Dark Matter Physics International Research Center

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KMI International Advisory Board

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 resource
(unsuccessful funding application for 2025)

DarMa (2025-)

Extended 2025-26

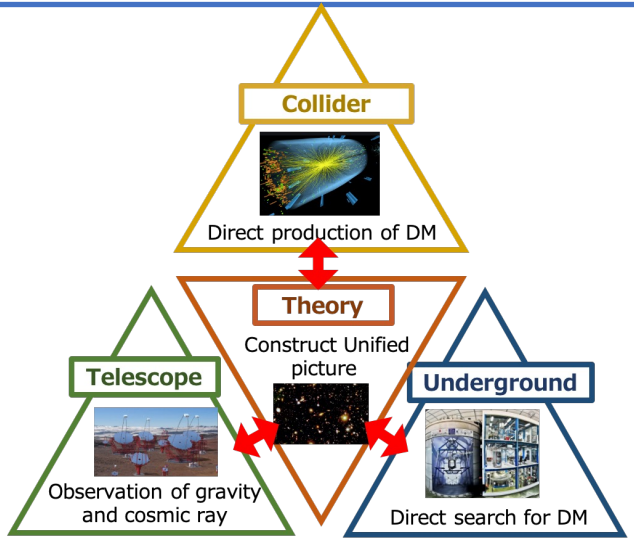
*) WPI-next unit: Cutting-Edge International Research Unit promoted by Nagoya U.

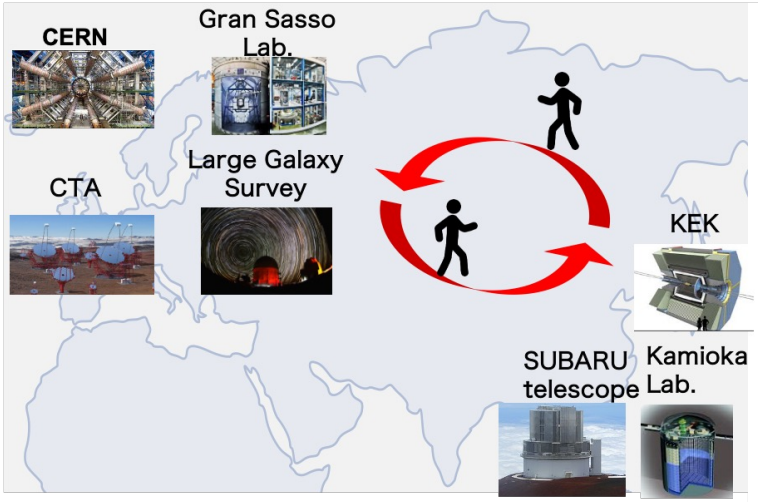
Purpose of DMnet

Fostering international research network to reveal dark matter

Interdisciplinary approach between theoretical and experimental studies in particle and astrophysics

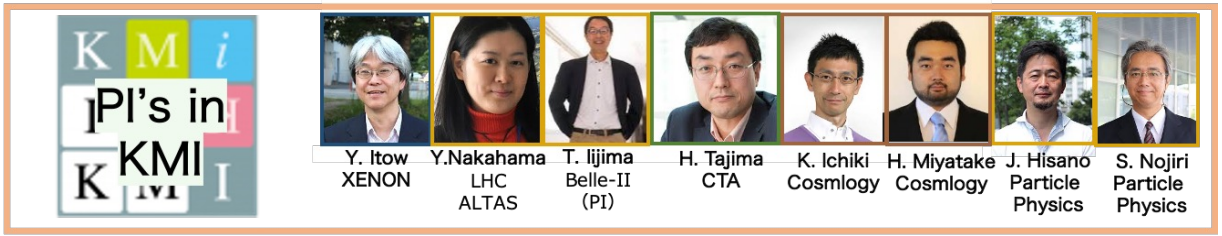
Cooperation with major research hubs and promotion of intensive interactions among researchers

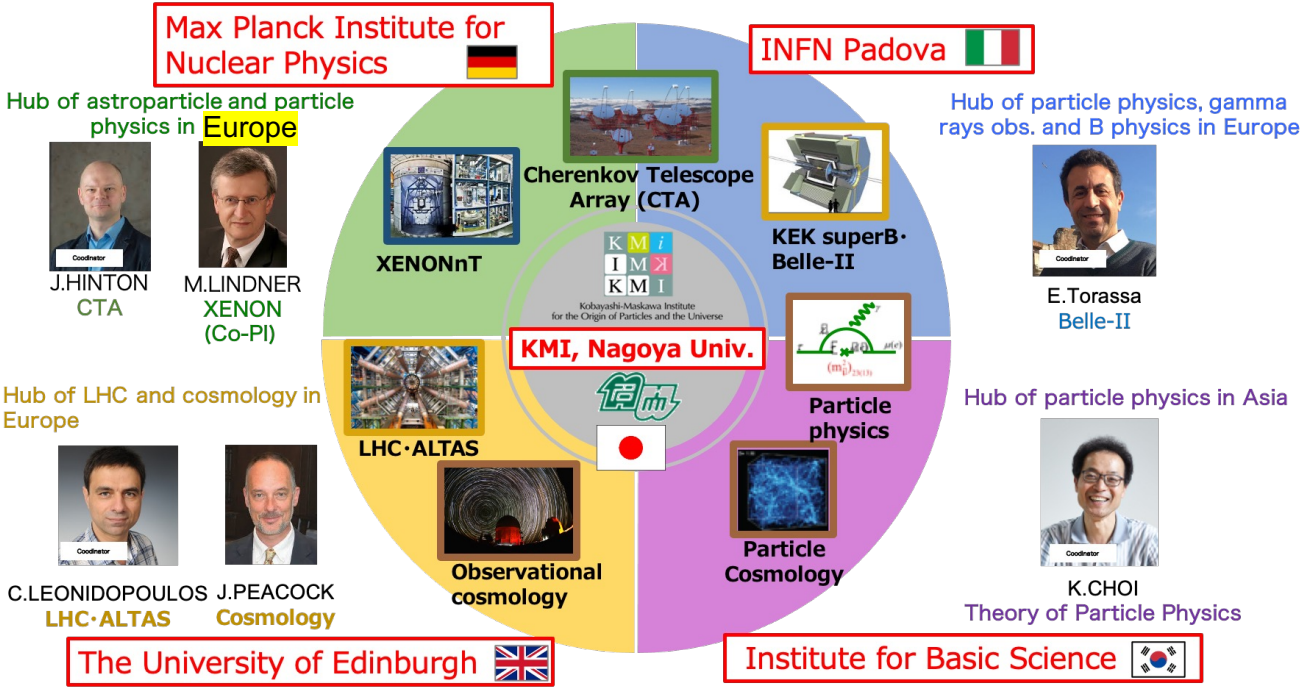




- Fostering young researchers across the fields and the borders (both of researches and of countries)
- Creation of research hub for dark matter searches covering various theories and experiments

DMnet international research network started in 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

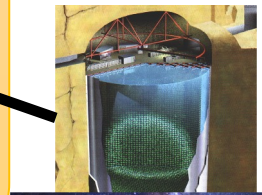
XENON
DARWIN/XLZD

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

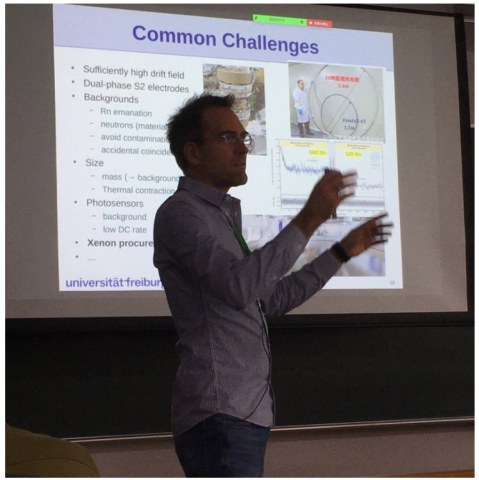
② R&D future liquid Xe detector
- Toward O(50t) LXe detector
- Hermetic TPC
- low-BG low-dark VUV photosensors

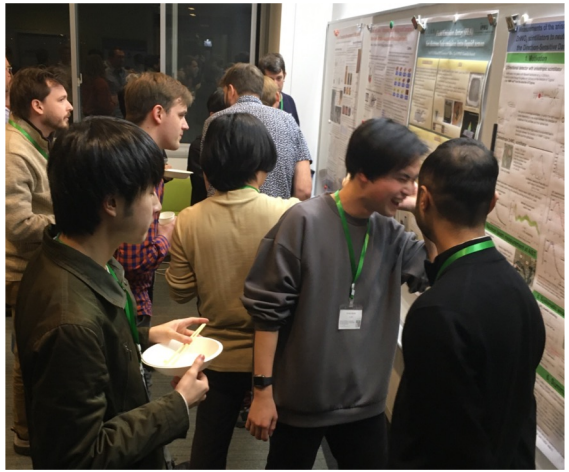
③ International workshop
- Liquid noble gas technology
- DM-neutrino physics
- Theory – experiment

International meetings by DMnet / DMunit

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

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





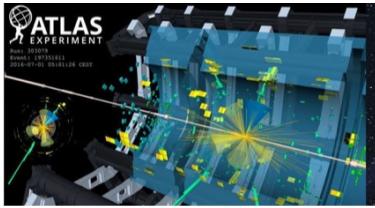
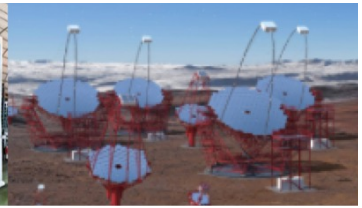
M. Schumann and colleagues from Freiburg Univ, and 52 participants including 35 overseas from 7 countries

DMnet symposium@2022, MPIK

DMnet symposium@2024, Korea IBS

Dark Matter Physics at KMI-DarMa

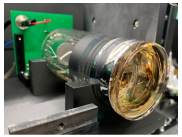
- Promote international research hub for dark matter physics with many milestones foreseen in 2020's.
- All-direction approach: Combine direct/indirect/accelerator/observational cosmology to reveal DM

Collider	Cosmology	Direct search	Indirect search
Production of DM particles	Characterize Dark Matter/Dark Energy	Detect dark matter scattering-off	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

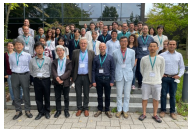
Excellent/highly-regarded? "Monozukuri"



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

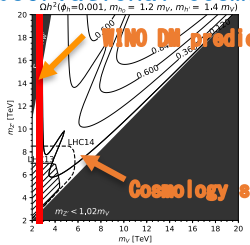
Combining knowledge, cross-field research

Theory-experiment collaboration



Workshop/School covering diverse fields and approaches.

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



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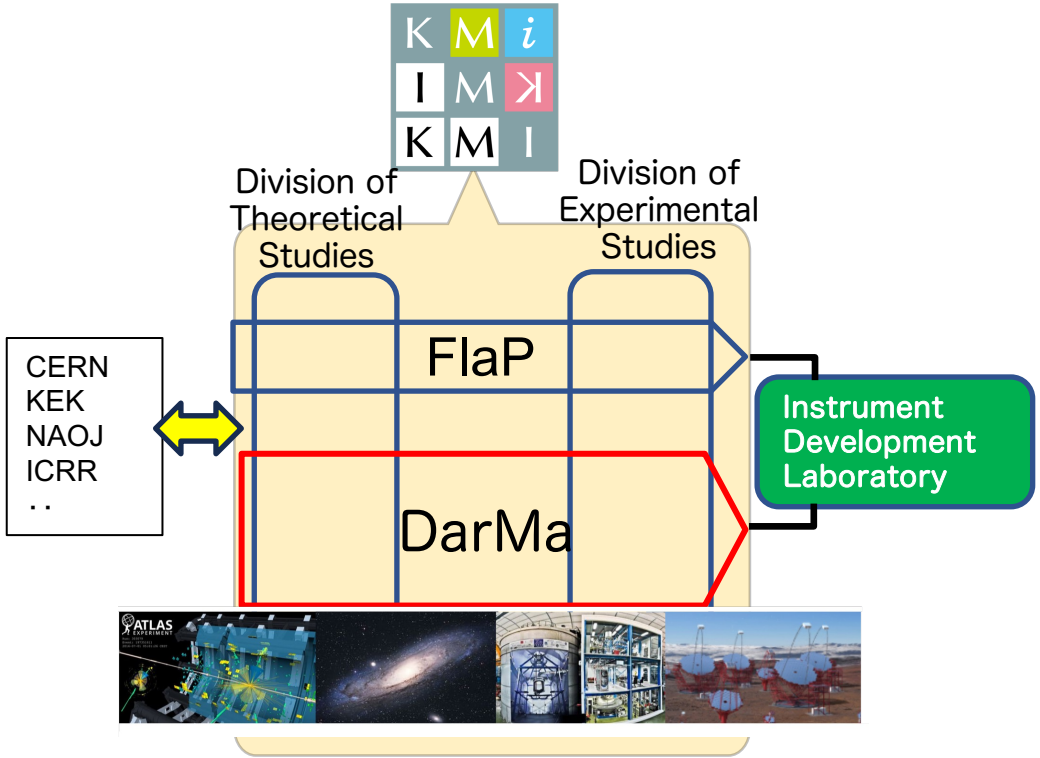
Organization of DarMa



- 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)
- Y.Maekawa(Theory)
- T.Shiromizu(Theory)

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