TSUNG-DAO LEE INSTITUTE · SHANGHAI JIAO TONG UNIVERSITY

李政道研究所 TSUNG-DAO LEE INSTITUTE

Particle and Nuclear Physics Division

- *Research at the frontiers of fundamental physics*

ACADEMIC TOUR

IFAE, Barcelona, May 2026

Yifan Chen

Tenure-track fellow · on behalf of the Division

Our People

李政道研究所
TSUNG-DAO LEE INSTITUTE

3 T. D. Lee Chair Professors


Xiaogang He


Michael Ramsey-Musolf


Xiangdong Ji

5 Distinguished Fellows


Jianglai Liu


Haijun Yang


Hong-Jian He


Dao Xiang


Ning Zhou

6 Tenured Fellows


Shu Li


Donglian Xu

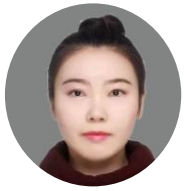

Shao-Feng Ge


Yuichiro Nakai


Kim Siang Khaw


Huilin Qu

6 Tenure-track Fellows


Sophia Han


Xin Xiang


Hualin Mei


Wenyuan Ai


Yifan Chen


Keping Xie

Head: Xiao-Gang He

Deputy head: Ning Zhou

Working closely with faculty in Institute of Nuclear & Particle Physics (INPAC) at SJTU

Similar number of faculties in INPAC.

Our People


Iwan Morton-Blake


Andrew Cheek


Cristian Felipe Sierra Fonseca


Haidar Masud Alfanda


Jiaqi Hui


Oleg Titov


Samip Basnet


Shihwen Hor

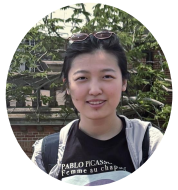

Matthias Jean Tartarin


Yusuke Takeuchi


Xiangyan An


Mohamed Younes Sassi


Yuqi Xiao


Tailin Zhu


Yufeng Wang


Sudhakantha Girmohanta


Yifan Zhu


Hailin Xu


Arsenii Gavrikov


Minzhen Zhang


Shota Nakagawa


Jiang Zhu


Joao Paulo


Roni Dey


Chao Chen


Ximeng Li

26
Postdoctoral Fellows

72
Graduate Students

Three Research Pillars

李政道研究所
TSUNG-DAO LEE INSTITUTE

Astroparticle Experiments

- Dark matter direct detection and Neutrinoless double-beta decay (PandaX)
- High energy cosmic neutrino telescope (TRIDENT)
- Reactor neutrino experiment (JUNO)

Accelerator-based Experiments

- Collider physics (ATLAS, CEPC, STCF)
- Beam dump (DarkSHINE)
- Muon g–2 and EDM

Theory

- Dark matter and neutrinos
- Beyond Standard Model and Phenomenology
- Early universe cosmology
- Quantum chromodynamics

TWO COORDINATED "BIG" EFFORTS:

PandaX — dark matter & fundamental neutrino properties · **TRIDENT** — deep-sea neutrino telescope

Using AI as discovery tool (“Autonomous Laboratory for Physical Sciences” funded by a private donor)

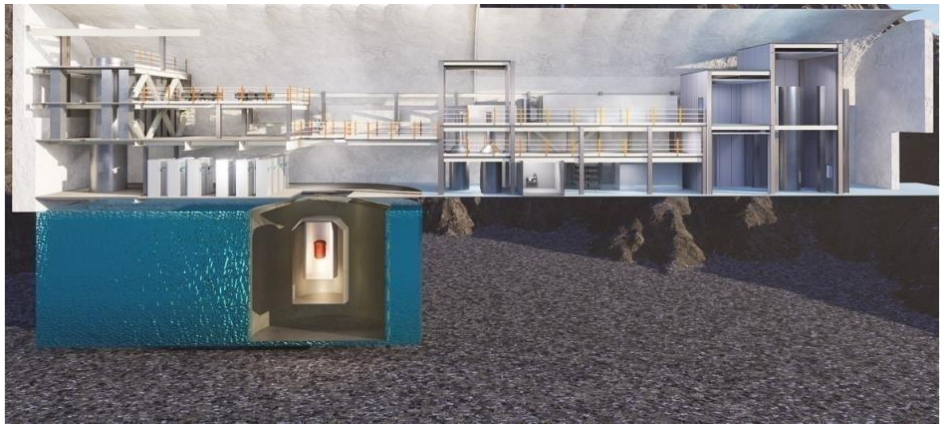
Dark Matter & Neutrinoless Double Beta Decay

PandaX as a discovery tool

EXPERIMENTAL PROGRAM

Step-wise scaling toward an “ultimate” 40-ton liquid xenon detector at 2,400 m deep underground

2020-2026	PandaX-4T	completed
2026-2030	PandaX-20T	2027 in operation
2031 -	PandaX-40T	next future



Very rich physics opportunities

Search for dark matter all the way to “neutrino floor”
Precise low-E astrophysical neutrino observatory
Search for Majorana neutrino to 15 meV mass sensitivity

A MULTI-PURPOSE ULTRALOW BACKGROUND LXe OBSERVATORY

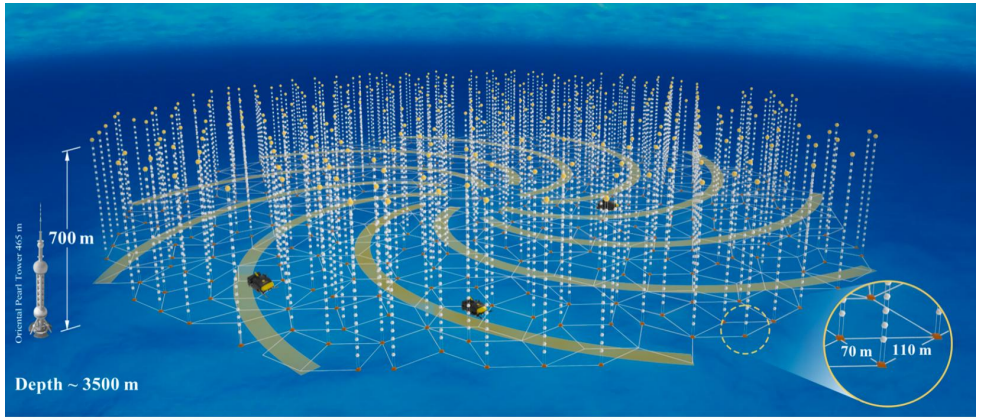
High Energy Neutrino & Multi-messenger Astrophysics

TRIDENT — opening the high-energy neutrino window from the West Pacific

EXPERIMENTAL PROGRAM

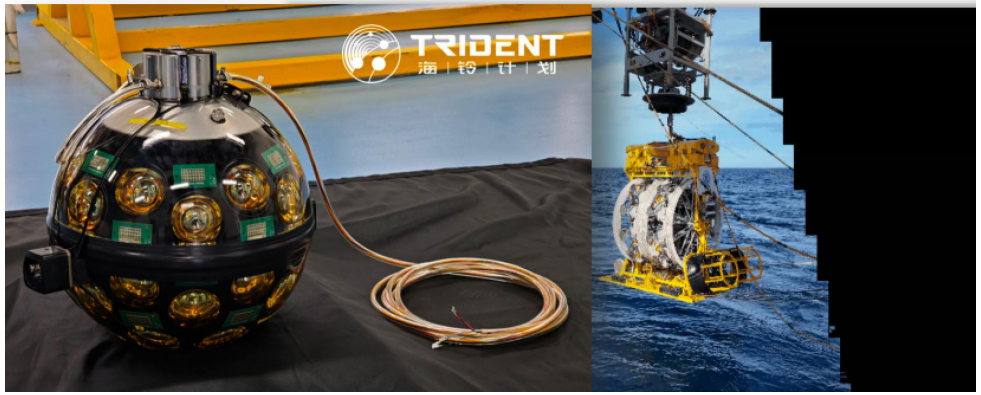
TRIDENT-I 0.1 km³-scale Cherenkov array

10 strings with hybrid digital optical modules ~3,500 m depth, 800 m vertical instrumentation height
Key technological demonstrator



Future TRIDENT full array, 10 km³-scale Cherenkov array (scaling up in steps)

Understand the origin of ultra-high energy cosmic rays
Messengers for extreme cosmic conditions
Fundamental neutrino properties



THE SOUTHERN-HEMISPHERE COMPLEMENT TO ICECUBE — IN West Pacific.

Higgs as a Portal to New Physics

From LHC Run 3 today to a Higgs/flavour factory tomorrow

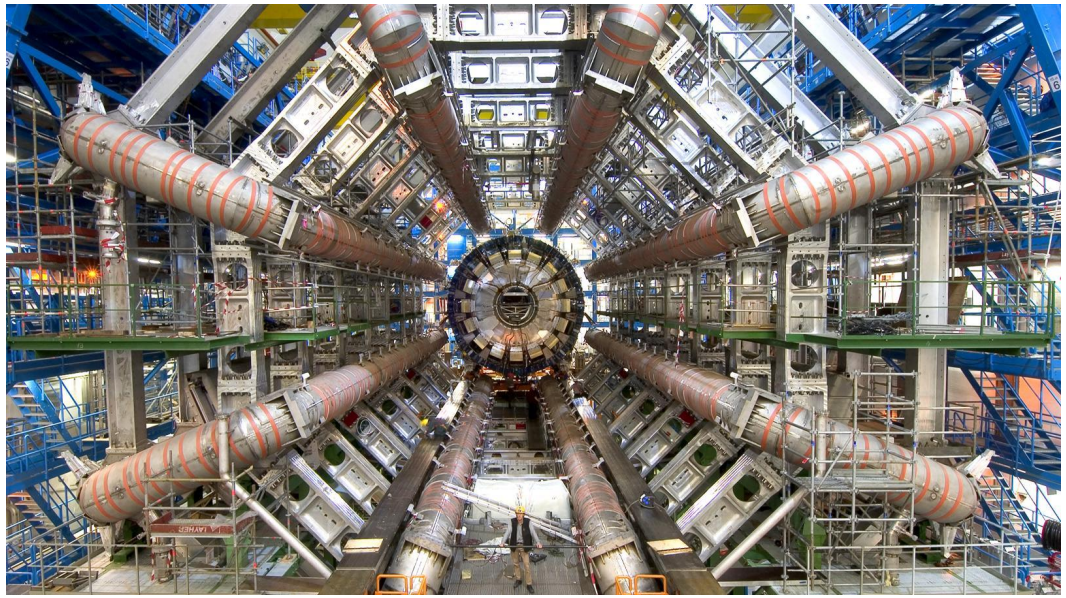
EXPERIMENTAL PROGRAM

ATLAS at LHC · Run 3 → HL-LHC

Higgs property measurements, electroweak physics, BSM searches

Advanced detector R&D

Continuing engagement on CEPC calorimeter R&D
Technology also applicable to Super tau-charm factory



ENERGY FRONTIER (LHC) + INTENSITY FRONTIER (CEPC/STCF).

Beam dump @ SHINE

DarkSHINE — exploiting Shanghai SHINE's 8 GeV electron beam

EXPERIMENTAL PROGRAM

GeV electron beam at Shanghai SHINE

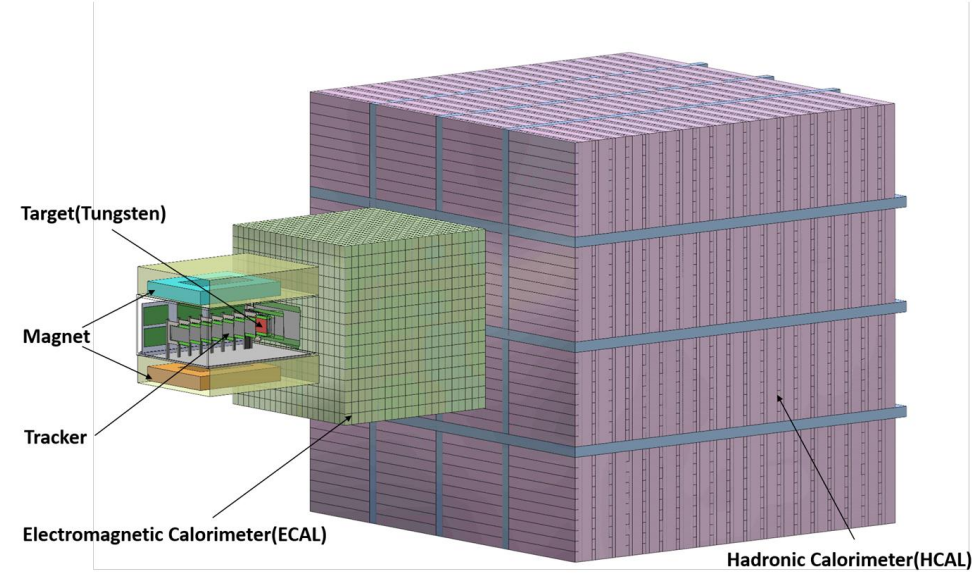
Facility under construction;
DarkSHINE schedule tracks SHINE commissioning (2028)

Tungsten-target missing-energy spectrometer

Tracker (Silicon Strip) - ECAL (Crystal) - HCAL (Sampling)

Beam-tested ECAL & electronics prototypes

Characterized at CERN and at DESY in 2024–2025



A NATIVE SHANGHAI EXPERIMENT — DETECTOR AND ACCELERATOR ON THE SAME CAMPUS.

The Muon Precision Frontier

From Fermilab to PSI to Shanghai — a fundamental muon program

EXPERIMENTAL PROGRAM

Muon g–2 at Fermilab · final analysis

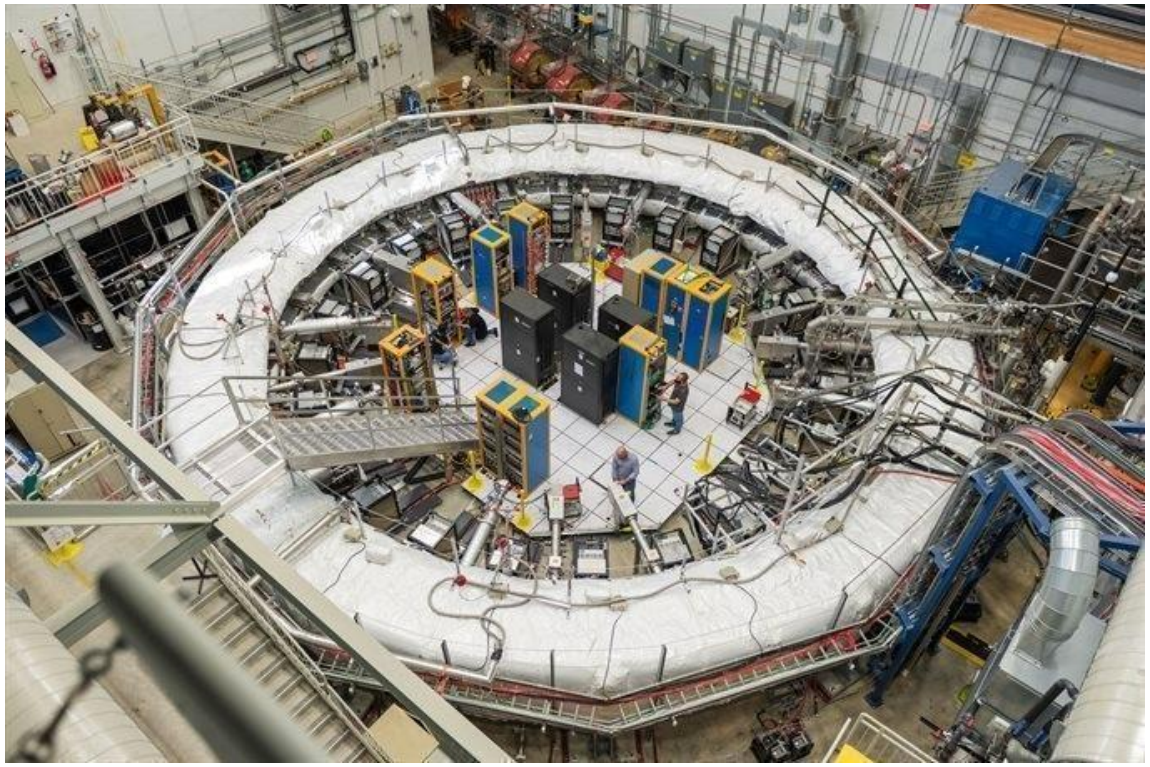
Breakthrough Prize 2025
TDLI is a long-term collaboration partner

Muon EDM at PSI (Switzerland)

Novel frozen-spin technique; muon trigger detector

SHINE muon facility — Shanghai

Production target R&D under way; Phase-0 prototype



MUONS AS A HIGH-LEVERAGE PROBE OF NEW PHYSICS — ACROSS THREE CONTINENTS.

The Theory Frontier

李政道研究所
TSUNG-DAO LEE INSTITUTE

Phenomenology, early-universe physics, and QCD

Theory–experiment interplay

Fully engage TDLI theorists with our experimental programmes — turning measurements into breakthroughs.

- Higgs, neutrino & flavour phenomenology
- BSM theory and phenomenology
- Collaborating with PandaX, TRIDENT, ATLAS, DarkSHINE, Wakefield Axion LSW

Early-universe particle physics

Build an international, coherent group connecting particle physics with cosmology.

- Quantum field theory in the early universe
- Electroweak phase transition & gravitational waves
- Inflation, dark energy and unified theories

Quantum chromodynamics

Develop a world-leading lattice QCD and hadron-structure programme to advance precision strong-interaction physics.

- Hadron structure and dynamics
- Parton distribution functions for precision physics
- Strong partnerships with experimental collaborations

THEORY CONNECTING THE BIGGEST WITH THE SMALLEST — STRONG SYNERGY WITH EXPERIMENTS

By the Numbers (2025)

Sustained funding and a steady pipeline of high-impact publications

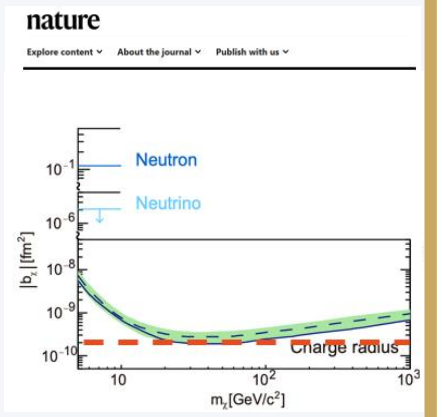
87
Active grants

¥ 222M
Total funding (RMB)

~150
SCI papers

13
PRL

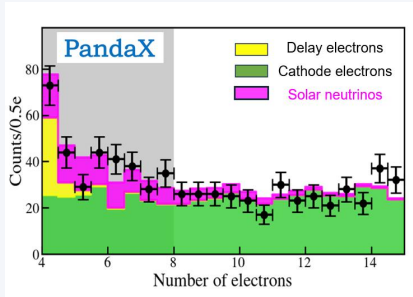
Selected Research Highlights



PandaX

Strongest constraints on the "luminance" of dark matter

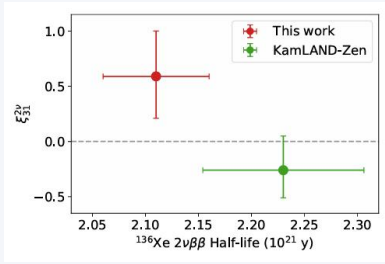
Nature 618, 7963 (2023)



PandaX

First solar ^{8}B neutrino CEvNS indication

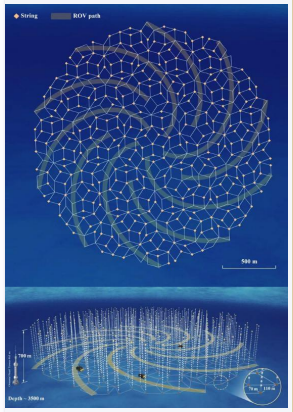
PRL 133, 191001 (2024)



PandaX

Most precise measurement to two-neutrino double beta decay of ^{136}Xe

PRL 136, 162501 (2026)



TRIDENT

Site and conceptual design for TRIDENT, a neutrino telescope in West Pacific

Nature Astron. 7 (2023) no.12

Muon g-2

Most precise muon g–2 measurement

PRL 135, 101802 (2025)

Phenomenology

Gravitational wave background probing galactic center density

Nature Astron. 10 (2026) no.4

李政道研究所
TSUNG-DAO LEE INSTITUTE

THANK YOU

We welcome partnership with European institutions.

Visiting scholars · joint postdocs · students exchange · joint grants

DIVISION HEAD

Xiao-Gang He

hexg@sjtu.edu.cn

DEPUTY HEAD

Ning Zhou

nzhou@sjtu.edu.cn

WEB

tdli.sjtu.edu.cn

Shanghai · China