“DarMa”
Dark Matter Physics International Research Center

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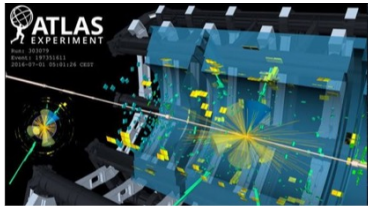
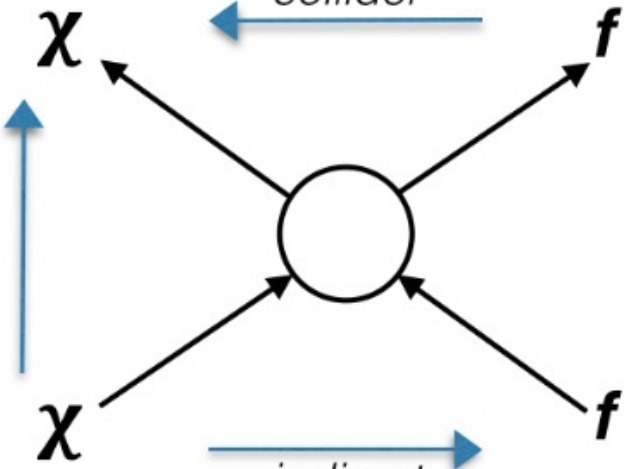
KMI Symposium 2025

Multiple approaches to reveal nature of DM

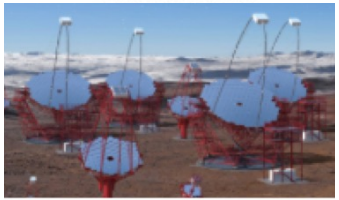


collider

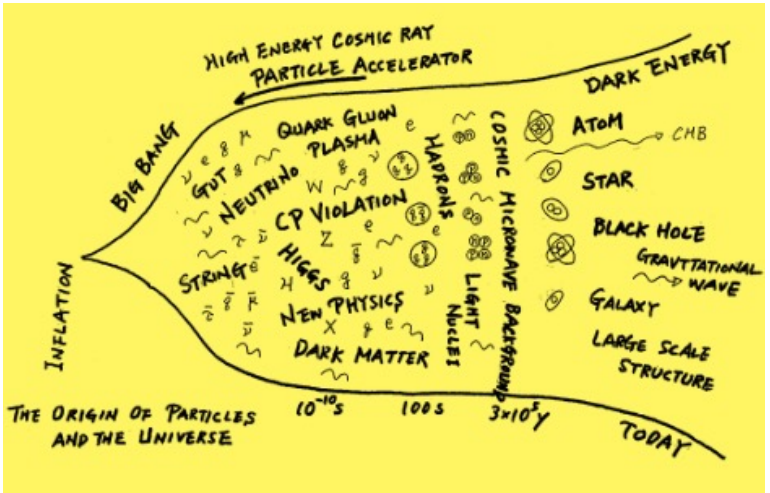
direct



indirect

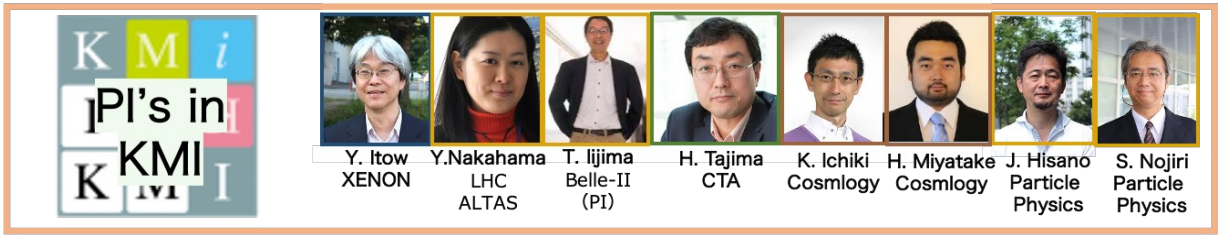


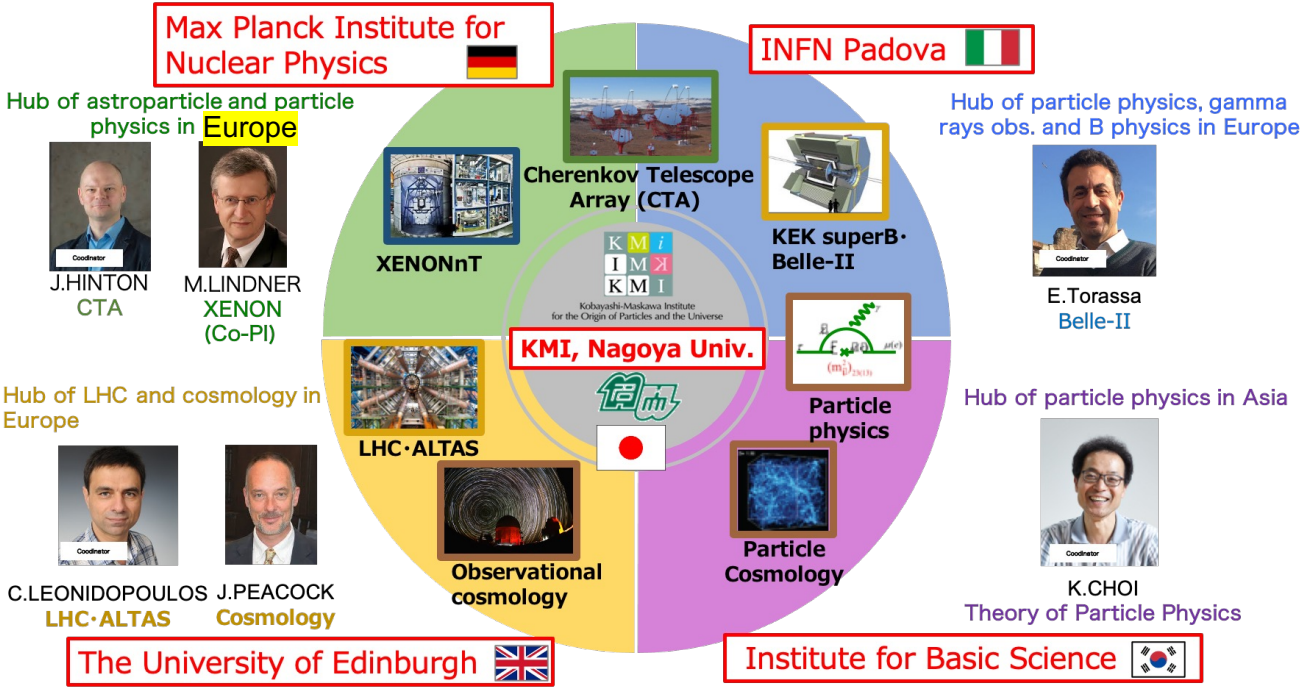
Particle theory



Cosmology

DMnet international research network started in KMI (2020-)





Overview of DMunit

IBS Korea
Padova
Edinburgh
Max Plank Institute
ICRR

JSPS Core-to-core(2020-25)

DMNet

Direct Search

Planning future / R&D

KMI DarMa

merged/unified

M.Schuman (44)

- DARWIN Co-PI
- DMnet Co-PI
- Dedicated liquid Xe facility

UNI FREIBURG

MOU

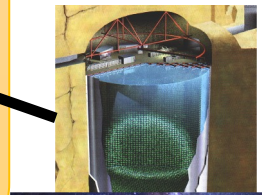
XENON
DARWIN/XLZD

J.Hisano

S.Kazama

M.Kobayashi

Y.Itow



INDEES2021 workshop

DMunit (2022-24): "S"-rating in the final evaluation
Decided extention for 2025-26

ISEE

① Direct DM Search
- XENONnT operation
- Analysis core in Japan
- Various new DM searches

② R&D future liquid Xe detector
- Toward O(50t) LXe detector
- Hermetic TPC
- low-BG low-dark VUV photosensors

③ International workshop
- Liquid noble gas technology
- DM-neutrino physics
- Theory – experiment

Two major agenda in KMI

- Missing anti-matter → Flavor physics and CP violation

Successfully funded by MEXT

FlaP (2023-)

- Dark Matter and Dark Energy

JSPS Core-to-Core Program
DMnet (2020-2024)

- Create research network
- Support long-term stays of young researchers

Nagoya U. WPI-next unit*)
DMunit (2022-2024)

- R&D future liquid Xe technology
- Synergy of underground experiment for dark matter and neutrinos

Started by KMI internal resources

DarMa (2025-)

Extended 2025-26

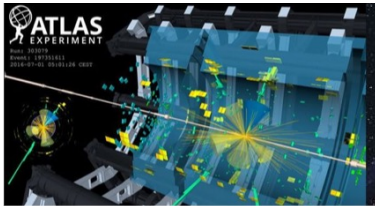
- Interdisciplinary DM workshop
- R&D of future DM experiments
- International research hub

*) WPI-next unit: Cutting-Edge International Research Unit promoted by Nagoya U.

Dark Matter Physics at KMI-DarMa

- Promote international research hub for dark matter physics with many milestones foreseen in 2020's.
- All-direction approach: Combine direct/indirect/accelerator/observational cosmology to reveal DM

Collider
Production of DM particles



ATLAS/ Belle II:
high luminosity era

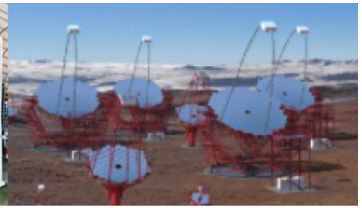
Cosmology
Characterize
Dark Matter/Dark Energy

large survey・spectroscopy
x5-20 statistics in z=4

Direct search
Detect dark matter
scattering-off

XENONnT/XLZD:
x10-100 statistics

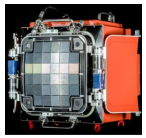
Indirect search
Search for gamma rays from
WIMP annihilations

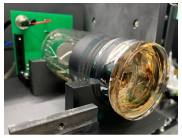


CTA:
x10 statistics in GeV/TeV range

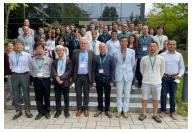
Theoretical work: Combine all the results to reveal DM and its nature.

R&D cutting-edge hardware
Excellent/highly-regarded? "Monozukuri"



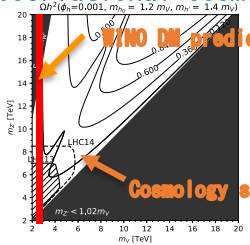


Combining knowledge,
cross-field research
Theory-experiment collaboration



Workshop/School covering
diverse fields and approaches.

Ex) Combing indirect DM results and particle theory/ observational cosmology

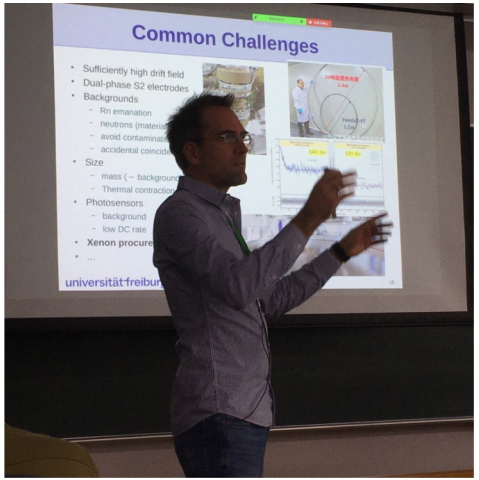


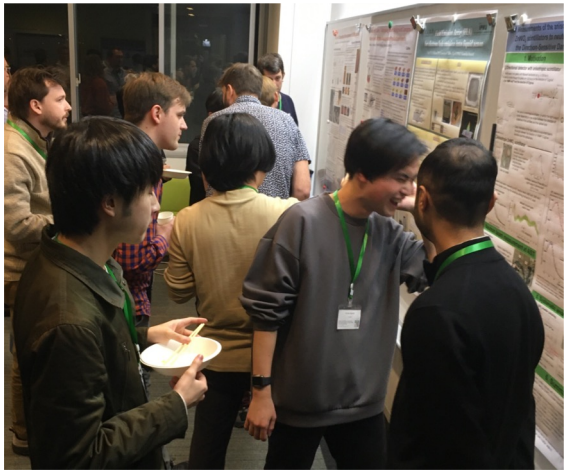
Cross-appointment and global-networking
Exchanges of students/early carrier researchers.

6

International meetings by DMnet / DMunit

Technical workshop by DMunit:
"Nagoya Workshop on Technology and Instrumentation in Future Liquid Noble Gas Detectors"
(2024 Feb14-16@KMI)





52 participants including 35 foreigners from 7 countries

Various international meetings are planed in DarMa with DMunit

- JSPS "DMnet" Symposium focusing on direct detection (2022 MPIK, 2024 IBS)

DMnet symposium@2022, MPIK

DMnet symposium@2024, Korea IBS

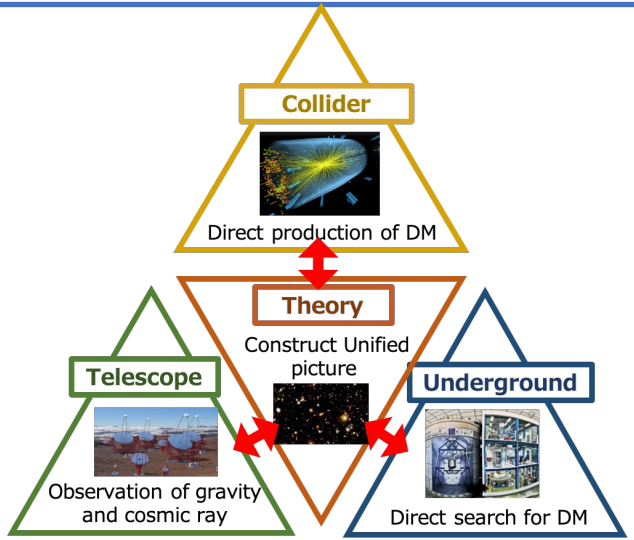
Backup

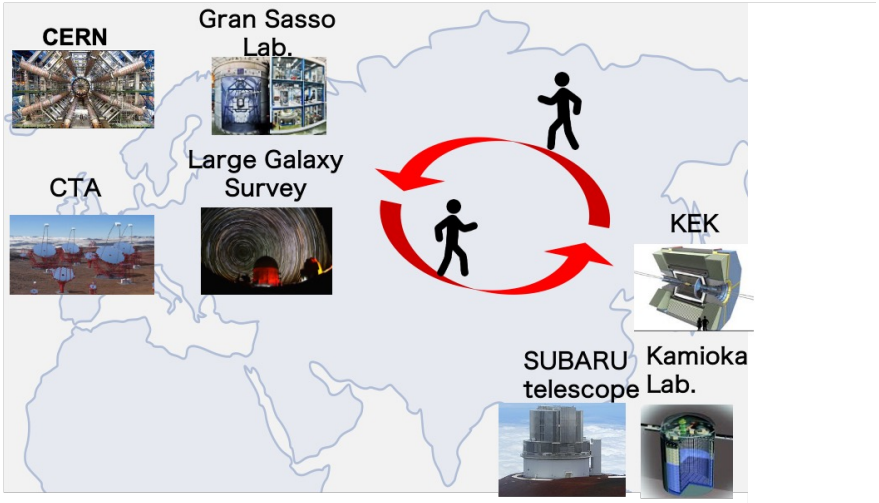
Purpose of DMnet

Fostering international research network to reveal dark matter

Interdisciplinary approach between theoretical and experimental studies in particle and astrophysics

Cooperation with major research hubs and promotion of intensive interactions among researchers





- Fostering young researchers across the fields and the borders (both of researches and of countries)
- Creation of research hub for dark matter searches covering various theories and experiments