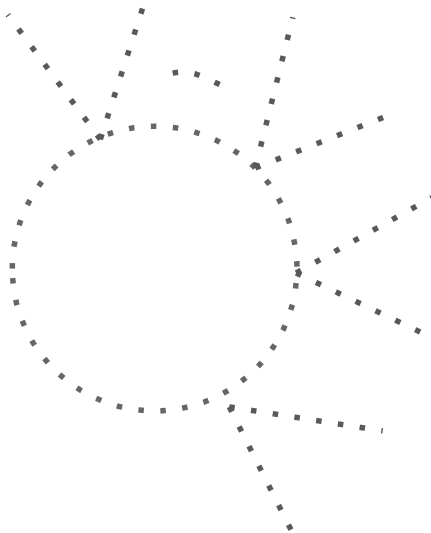
Higgs like inflation in light of ACT data

Higgs like pole inflation in light of the ACT (Jeonghak Han)

$$\frac{\mathcal{L}_J}{\sqrt{-g_J}} = -\frac{1}{2}M_P^2 \Omega(H) R(g_J) + |D_\mu H|^2 - V_J(H) \quad V_J(H) = c_m \Lambda^{4-2m} |H|^{2m} \left(1 - \frac{1}{3M_P^2} |H|^2\right)^2$$



$$\frac{\mathcal{L}_E}{\sqrt{-g_E}} = -\frac{1}{2}M_P^2 R(g_E) + \frac{|D_\mu H|^2}{\left(1 - \frac{1}{3M_P^2} |H|^2\right)^2} - \frac{1}{3M_P^2 \left(1 - \frac{1}{3M_P^2} |H|^2\right)^2} \left(|H|^2 |D_\mu H|^2 - \frac{1}{4} \partial_\mu |H|^2 \partial^\mu |H|^2 \right) - V_E(H)$$



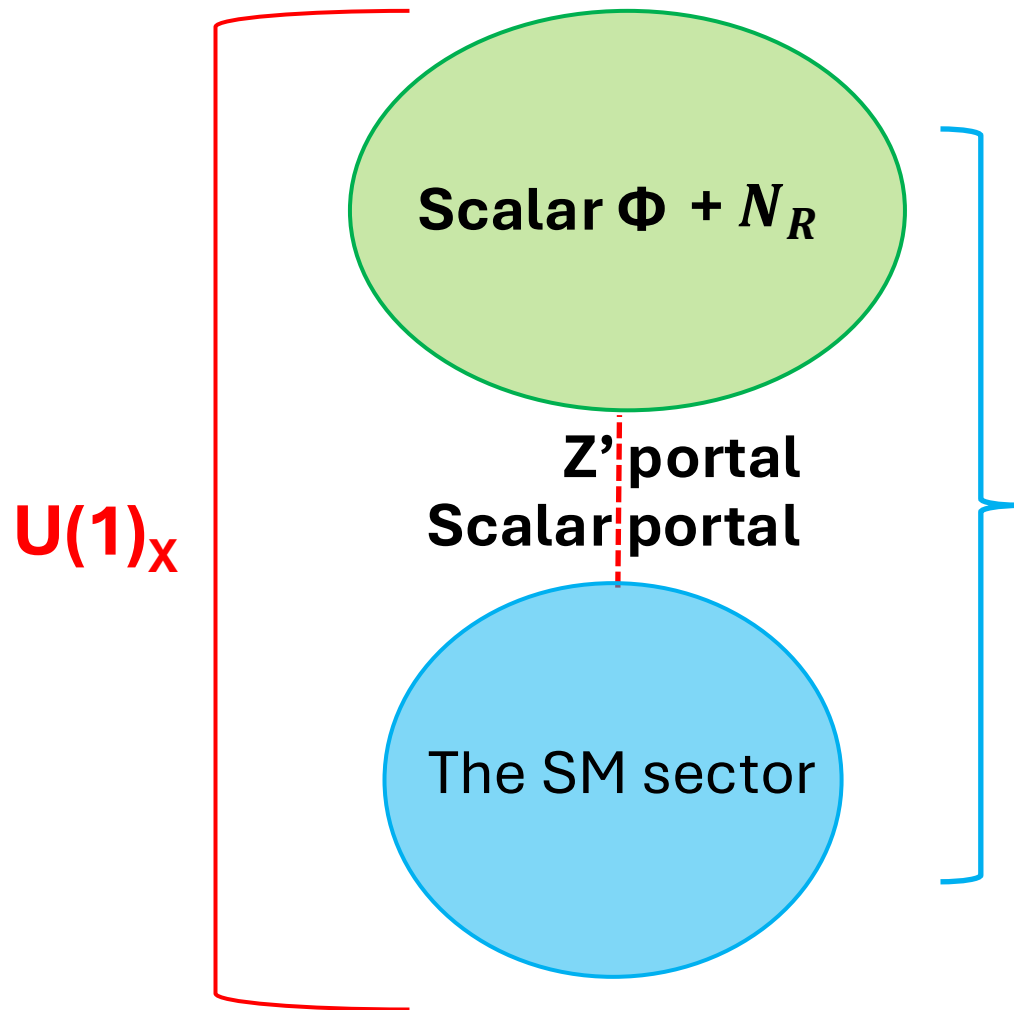
P25

Takaaki Nomura

Lepton number violation signals via Higgs/Z decays into a pair of
right-handed neutrinos

Lepton number violation signals via Higgs/Z decays into a pair of right-handed neutrinos

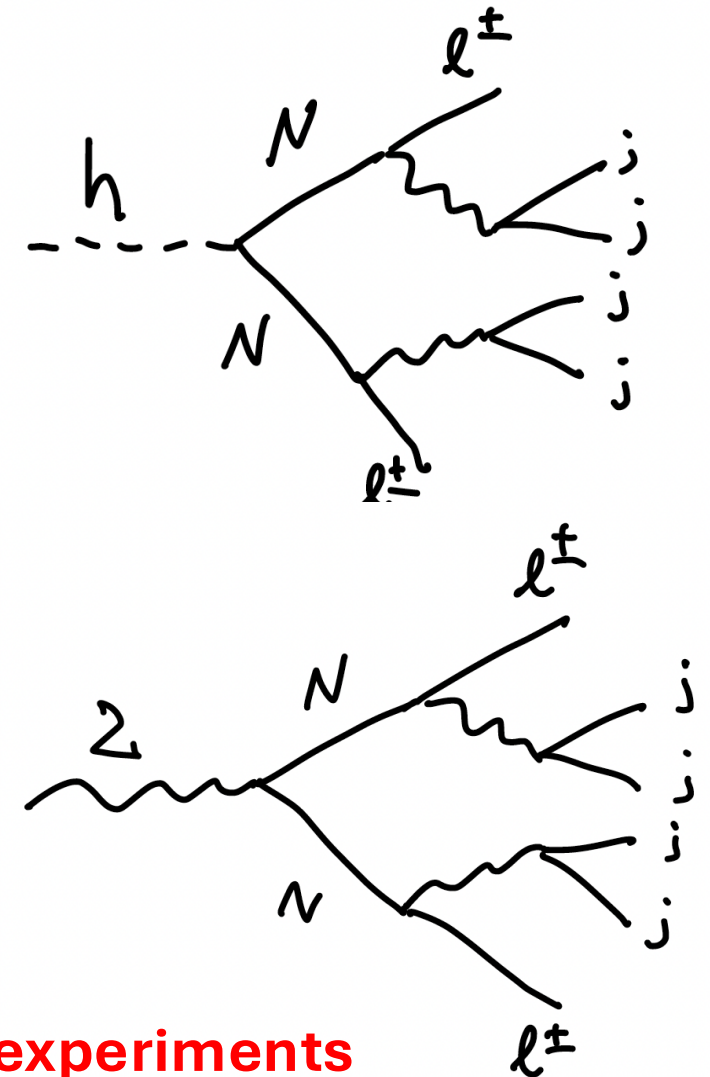
A spontaneously broken $U(1)_X$ model



Signals of N_R
via
Scalar mixing
&
Z-Z' mixing



Lepton number violation signals



Test of the signals at current/future collider experiments

Takaaki Nomura (Sichuan University)

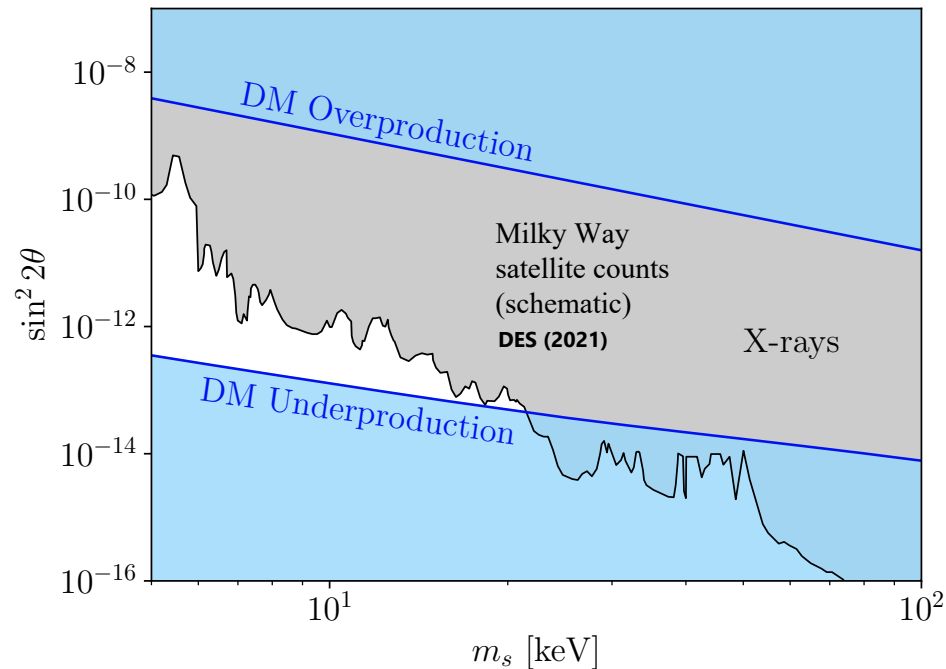
P27

Kensuke Akita

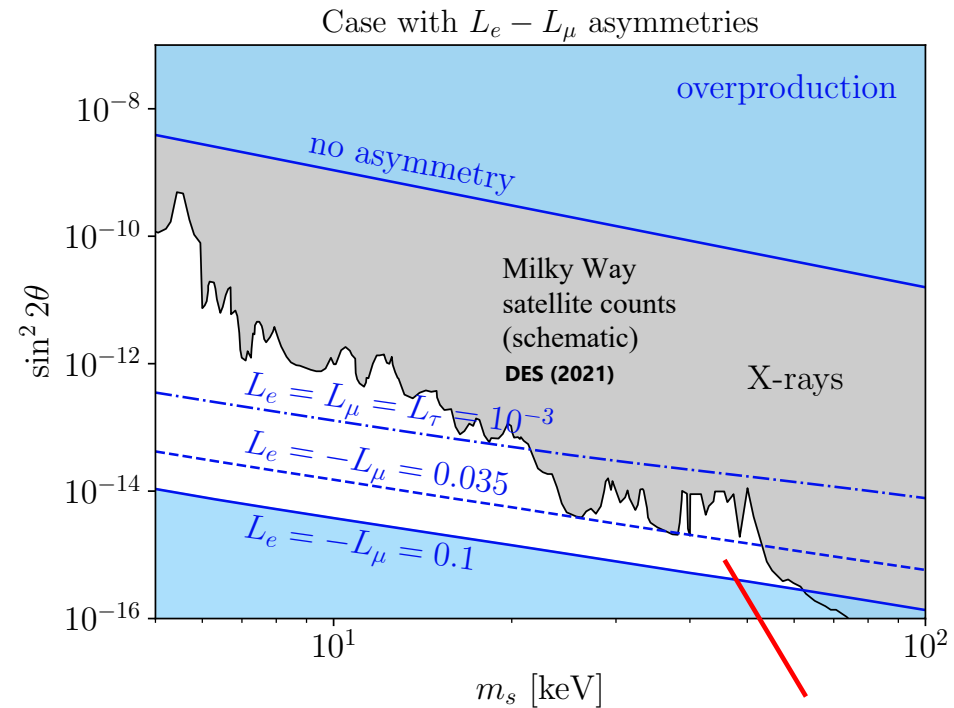
Maximal parameter space of sterile neutrino dark matter with lepton asymmetries

Maximal Parameter Space of Sterile Neutrino Dark Matter with Lepton Asymmetries

[K. Akita, K. Hamaguchi, M. Ovchinnikov, Phys. Rev. Lett. 136 \(2026\) 11, 111001 \[2507.20659\].](#)



Adapted from DES collaboration [arXiv:2008.00022]



Newly opened space may be testable by future X-ray, structure formation and CMB searches!

- Some simple models of sterile neutrino dark matter are (almost) excluded...
- We showed large lepton flavor asymmetries with vanishing total lepton asymmetry open a new parameter space as in the right figure!

P28

Subaru Fujisawa

MeV-Scale Majoron Dark Matter and Future Detection Prospects with
COSI

MeV-Scale Majoron Dark Matter and Future Detection Prospects with COSI

Subaru Fujisawa, First-year PhD student, The University of Tokyo

Question

Is there a well-motivated mechanism that explains the majoron mass?



Model

Discrete gauged $\mathbb{Z}_N \Rightarrow$ theoretically controlled majoron mass
For $\mathbb{Z}_7$, the majoron has a mass in the MeV range



Detection

COSI is expected to probe most of our scan region.

P29

Haruto Kitagawa

Minimal Majoron Dark Matter

- Majoron : pNG boson from global $U(1)_{B-L}$ breaking (c.f. RHN mass)

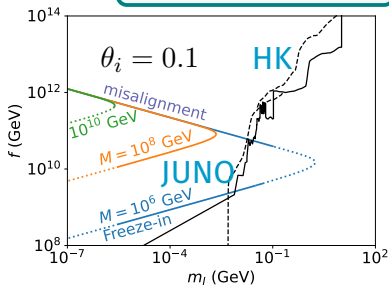
$$\begin{aligned} \mathcal{L} \supset & i\bar{N}_i \not{\partial} N_i + |\partial_\mu \sigma|^2 - V(\sigma) \\ & - \left[\frac{1}{2} g_i \sigma \bar{N}_i^c N_i + y_{\alpha i} \bar{L}_\alpha \tilde{H} N_i + \text{h.c.} \right] \end{aligned}$$

- Production via freeze-in and misalignment for Majoron DM
- Constraints from ν, q, l, γ
- JUNO and HK can probe our model.
- Consistency with leptogenesis

↑ Motivation

Seesaw

- neutrino mass
- Baryon asymmetry (Leptogenesis)



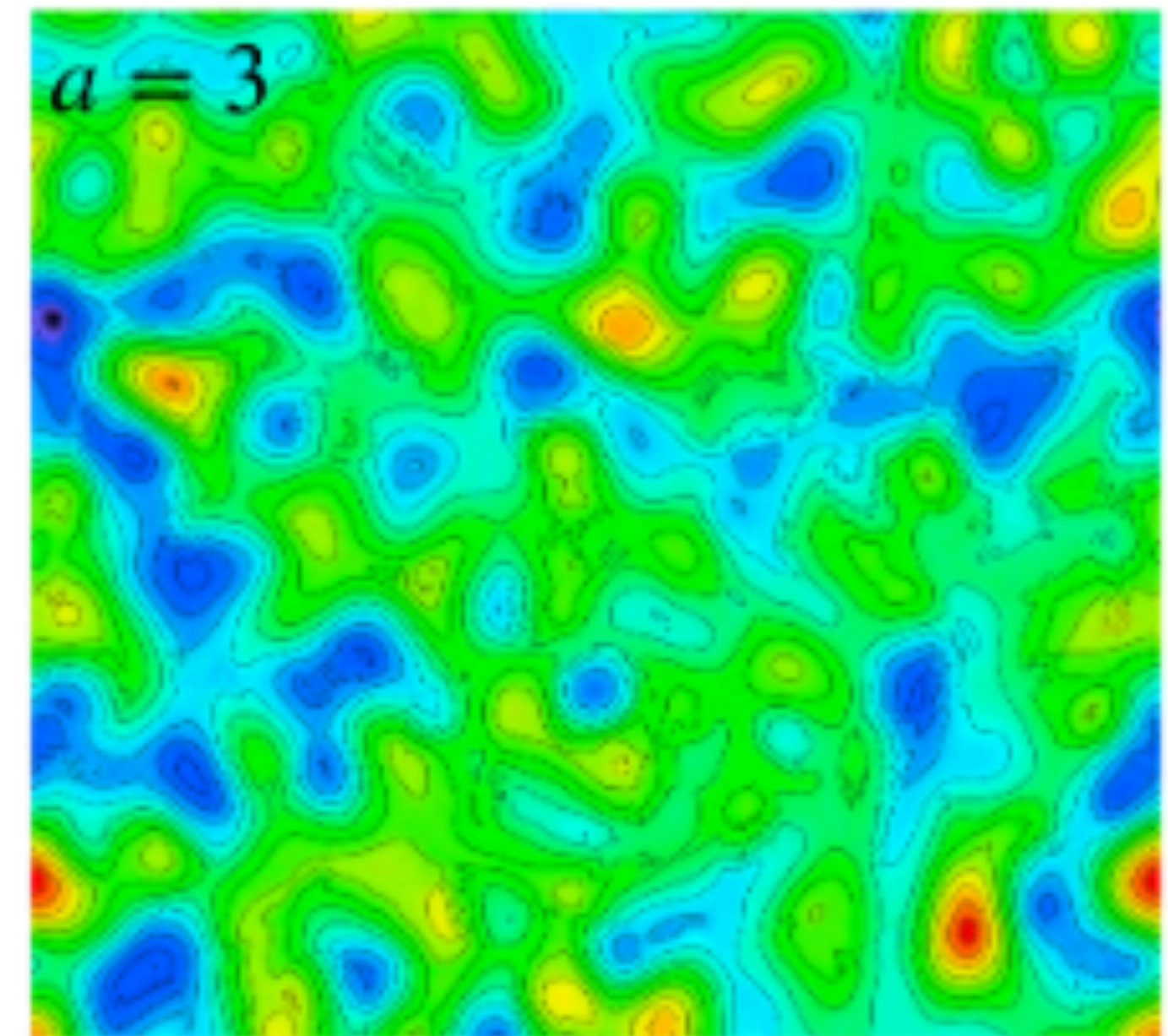
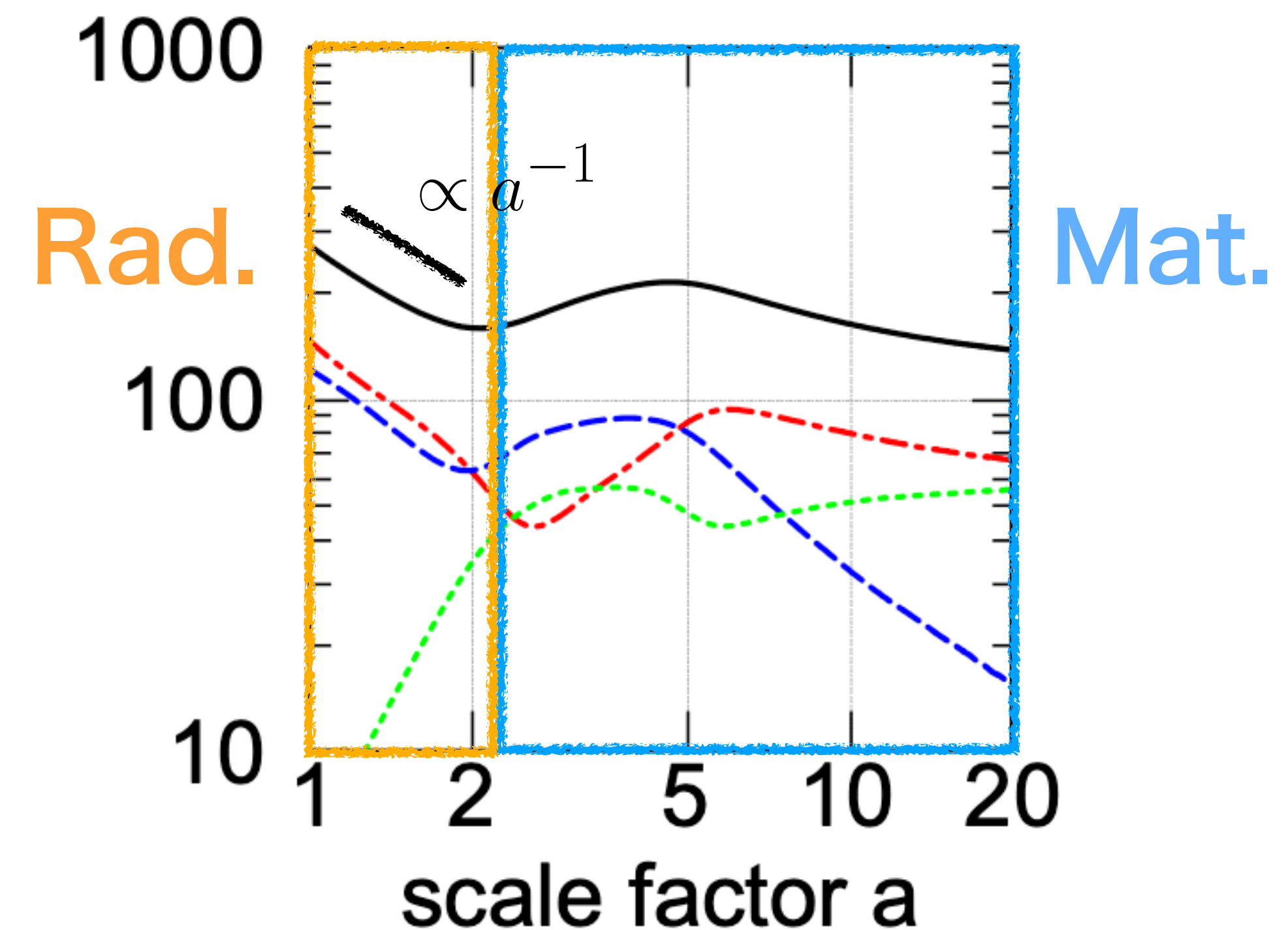
P30

Yuma Narita

Relativistic-like behavior of ALPs with non-relativistic momenta

Key result

- Even for “cold” modes with $\bar{p}_\phi < m_\phi$, axions can redshift **radiation-like** if $\rho_\phi > m_\phi^2 f_\phi^2$.
- At $\rho_\phi \sim m_\phi^2 f_\phi^2$, the transition to matter becomes **nonlinear**.
- “**Baumkuchen**” domain walls source stochastic GWs, with a peak captured by a simple analytic estimate.



P31

Coh Miyao

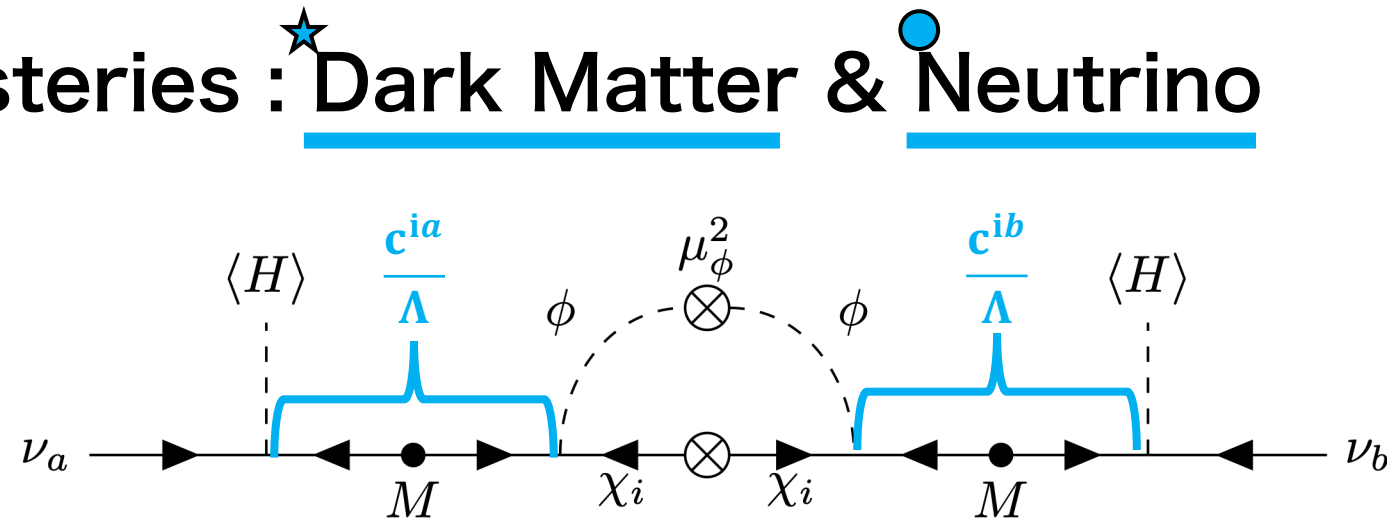
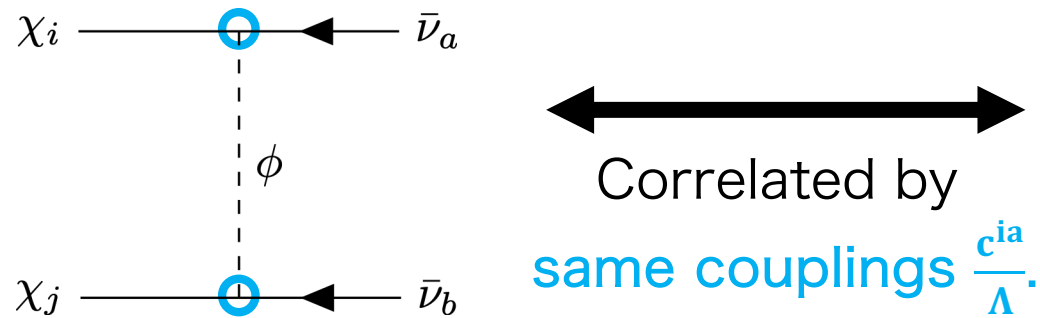
Neutrino Mass Generation and Dark Matter Phenomenology in a
Neutrinophilic Dark Matter Model

Neutrino Mass Generation and Dark Matter Phenomenology in a Neutrinophilic Dark Matter Model

Work in progress

Coh Miyao (Tokyo University of Science) in collaboration with Tomohiro Abe (Tokyo University of Science)

Two of the greatest mysteries : ★ Dark Matter & ● Neutrino



★ DM relic abundance

● Origin of Neutrino Mass

We investigate whether this structure explain the DM relic abundance and the origin of the neutrino mass simultaneously in the realistic model.

P32

Sanghoon Lee

Resonant Vector Dark Matter in $SU(2)$ Dark Gauge Theories

Resonant Vector Dark Matter in SU(2) Dark Gauge Theories (ongoing Work!)

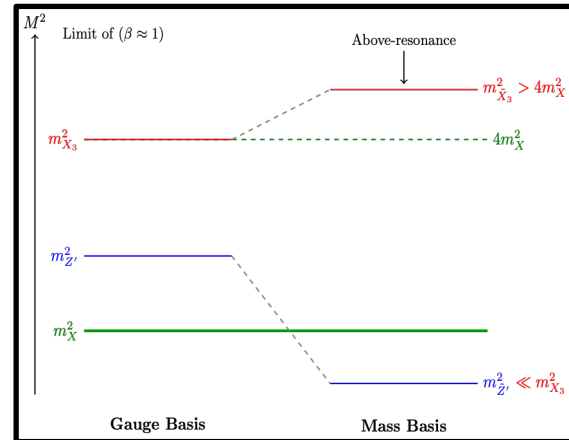
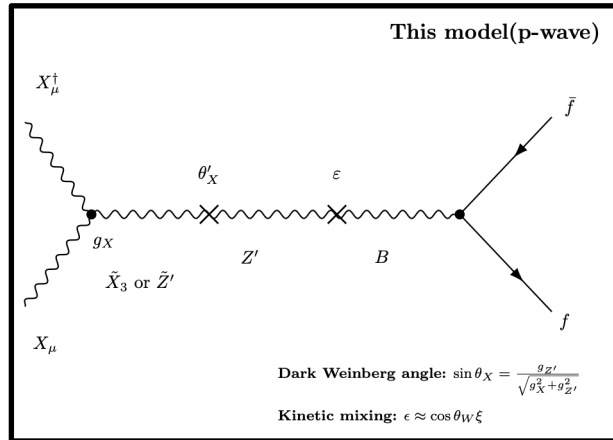
Sanghun Lee, Hyun-Min Lee Chung-Ang University, Theoretical High Energy Physics Group

What we do :

SSB w/ higher-representation dark Higgs in extra $SU(2)_X \times U(1)_{Z'}$,

→ Dark gauge bosons get masses with specific relation

→ Gives resonant condition in annihilation

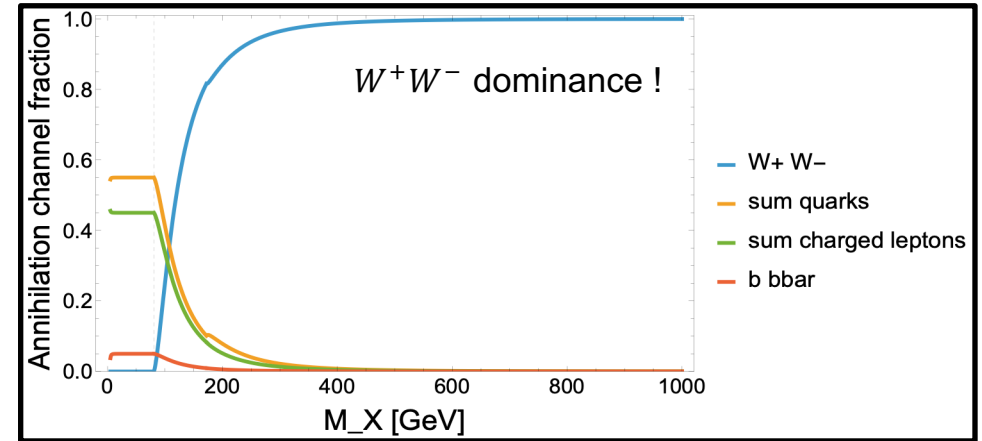


$$\frac{m_{X_{3,0}}^2}{m_X^2} = 2I, \quad m_{X_3}^2 \approx 2m_X^2 \left(\frac{\sum I^2 v_I^2}{\sum I v_I^2} \right) (1 + \tan^2 \theta_X)$$

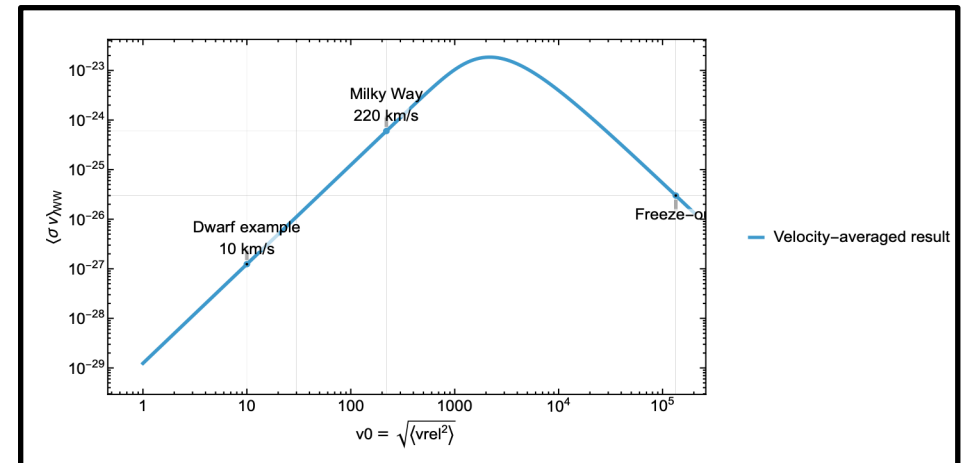
$$I = 2 \Rightarrow m_{X_3} \approx 2m_X$$

Quintuplet dark Higgs realizes a near-threshold neutral-sector resonance !

<Fraction of annihilation channels (only SM)>



<Velocity-averaged annihilation cross section>



P33

Junho Kang

Phenomenology of a pNGB Dark Matter from Gauged $U(1)_X$
Symmetry

Pseudo Scalar Dark Matter from a Broken Gauge Symmetry ^[P33]

Junho Kang*, Sarif Khan, Jongkuk Kim, Hyun Min Lee
Chung-Ang University

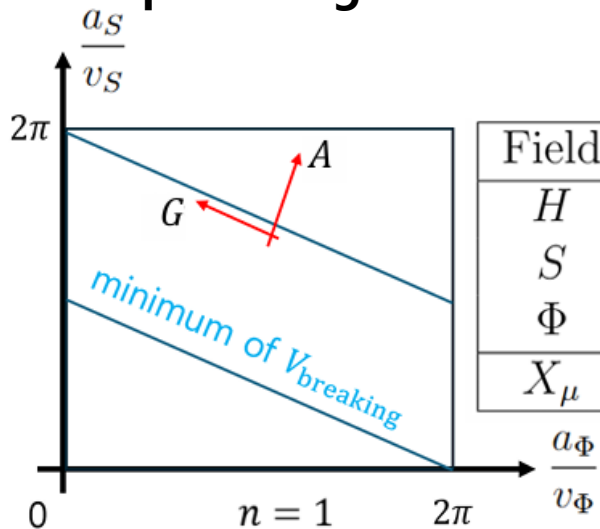
• Field Contents in the Polar Basis

$$H = \begin{pmatrix} 0 \\ \frac{v+h}{\sqrt{2}} \end{pmatrix} \quad S = \frac{1}{\sqrt{2}}(v_S + \rho_S)e^{i\frac{a_S}{v_S}} \quad \Phi = \frac{1}{\sqrt{2}}(v_\Phi + \rho_\Phi)e^{i\frac{a_\Phi}{v_\Phi}}$$

One SM Higgs doublet H and Two complex scalars S, Φ .

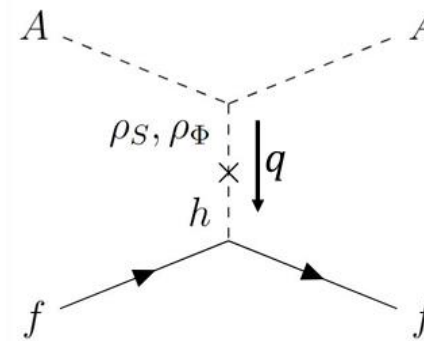
$$\begin{aligned} V(H, \Phi, S) = & -\mu_H^2 (H^\dagger H) + \lambda_H (H^\dagger H)^2 - \mu_\Phi^2 (\Phi^\dagger \Phi) + \lambda_\Phi (\Phi^\dagger \Phi)^2 - \mu_S^2 S^\dagger S \\ & + \lambda_S (S^\dagger S)^2 + \lambda_{H\Phi} (H^\dagger H) (\Phi^\dagger \Phi) + \lambda_{HS} (H^\dagger H) (S^\dagger S) \\ & + \lambda_{\Phi S} (\Phi^\dagger \Phi) (S^\dagger S) - \left(\frac{\kappa_n}{\Lambda^{n-2}} \Phi^n S^2 + \text{h.c.} \right). \end{aligned}$$

• Unique Charge Structure from Gauged U(1) Symmetry

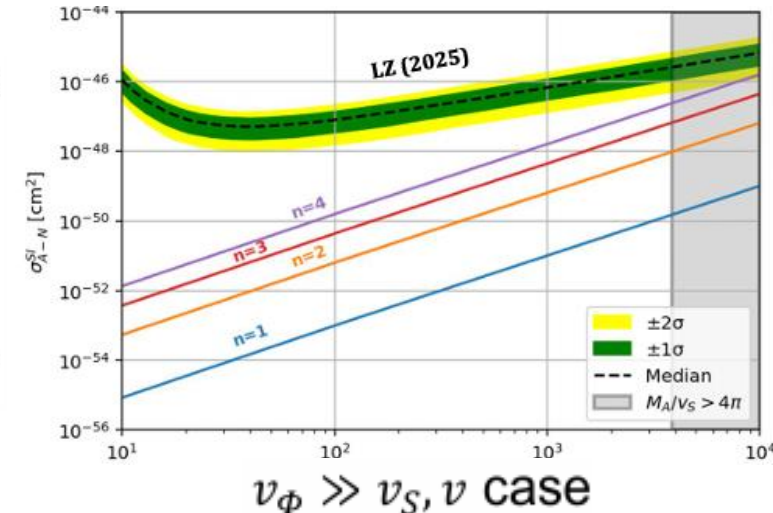
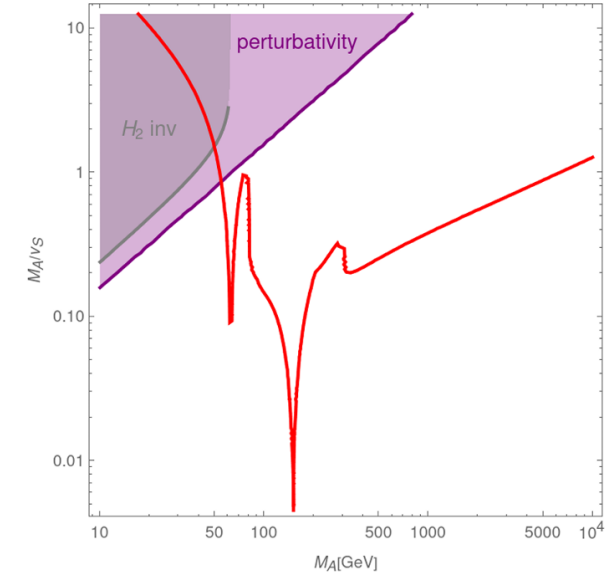


Field	$SU(2)_L$	$U(1)_Y$	$U(1)_X$
H	2	1/2	0
S	1	0	1
Φ	1	0	$-2/n$
X_μ	1	0	0

• Direct-Detection Cross Section



• Dark Matter Relic Density



P34

Van Que Tran

Search for Long-Lived Dark Photons from Dark Radiation at the LHC



The Search for Long-Lived Dark Photons from Hidden Radiation at the LHC

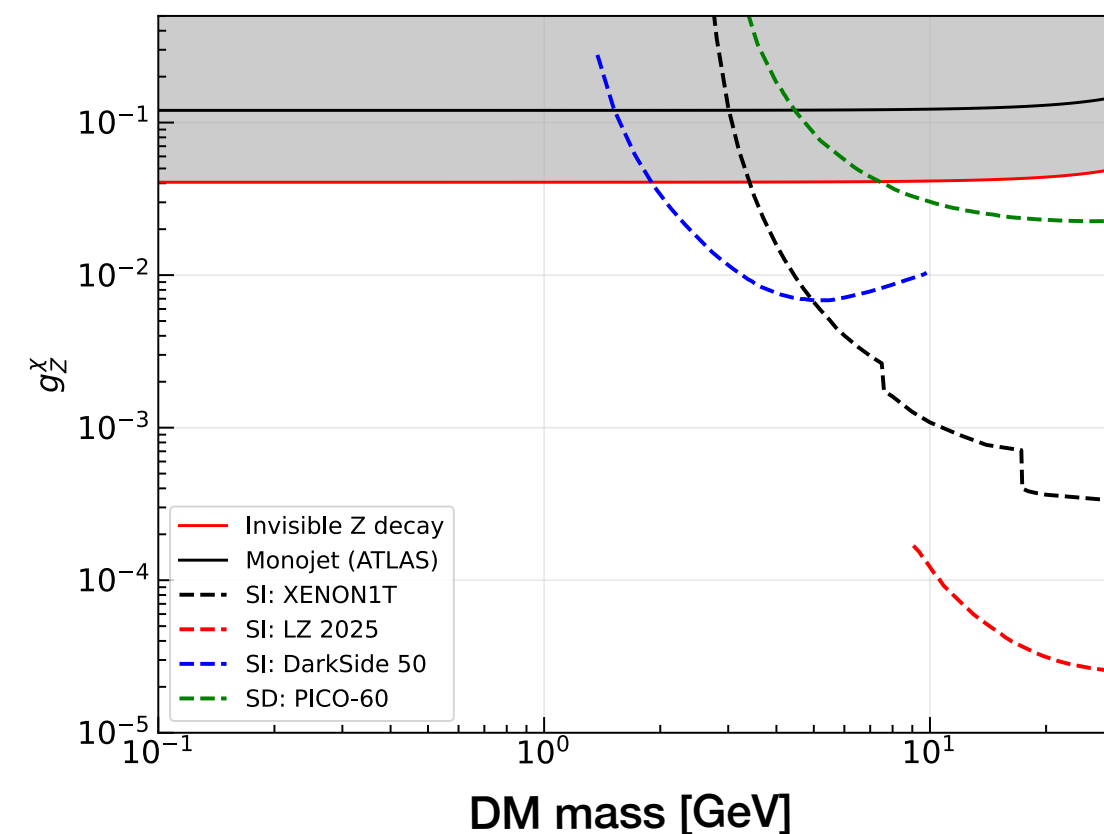
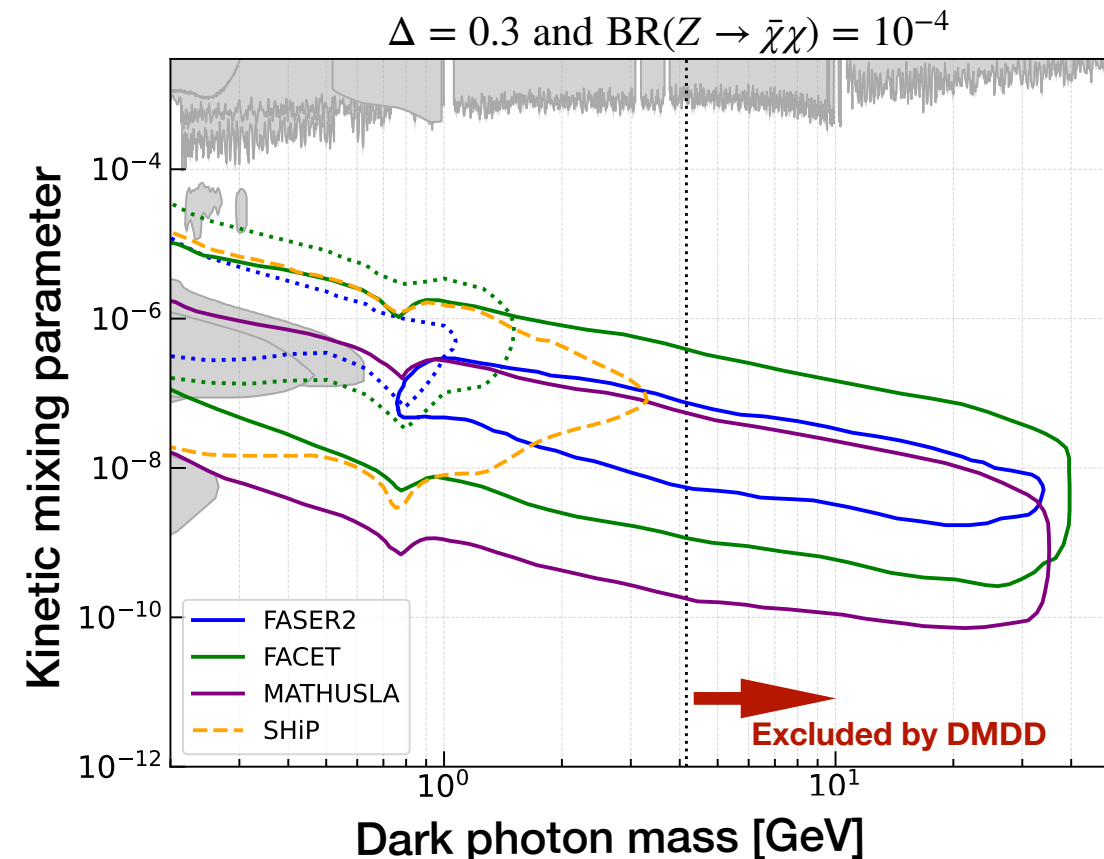
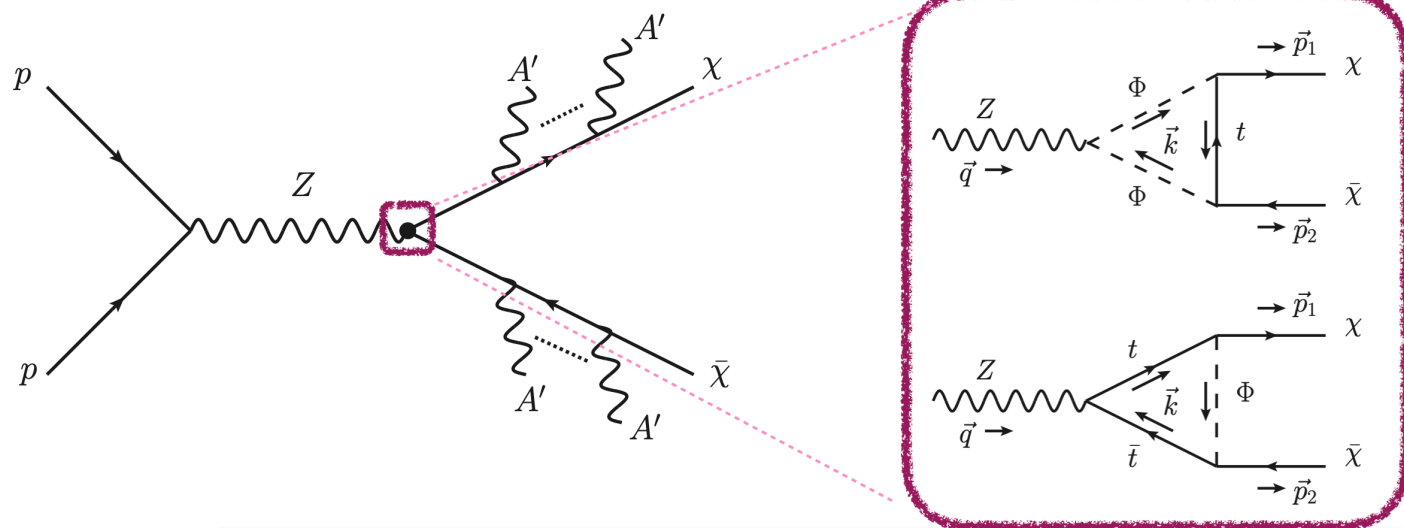
Chuan-Ren Chen and Van Que Tran [arXiv:2605.03427]



- ◆ A dark photon would reveal a new fundamental force and open a window to the hidden sector. It can be probed by dedicated LLP detectors.
- ◆ In the minimal scenario, sensitivity is limited to low masses due to correlated production and decay.
- ◆ We introduce **minimal extensions** where **production and decay are decoupled**: *Loop-induced $Z \rightarrow \bar{\chi}\chi$ portal model*.
- ◆ LLP detectors (FASER2, FACET, MATHUSLA) can probe dark photon parameter space far beyond conventional reach (smaller ϵ , heavier mass).

Field	Spin	$(SU(3)_c, SU(2)_L, U(1)_Y)$	$U(1)_D$
χ	1/2	$(\mathbf{1}, \mathbf{1}, 0)$	+1
Φ	0	$(\mathbf{3}, \mathbf{1}, +2/3)$	-1
A'_μ	1	$(\mathbf{1}, \mathbf{1}, 0)$	-

Table I. Particle content and charge assignments in the model.



P35

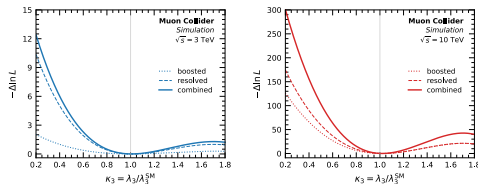
SooJin Lee

Probing the trilinear Higgs self-coupling in Higgs boson pair production
at multi-TeV muon colliders

Probing the trilinear Higgs self-coupling in Higgs boson pair production at multi-TeV muon colliders

Soojin Lee (NTHU), arXiv:2608.01888

- **Target:** trilinear Higgs self-coupling
 $\kappa_3 = \lambda_3/\lambda_3^{\text{SM}}$
- **Probe:** multi-TeV muon collider
 HH via **vector boson fusion**
- **Final state:** $b\bar{b}b\bar{b}$,
resolved + **boosted** regions
- **Analysis:** SPANet pairing,
two ML classifiers ($\mathcal{D}_{HH}, \mathcal{D}_{\kappa_3}$)



$-\Delta \ln \mathcal{L}(\kappa_3)$ at $\sqrt{s} = 3$ and 10 TeV.

κ_3 to the few-percent level

$0.96 < \kappa_3 < 1.05$ at 10 TeV (68% CL)

P36

Jinheung Kim

Spin-discriminating prospects of Higgs portal dark matter at future
muon colliders

What is the **spin** of dark matter?

P36(PM)



Spin-discriminating prospects of Higgs portal dark matter at future muon colliders

Jinheung Kim, Xu Deng, Jeong Han Kim, Pyungwon Ko, Jinmian Li

KIAS · SI2026

1 A rich dark sector hides from us.

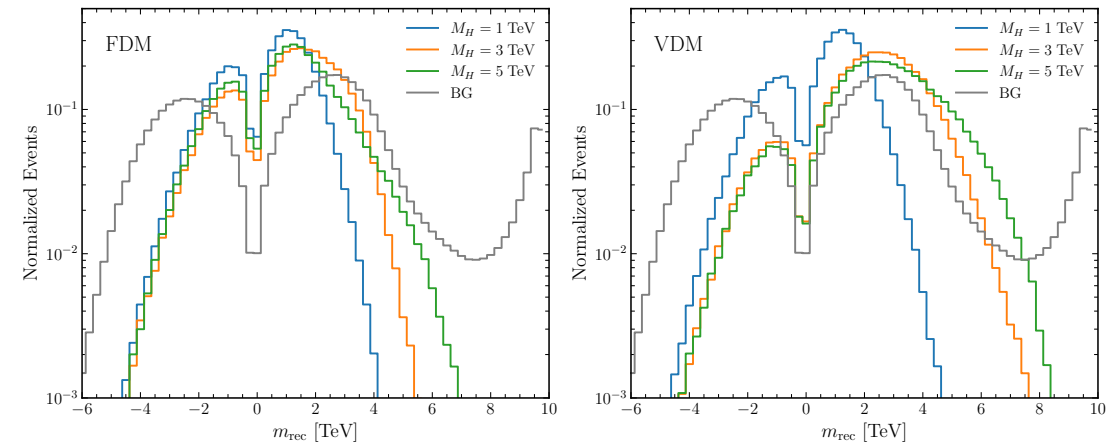
Relic density and direct detection are evaded
— and the spin of DM **maps the dark sector's structure**.

2 The muons measure the invisible.

$\mu^+\mu^- \rightarrow \mu^+\mu^- + h^*/H^*(\rightarrow \chi\chi)$: the fixed initial state makes the muon pair alone give $m_{\text{rec}} = t$.

3 Spin sets the shape.

Couplings tuned for **identical rates** — any difference left is the spin.



$$\Gamma \propto t \text{ (fermion) vs. } \Gamma \propto t^3 \text{ (vector)}$$

→ vector spectra are systematically **broad**

fermion and vector DM told apart at 2σ for $m_H \gtrsim 2 \text{ TeV}$, $\sin \alpha \gtrsim 0.04$

$$10\text{ab}^{-1} \text{ at } \sqrt{s} = 10 \text{ TeV}, g_\psi = 3$$

P37

Tomohiro Abe

Sommerfeld enhancement in an electroweakly interacting spin-1 dark matter model

Sommerfeld enhancement in an electroweakly interacting spin-1 dark matter model

Tomohiro Abe (Tokyo University of Science)

Based on arXiv:2606.16442

in collaboration with Motoko Fujiwara (Kyushu U) and Junji Hisano (Nagoya U)

Motivation:

Electroweakly interacting DM models (Higgsino, Wino, Minimal DM, ...) are widely studied. However, they are spin-0 or 1/2. **How about spin-1?**

Our works:

- ★ We constructed a renormalizable electroweakly interacting spin-1 DM model (spin-1, $SU(2)_L$ triplet DM model) [TA, Fujiwara, Hisano, Matsushita (JHEP07(2020)136)]
- ★ We updated the analysis including Sommerfeld enhancement for relic abundance calculation
→ The thermal relic is explained for $3.6 \text{ TeV} < m_{\tilde{\chi}} < 9.2 \text{ TeV}$
- ★ The indirect detection (WW) excludes $8.6 \text{ TeV} < m_{\tilde{\chi}} < 9.6 \text{ TeV}$
- ★ Two gamma-ray line peaks by $\gamma\gamma + Z\gamma$ and $Z'\gamma$
- ★ Both gamma-ray lines can be detected in CTAO for $m_{\tilde{\chi}} > 7.5 \text{ TeV}$

P38

Takumi Ishikawa

Toward the experimental test of a pseudo-Nambu Goldstone dark
matter model

Testing pseudo-Nambu Goldstone dark matter via a two-component scenario

Takumi Ishikawa, Tomohiro Abe (Tokyo Univ. of Science)

Motivation

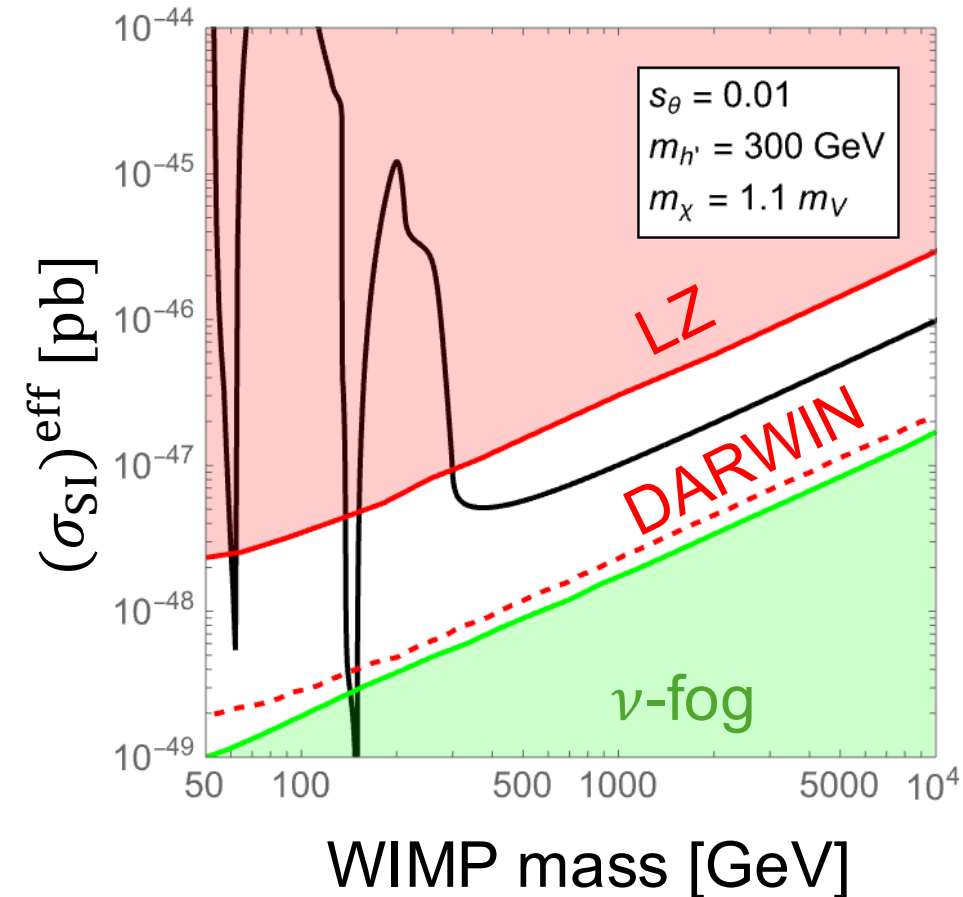
- pNGDM naturally evades direct detection
- This makes the model difficult to test

Idea

- (pNGDM + WIMP)
- Many pNGDM models can realize two-component scenario
- The WIMP component may give detectable signals

Result

- DARWIN experiment can probe wide parameter regions
- Two-component scenario improves the testability of pNGDM model



P39

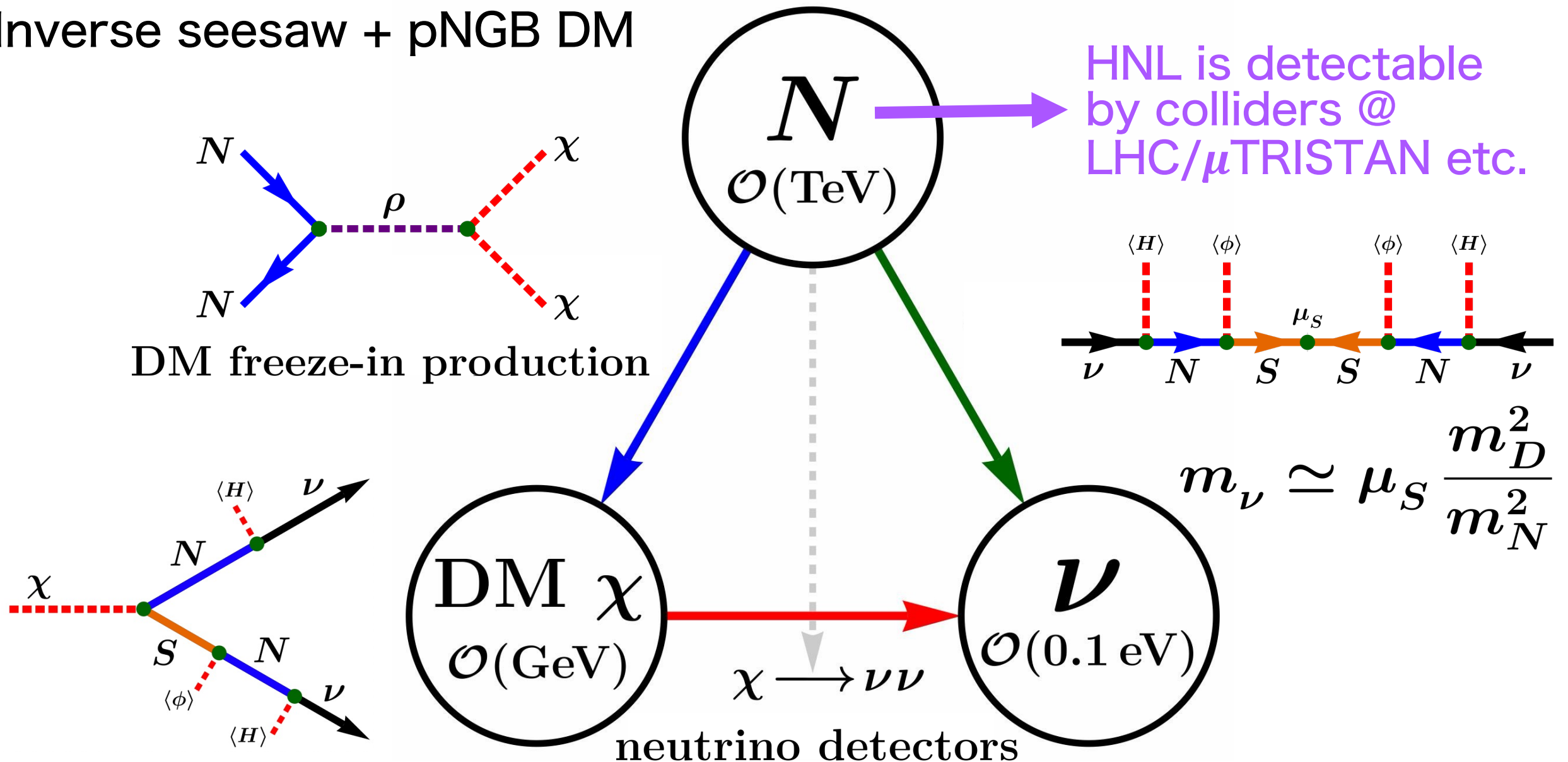
Shu-Yu Ho

TeV-scale unification of light dark matter and neutrino mass

#39 TeV-scale origin of light DM & ν mass

C.W. Chiang (NTU), [Shu-Yu HO \(AS\)](#), V.Q. Tran (NCTS) arXiv : 2603.05200

Inverse seesaw + pNGB DM



P40

Riasat Sheikh

Two component pseudo-Nambu-Goldstone-boson dark matter

Can symmetry keep the heavy dark matter abundant?

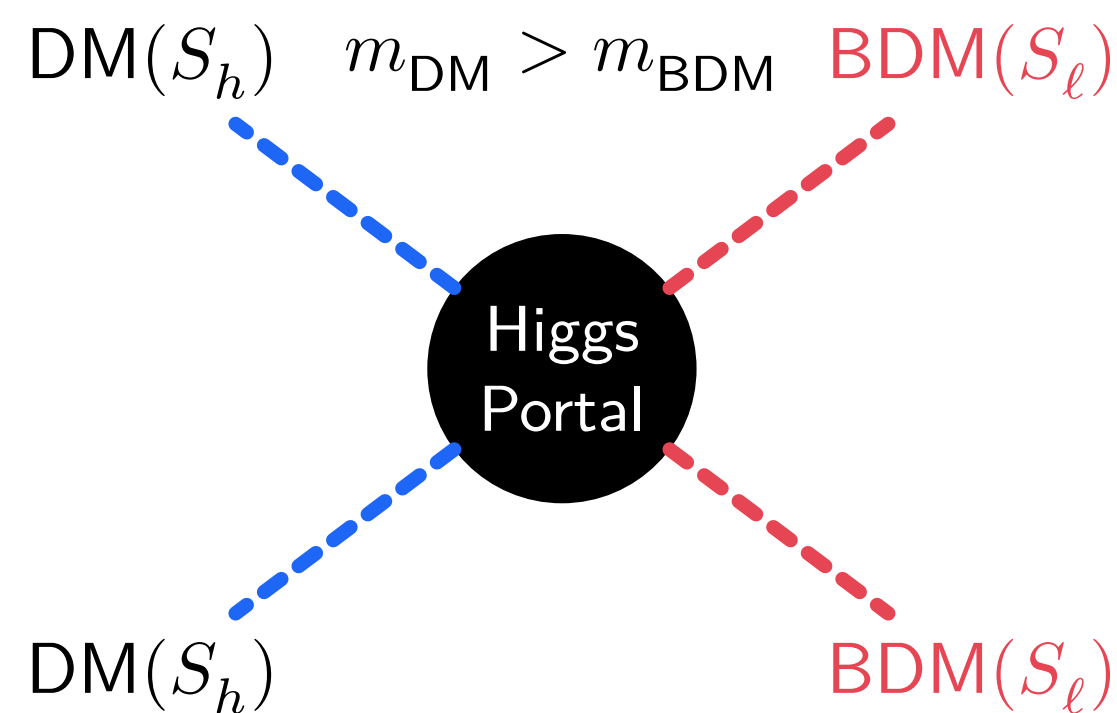
Riasat Sheikh, Takashi Toma, Koji Tsumura

Why boosted pNGB?

- pNGB derivative interactions suppress low-momentum scattering:

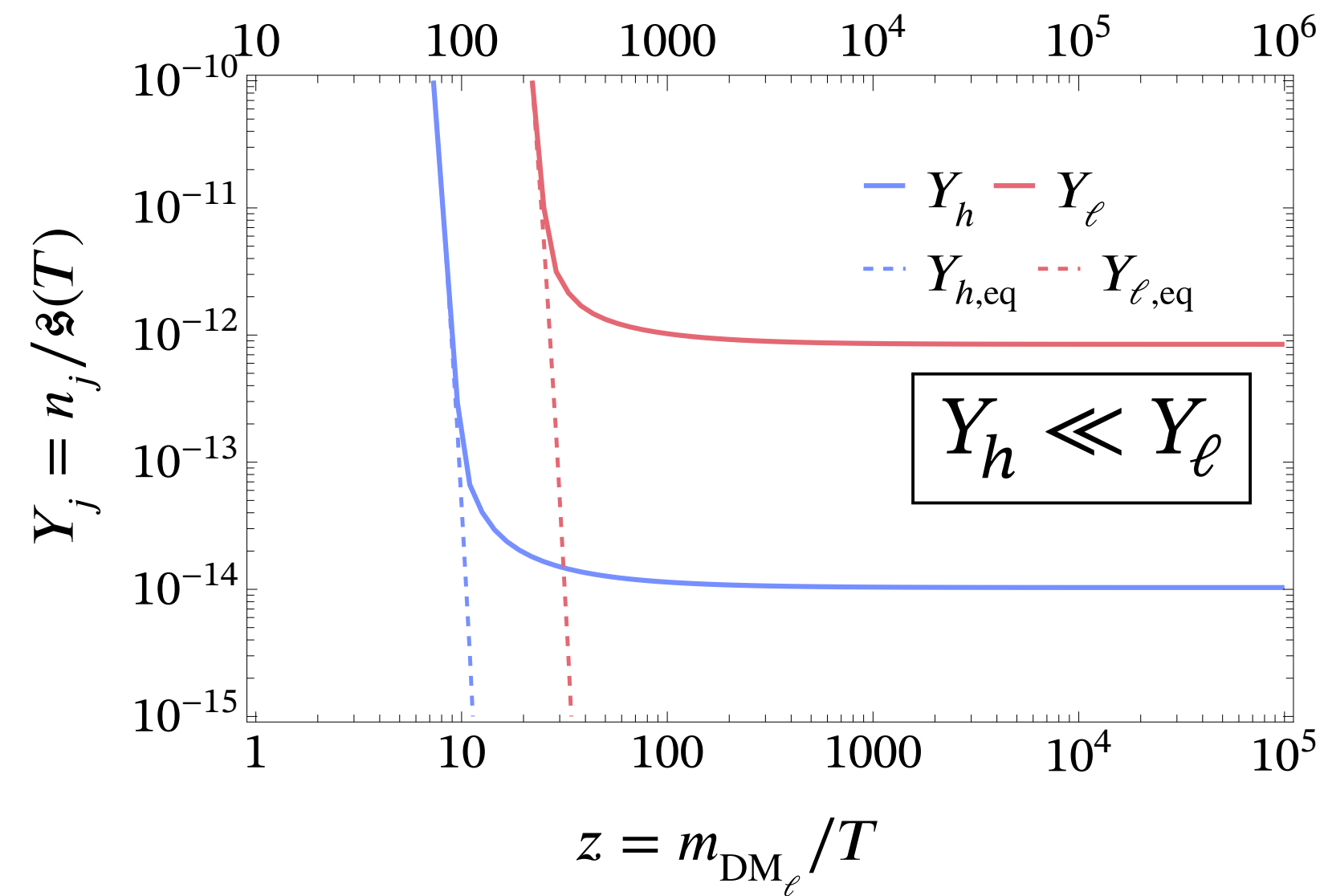
$$\sigma_{\text{SI}} \propto q^4 \xrightarrow{q \rightarrow 0} 0$$

- Boosting increases pNGB momentum



Thermal Challenge

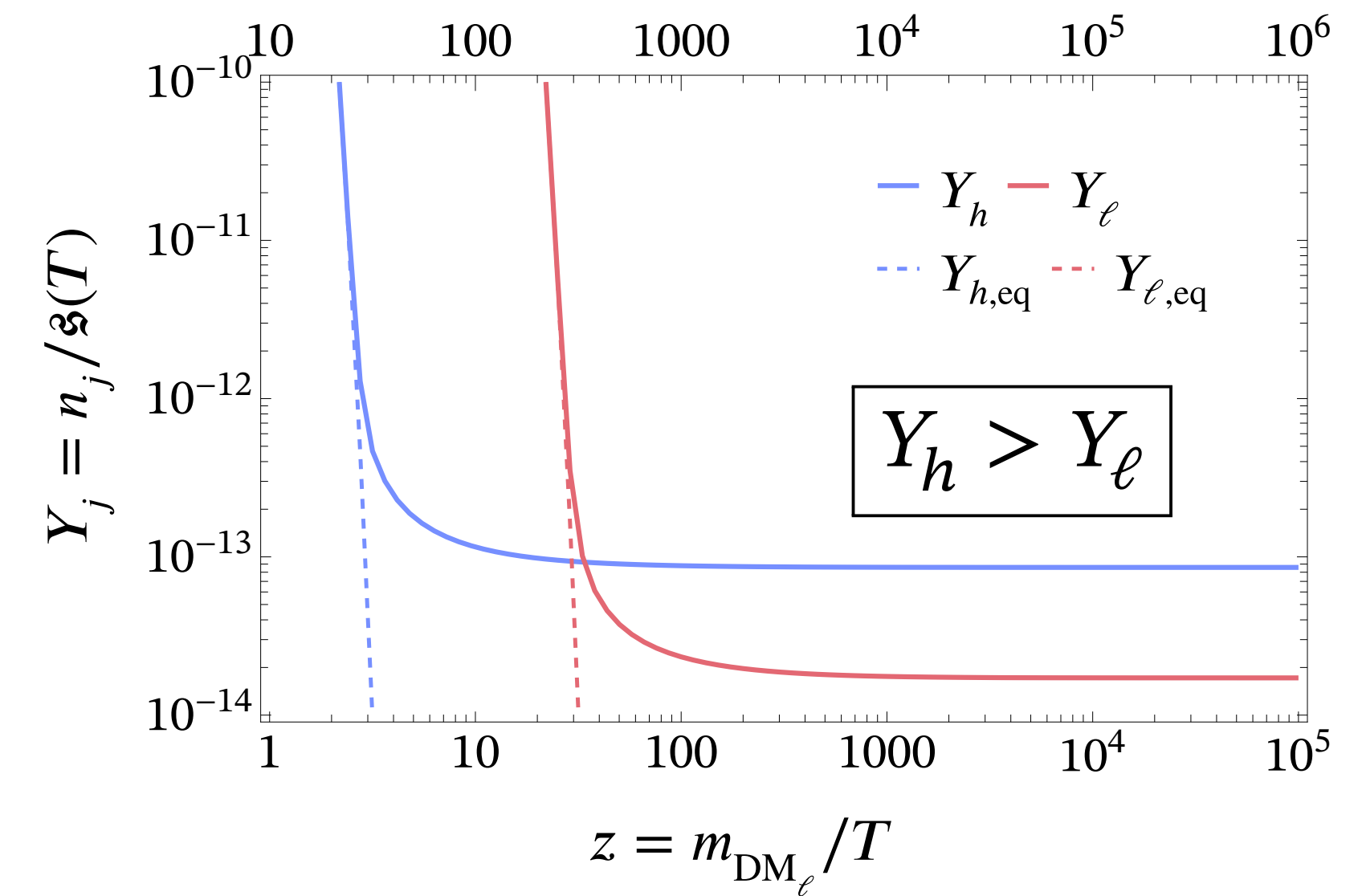
- Generic multi-component expectation: heavier DM (S_h) is Boltzmann suppressed



- But BDM requires appreciable S_h today.

Our result

- Symmetry-related couplings control annihilation and conversion.



- No ad hoc tuning of independent portal couplings.

P41

Nivedita Ghosh

Uncovering Long-Lived Doubly Charged Scalars

Uncovering Long-Lived Doubly Charged Scalars

Nivedita Ghosh | Kavli IPMU, The University of Tokyo

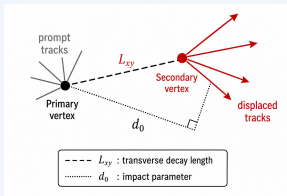
Based on N. Das, D. K. Ghosh, **N. Ghosh** and R. K. Singh, arXiv:2602.02308.

Physics target

- ▶ The Type-II seesaw model predicts doubly charged scalars, $H^{\pm\pm}$.
- ▶ Prompt-search assumptions leave a light long-lived region unexplored.
- ▶ Near the dilepton–diboson crossover,

$$c\tau \sim \mathcal{O}(\text{mm}).$$

Displaced signature



Four muons with displaced tracks
Same-sign dimuon pairs reconstruct the $H^{\pm\pm}$ mass.

Collider sensitivity

- ▶ **ILC at $\sqrt{s} = 500 \text{ GeV}$:**
Clean production and reconstruction of same-sign dimuon mass peaks.
- ▶ **Muon collider at $\sqrt{s} = 10 \text{ TeV}$:**
Complementary sensitivity to the long-lived parameter region.
- ▶ Displaced tracks strongly suppress prompt Standard Model backgrounds.

Takeaway: displaced same-sign dimuons provide a powerful discovery channel for light long-lived $H^{\pm\pm}$.