Perspective on $0\nu\beta\beta$ Program in China

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December 11, 2020 @ACFI/Snowmass Workshop

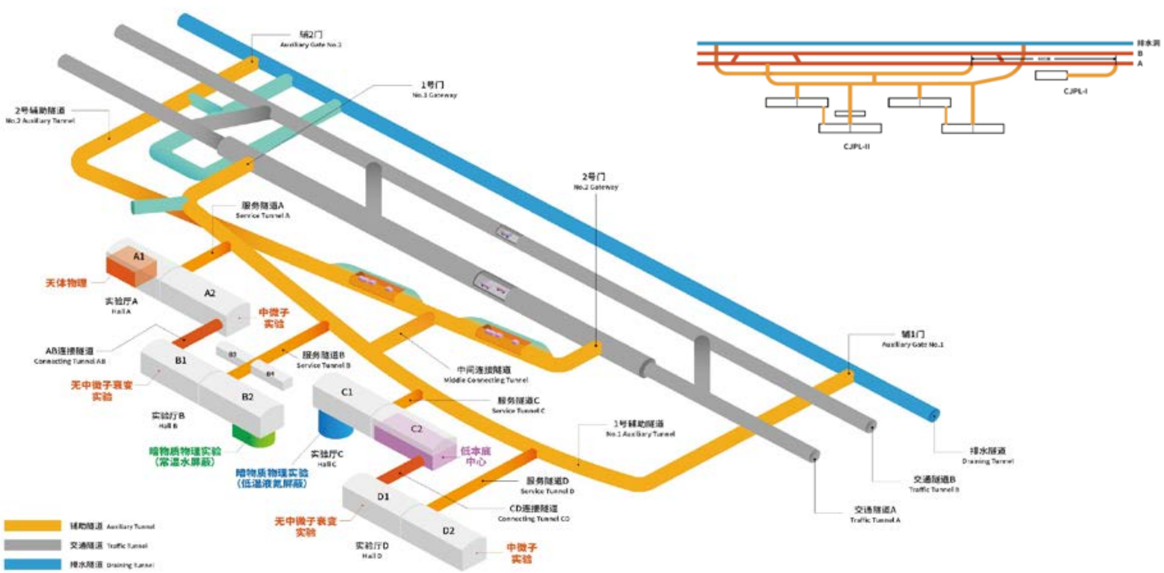
Many thanks to Q. Yue, Z. Zeng, Z.Z. Xing, L.J. Wen, N. Xu, K. Han, L. Ma, H. Qiu, H.Q. Zhang

CJPL-II current status

CDEX in C1

PandaX in B2

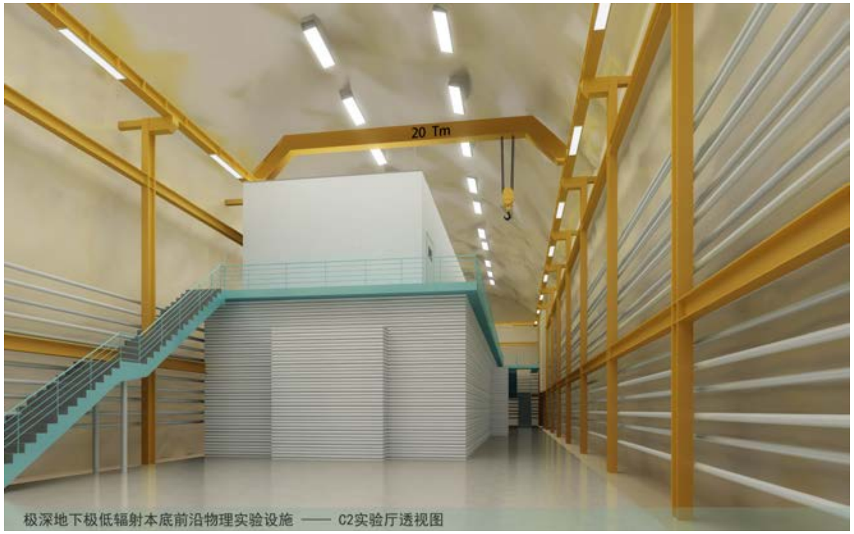
JUNA in A1



Construction of Dark Matter Exp:
CDEX-100kg and PandaX-4T
JUNA (Astro-Nuclear)

Future and Timeline

- Excavation and reinforce tunnel, 2020.12-2021.12
- Interior decoration, 2021. 1-2023. 12
- Ground laboratory, 2021. 1-2022. 6
- Equipment and installations: 2021. 12-2023.12



Underground Exp Hall (Designed)

Ground Lab Building Near Xichang Airport

CJPL 0νββ Program

Detector Technologies Under R&D:

LEGEND – HP^{76}Ge technology
(Detector production in China)

CUPID – $Li_2{}^{100}MoO_4$ Crystal Bolometer technology
(LMO crystal production in China)

HP TPC Gas
– ^{136}Xe gas with micromegas readout (PandaX III)
-- $^{82}SeF_6$ gas with ion drift and topmetal pixel readout

Demonstrators will be needed at CJPL
Ton-scale detector down selection may be a few years away

Enrichment in China ?

At a recent meeting with Institute of Physical and Chemistry Engineering Regarding Se-82 and Mo-100 enrichment:

To build up a facility with production capability of 100 kg/year ~ $10M investment !

This is an issue that needs to be worked out.

Into the NH Region

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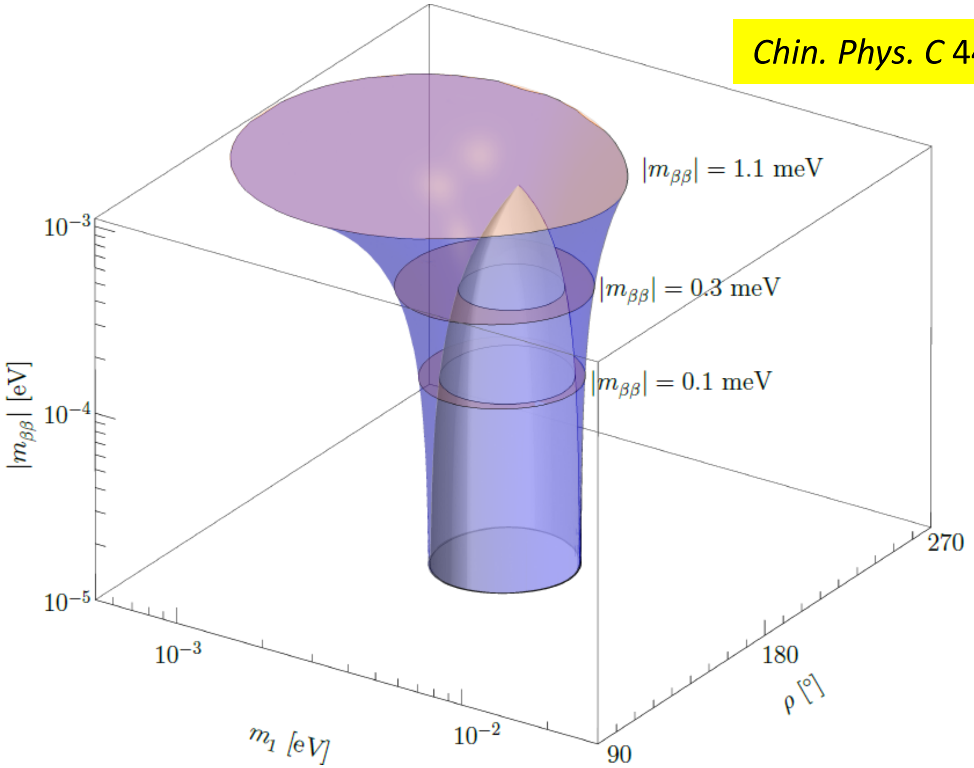
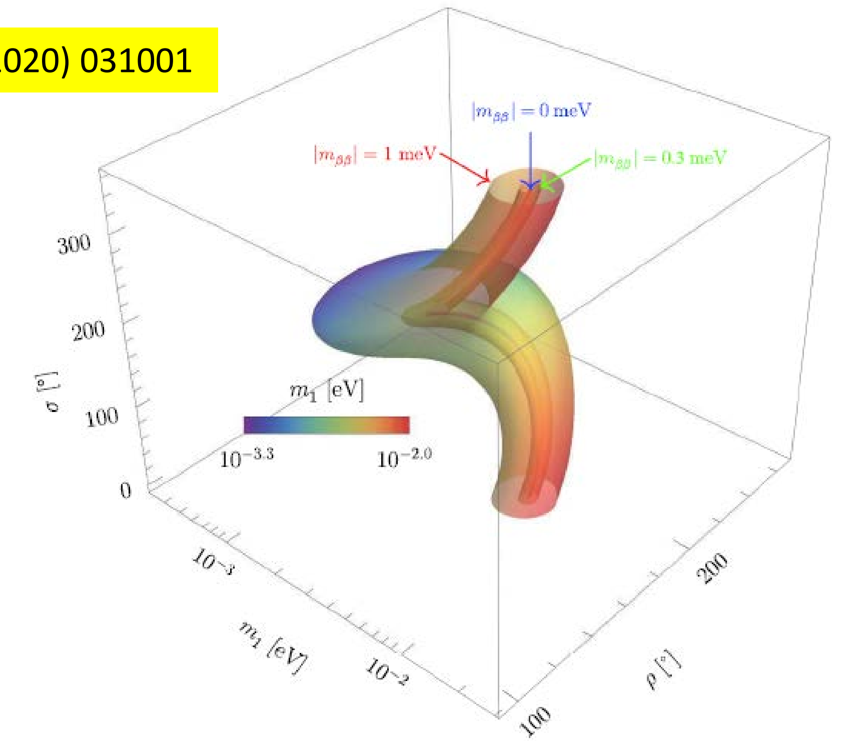
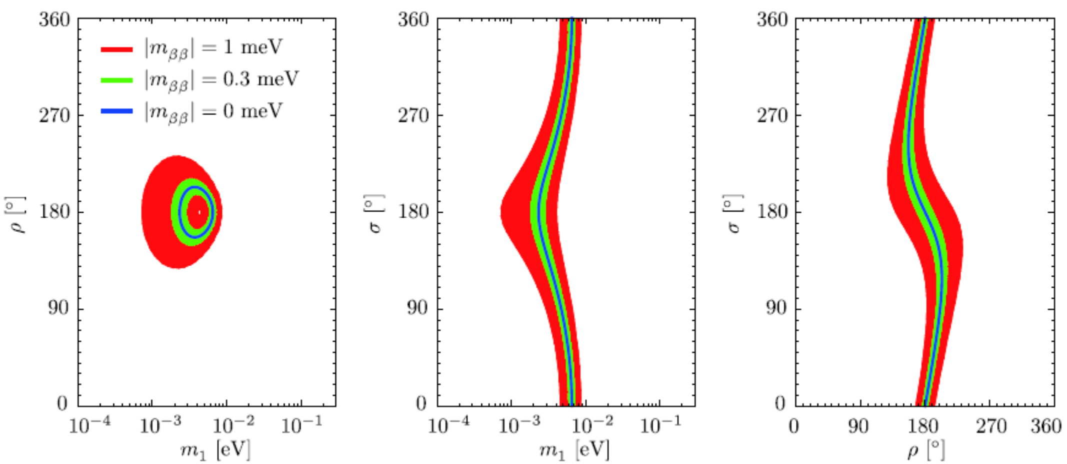




实验上追求 $|m_{\beta\beta}|$~meV的意义

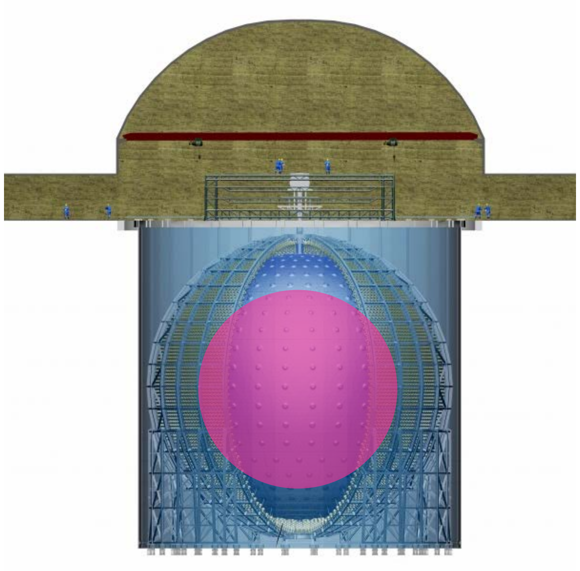
- 最轻中微子质量m_1、Majorana相位(ρ, σ)的参数空间被限制得很小
- 有望确定三代中微子质量谱



From Liangjian Wen

Outlook on Technology Advances

Brute Force Approach:



JUNO-ββ (1800 m.w.e.)

50 Tons ^{136}Xe (5years):

> 1.8×10^{28} yrs

^{130}Te Doping; 100 Tons possible.

Issues:

- **Depth at JUNO + Muon veto enough?**
- **Radiopurity of Te doping?**
- **Liquid Scintillator with Te doping**
  - **-- stability**
  - **-- light transmission**

2030+

Can CUPID-like technology be viable for x10 increase in sensitivity beyond IH region?

Increase the detector mass alone not viable;

Further background reduction from Crystal and Copper;

Improvement of pile-up rejection;

Multiple super-size detectors.

CUPID-China Collaboration

International CUPID collaboration

Many thanks to the CSNSM Orsay group and CUPID-Mo Collaboration, Milan-Bicocca, UCB, LNGS Groups for helping us to get started.

CUPID-China

- Fudan University*
- Beijing Normal University*
- Shanghai Institute of Applied Physics
- Shanghai Institute of Ceramics
- Shanghai JiaoTong University*
- Tsinghua University
- University of Science and Technology of China*
- Ningbo University

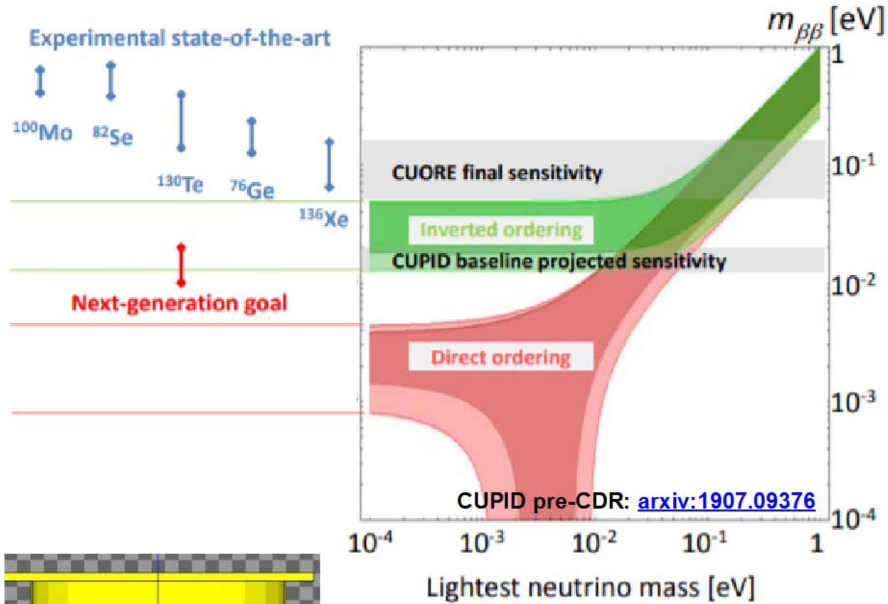
*officially joined international CUPID

Thanks

CUPID-1T: the future bolometric experiment

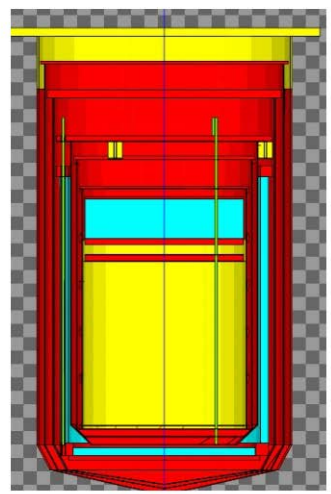
CUPID-1T: HALLMARKS

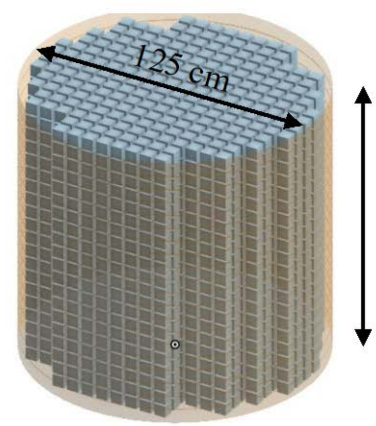
- ➢ 1000 kg of ^{100}Mo in a new cryostat or multiple facilities world wide
- ➢ Sensitivity: $m_{\beta\beta}$<10 meV (NH)



POTENTIAL EXPANSIONS

- ➢ Large volume cryogenic facilities in multiple Underground Labs worldwide
- ➢ ~1900 kg of LMO

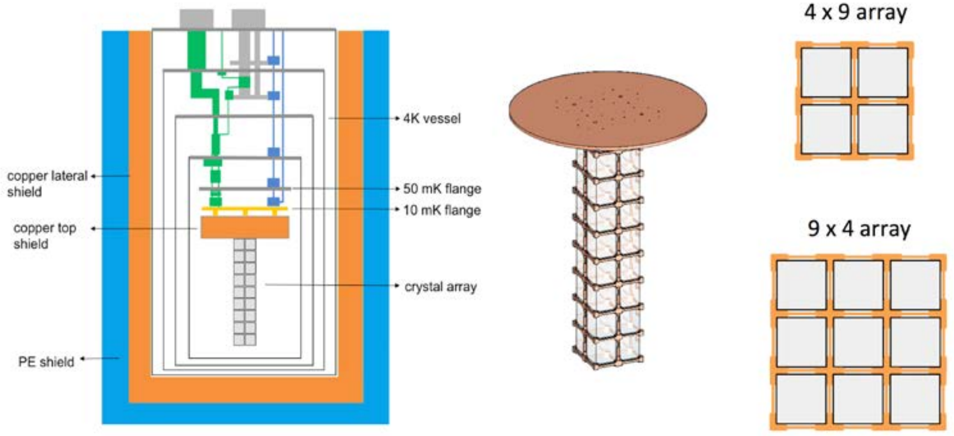




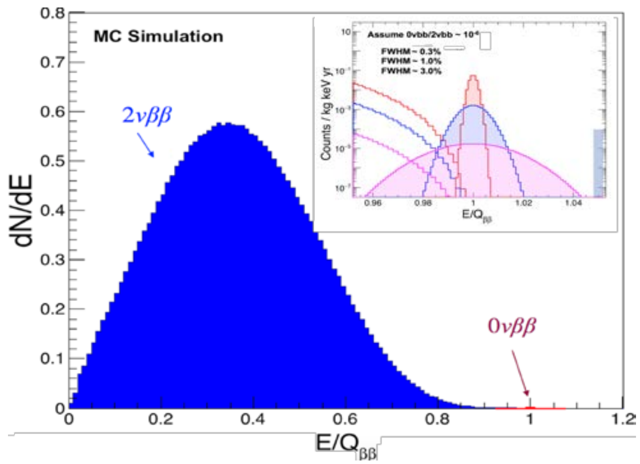
From Danielle Speller's Presentation at Towards CUPID-1T. Snowmass 2021 Planning workshop

A CUPID-CJPL detector can fit in the CUPID future as envisioned

CUPID-CJPL Demonstrator

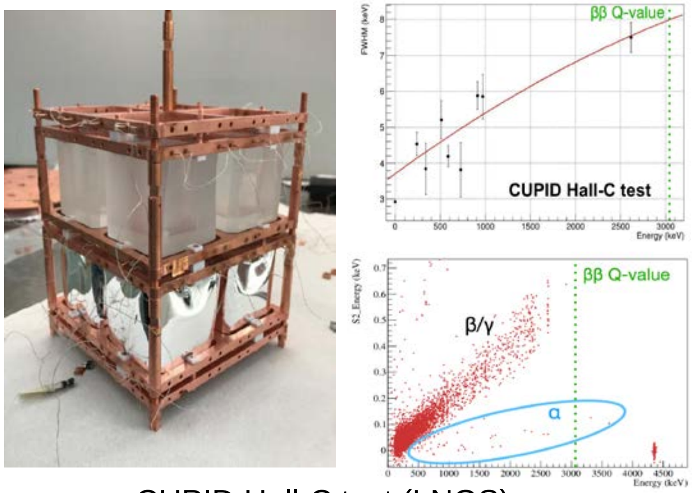


CUPID-CJPL demonstrator conceptual design



Single crystal	Array structure	Total mass [kg]
45×45x45 mm^3 280 g (LMO)	4x9 (9x4)	10

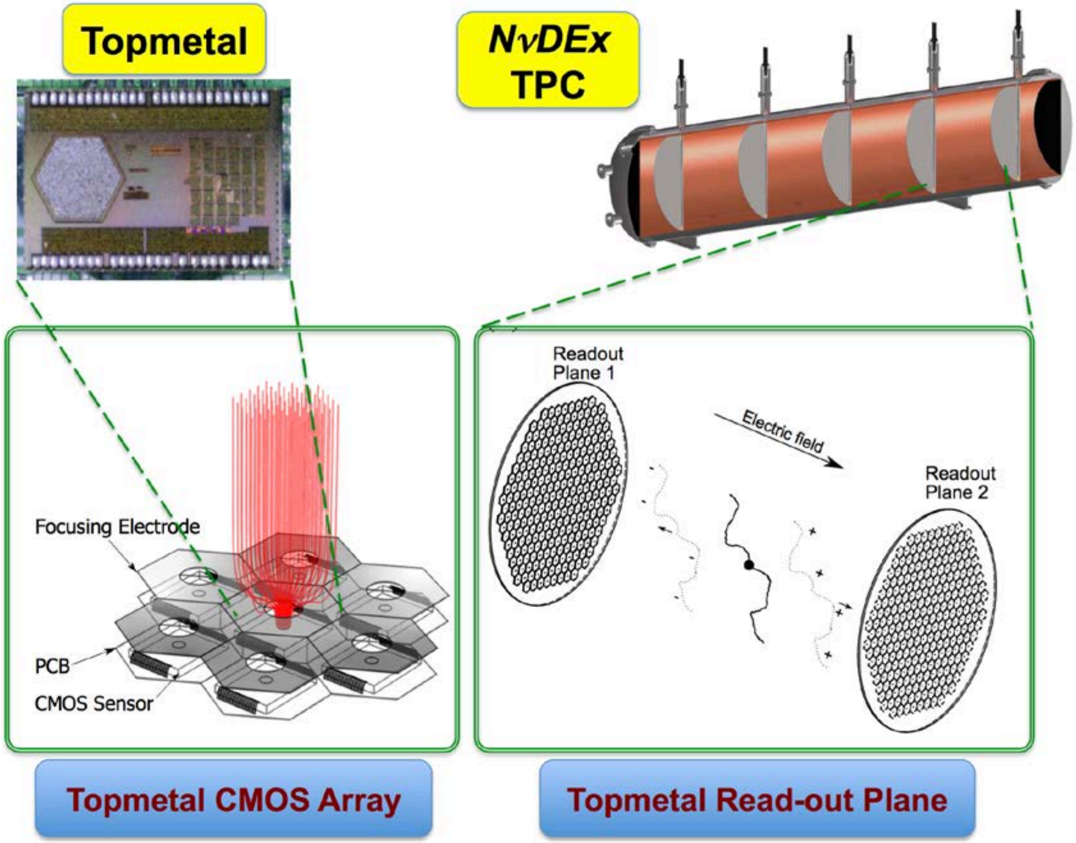
Goal: Using Chinese LMO crystals to achieve similar energy resolution, alpha rejection and background index as achieved by CUPID-Mo and Hall-C Test



CUPID Hall-C test (LNGS)

(BI(ROI)<10^{-3}cts/keV/kg/yr)

NνDEx Concept



Maintain tracking capability (pixel readout) and Achieve energy resolution of ~1% with ion drift/no avalanche/low noise readout