“DarMa”
Dark Matter Physics International Research Center

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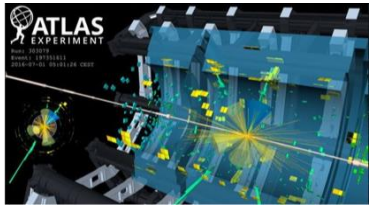
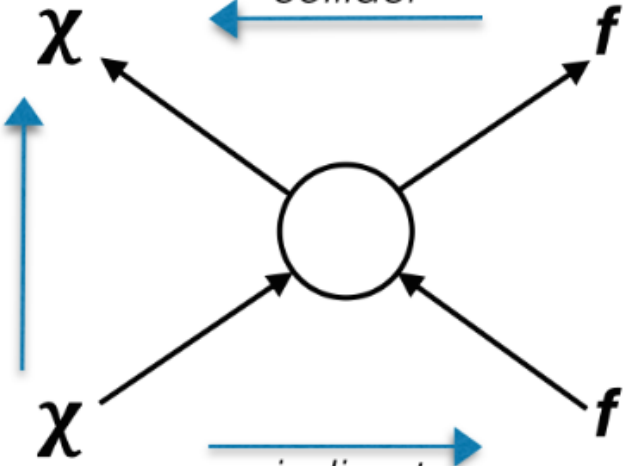
KMI Symposium 2025

Multiple approaches to reveal nature of DM

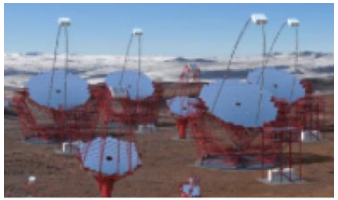


collider

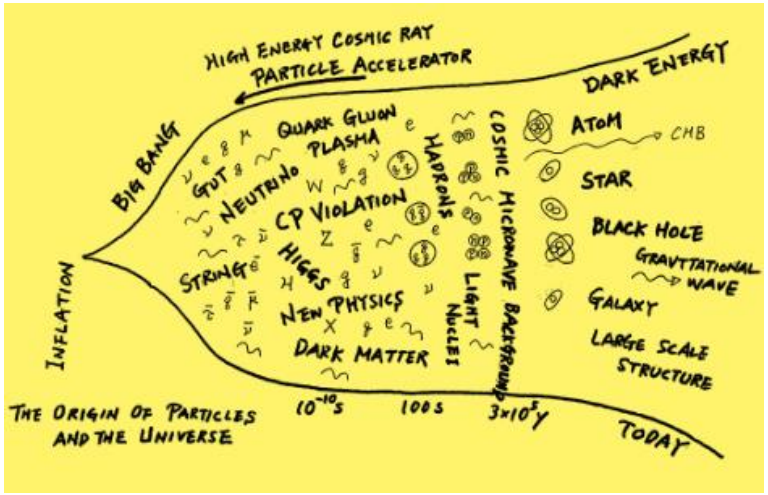
direct



indirect

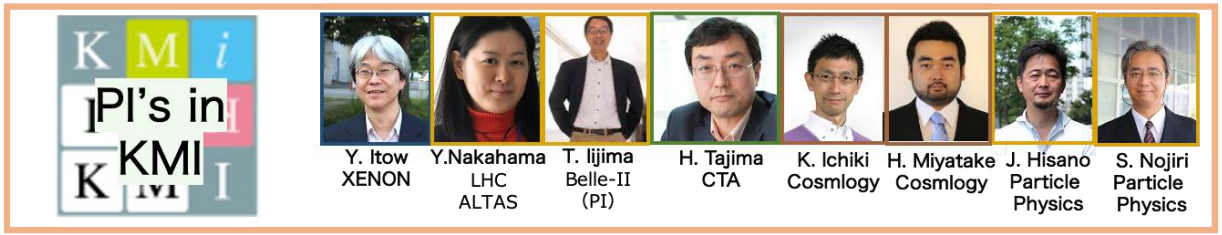


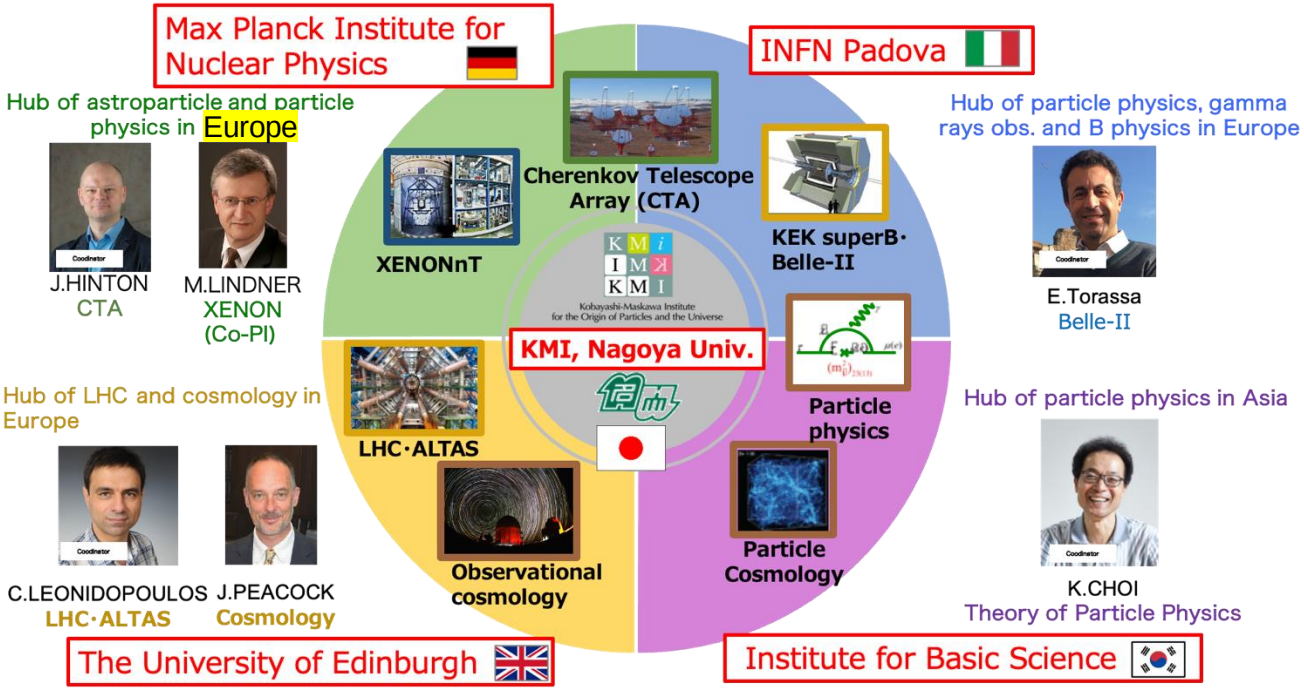
Particle theory



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

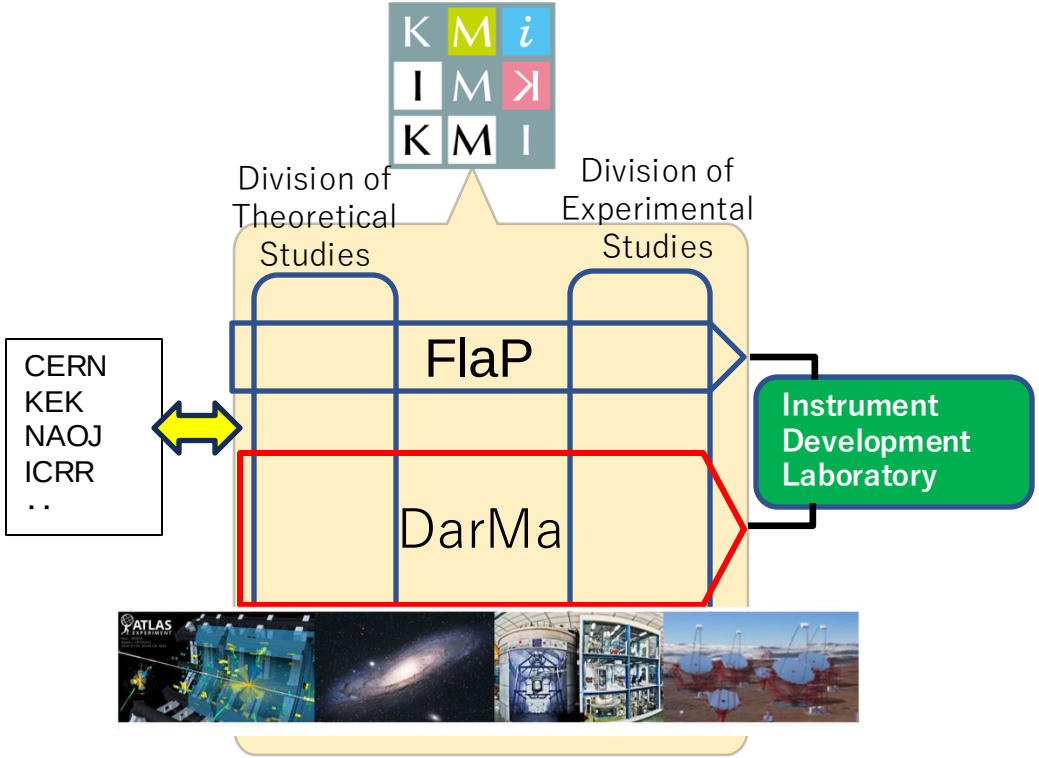
DarMa (2025-)

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.

Organization of DarMa



- H.Tajima (Head of Center; Indirect detection)
- S.Kazama (Direct detection)
- Y.Horii (Collider)
- K.Inami (Collider)
- H.Miyatake (Cosmology)
- S.Yokoyama (Cosmology)
- J.Hisano (Theory)
- K.Tobe(Theory)
- N.Maekawa(Theory)
- T.Shiromizu(Theory)

Dark Matter Physics at KMI-DarMa

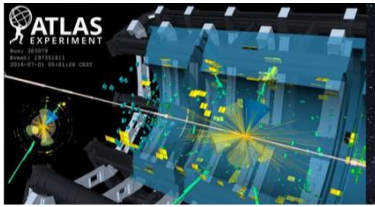
- Promote international research hub for dark matter physics with many milestones foreseen in 2020's.
- All-direction approach: Combine direct/indirect/accelerator/observational cosmology to reveal DM

Collider
Production of DM particles

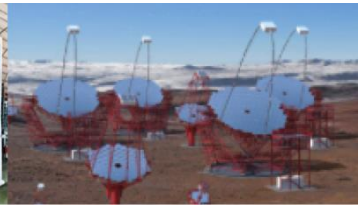
Cosmology
Characterize Dark Matter/Dark Energy

Direct search
Detect dark matter scattering-off

Indirect search
Search for gamma rays from WIMP annihilations







ATLAS/ Belle II:
high luminosity era

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

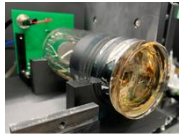
XENONnT/XLZD:
x10-100 statistics

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"

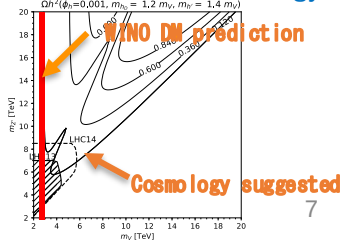
Cross-appointment and global-networking
Exchanges of students/early carrier researchers.

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



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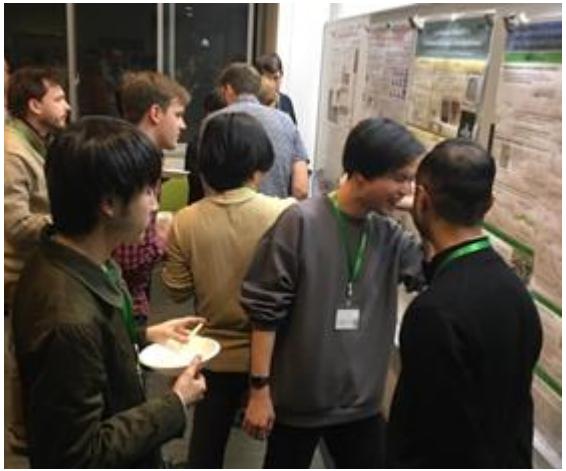
International meetings by DMnet / DMunit

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

Summary

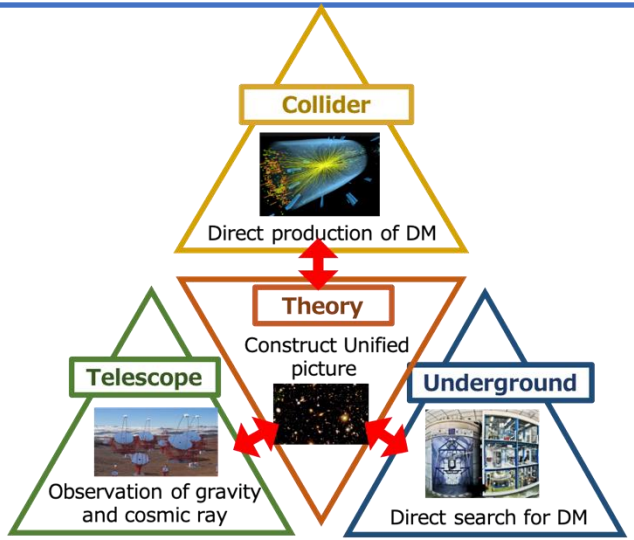
- Nature of dark matter needs multiple approach to be revealed
- DarMa is kicked-off to integrate all the efforts of different areas (direct, indirect, collider, cosmology and theory), and two divisions (experimental and theoretical studies)
- DarMa will be a hub to promote international research network with legacy of DMnet and DMunit.
- Stay tuned !

Backup

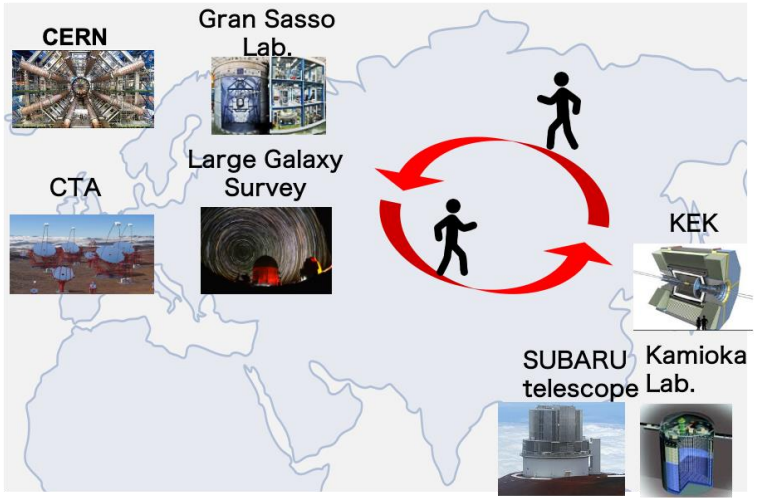
Purpose of DMnet

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