

Advanced bolometers for neutrinos, axions and dark matter

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Important non-accelerator particle-physics topics in the P2IO labex area

- ❑ Search for neutrinoless double beta decay ($0\nu 2\beta$)

CSNSM – IRFU/DPhP – LAL → CUPID project

- ❑ Detect coherent elastic neutrino-nucleus scattering (CEvNS) at nuclear reactors

IRFU/DPhP – CSNSM → CEvNS experiment at Double Chooz

- ❑ Search for solar axions

IRFU/DEDIP-DPhP – CSNSM → IAXO project

- ❑ Search for low-mass dark matter particle candidates

CSNSM – IRFU/DPhP → EDELWEISS (EDELWEISS + SuperCDMS in prospect)

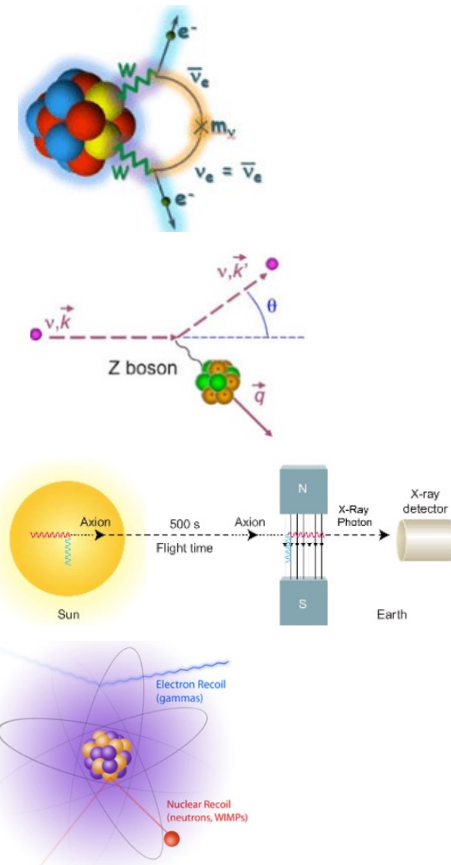
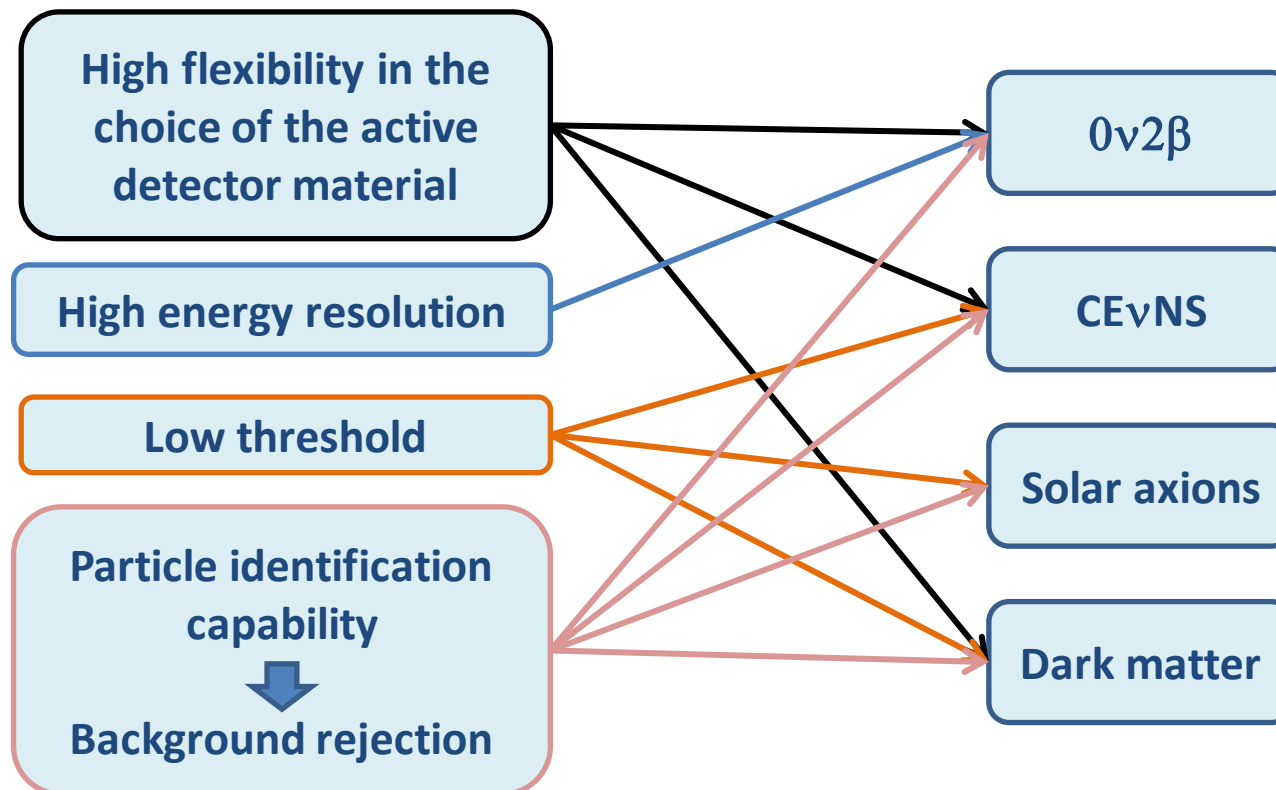
Wide physics reach in several fields at the frontier of human knowledge

- ☐ Search for neutrinoless double beta decay ($0\nu 2\beta$)
Nature of neutrino (Dirac or Majorana?) – Lepton Number symmetry
- ☐ Detect coherent elastic neutrino-nucleus scattering (CEvNS) at nuclear reactors
Non-standard ν interaction – sterile neutrinos – neutrino magnetic moment
- ☐ Search for solar axions
Discover of a new particle – solution of the strong CP problem
- ☐ Search for low-mass dark matter particle candidates
Identification of the dark-matter nature

The role of bolometers in this project

- ❑ Bolometers are phonon-mediated cryogenic detectors
Strong expertise on advanced bolometers in P2IO: CSNSM – IRFU

- ❑ Advantages of bolometers in the topics under study

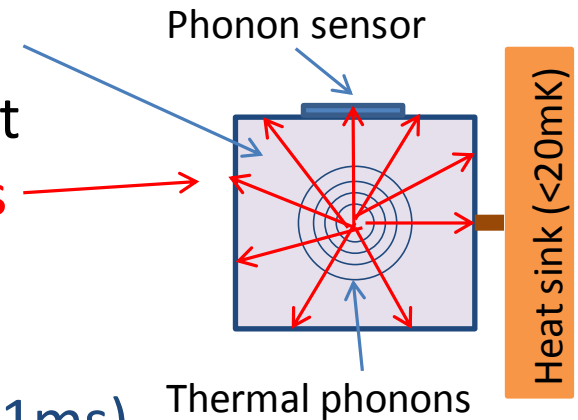


Technological goals of this project

Strong physics impact (labex visibility)

Bolometry is a « recent » technique → large margins for improvement

- ❑ Exploration of **new detector materials**
- ❑ Study of new sensors capable to detect efficiently **out-of-equilibrium phonons**



Higher energy sensitivity

Higher speed ($< 1\text{ms}$)

- Higher energy resolution (0.1 %)
- Lower threshold (1-10 eV)

Better particle identification capability through:

- Pulse shape discrimination
- Hybrid readout

- ❑ Improvement of **detector radiopurity**

→ **Crucial advancements in all the four physics topics**

Strong integrating function of this project

1 Foster cooperation among different groups in the P2IO area

Physics expertize on the research topics



Technological expertize on bolometers



IRFU/DPhP – low energy neutrino group
IRFU/DEDIP
LAL
IRFU/DPhP – EDELWEISS/CUPID group
CSNSM

CSNSM

IRFU/DPhP – EDELWEISS/CUPID group

2 Strong « transversal » character of the R&D subjects

The improvement of a given detector feature can have a major impact on several fundamental physics subjects simultaneously