RES-NOVA

Archaeological lead based cryogenic detector

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Astro-particles: Neutrinos and Dark Matter

Neutrinos and Dark Matter are among the most abundant particles in the Cosmos

Nuclear reactors
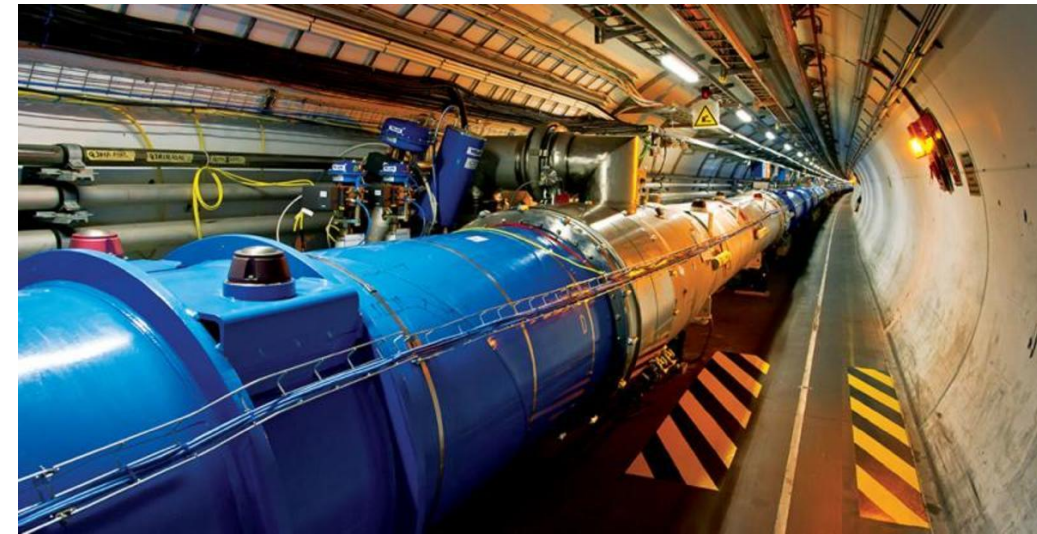
Accelerators

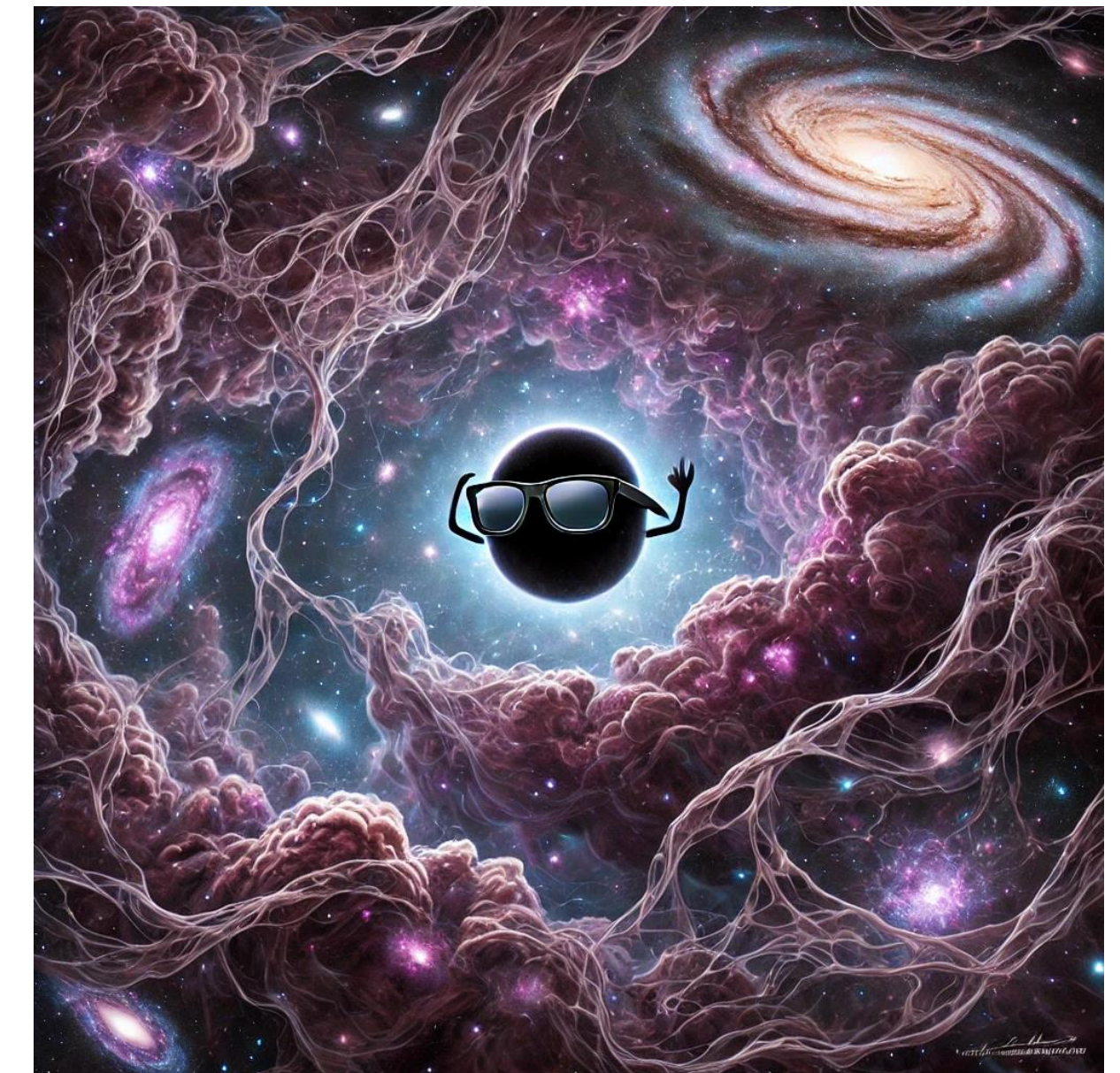Supernovae

Dark Matter

Atmosphere

Earth

Neutrino sources

We can use neutrinos/DM properties to study neutrino/DM sources
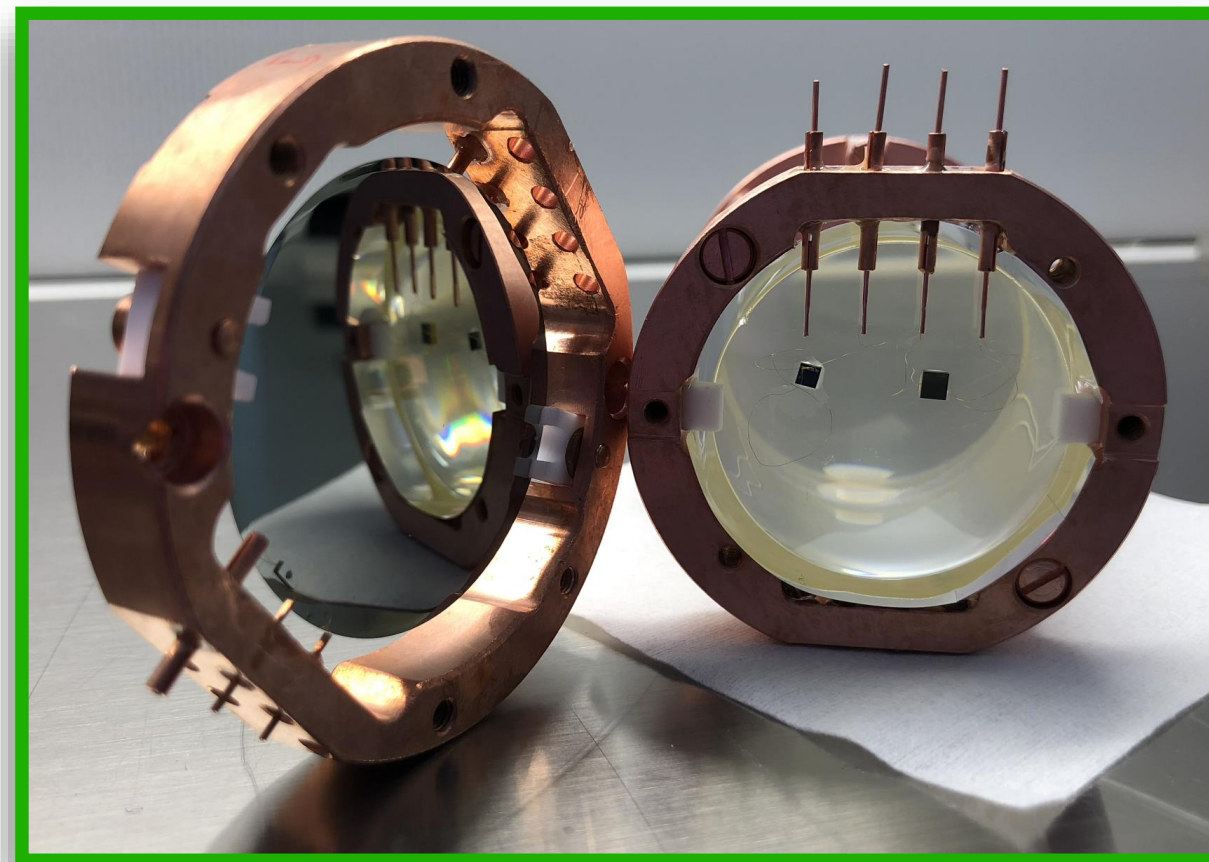
Archaeo-Pb based cryogenic detectors

detection of neutrinos and Dark Matter with archaeo-Pb

Archaeological-Pb ensures <u>ultra-low-background</u> and <u>high statistics</u> (largest cross-section)

RES-NOVA cryogenic detectors

Traditional neutrino detector

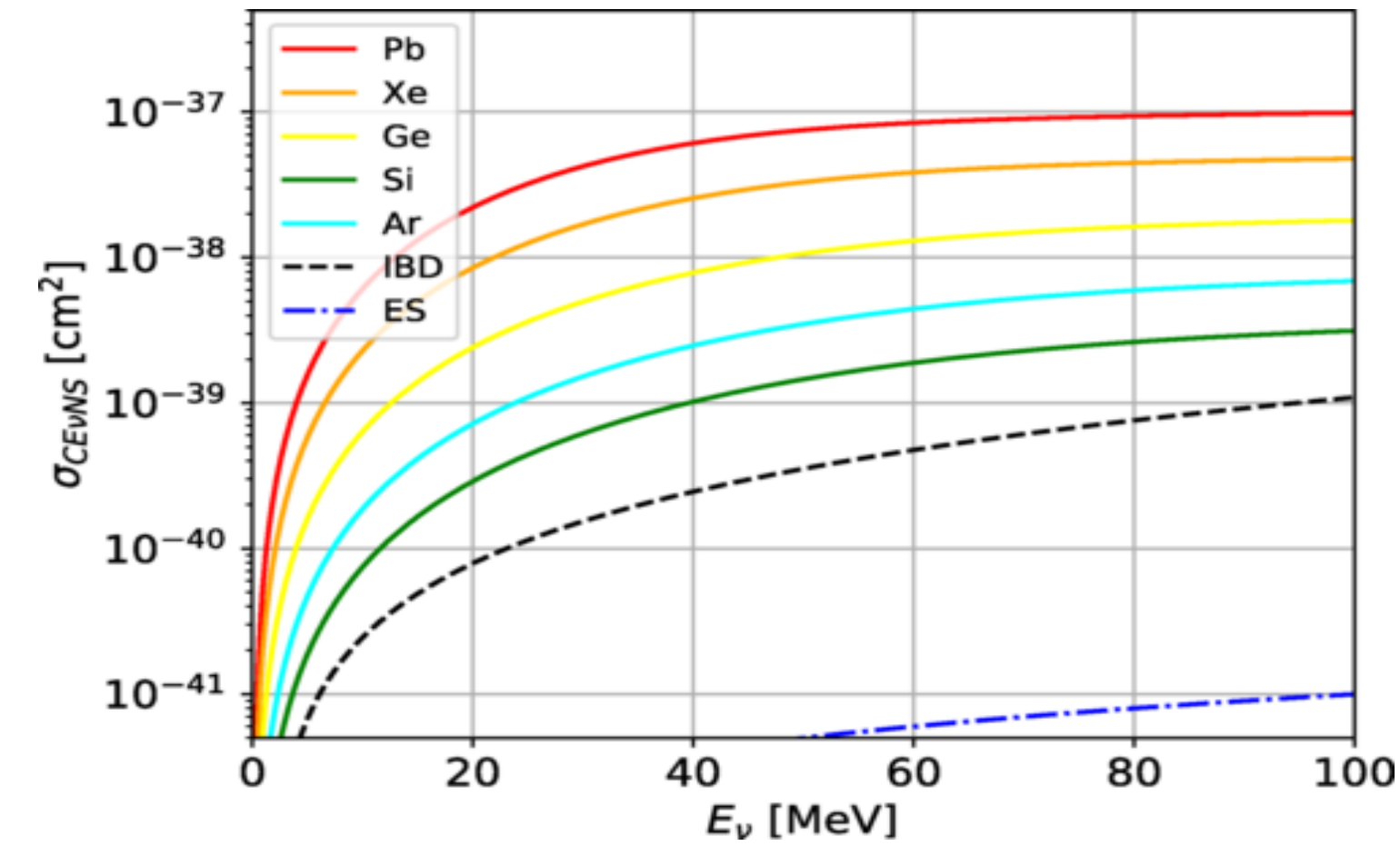4 cm

20 m

Archaeo-PbWO$_4$ crystal
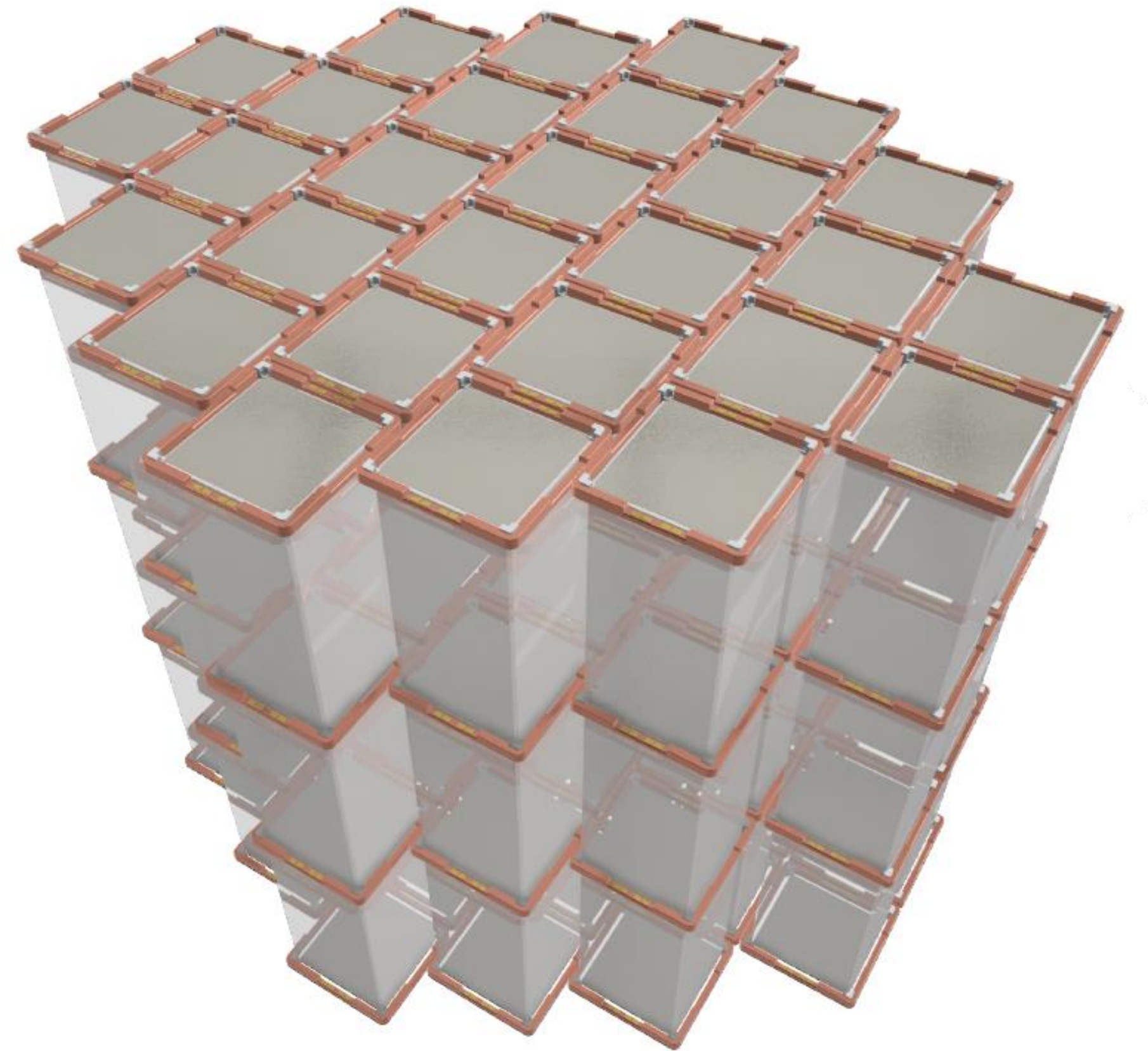
Water Cherenkov detector

RES-NOVA: New experimental approach with cm-scale neutrino detector
AIM: Measurement of Supernovae neutrinos to study stellar core collapses

RES-NOVA detector

Cross-section comparison

of neutrino interactions

with different means

RES-NOVA demonstrator detector

structure (30 cm^3)

Key research areas for the RES-NOVA experiment:

- **Radioactivity:** analysis and assessment of materials radiopurity.
- **Electronics:** development and testing of signal readout electronics.
- **Monte Carlo Simulations:** development of the experimental background model.
- **Machine Learning:** development of decision algorithms for signal discrimination.

Check us out @ https://res-nova.unimib.it/home

Proposed Thesis Topics
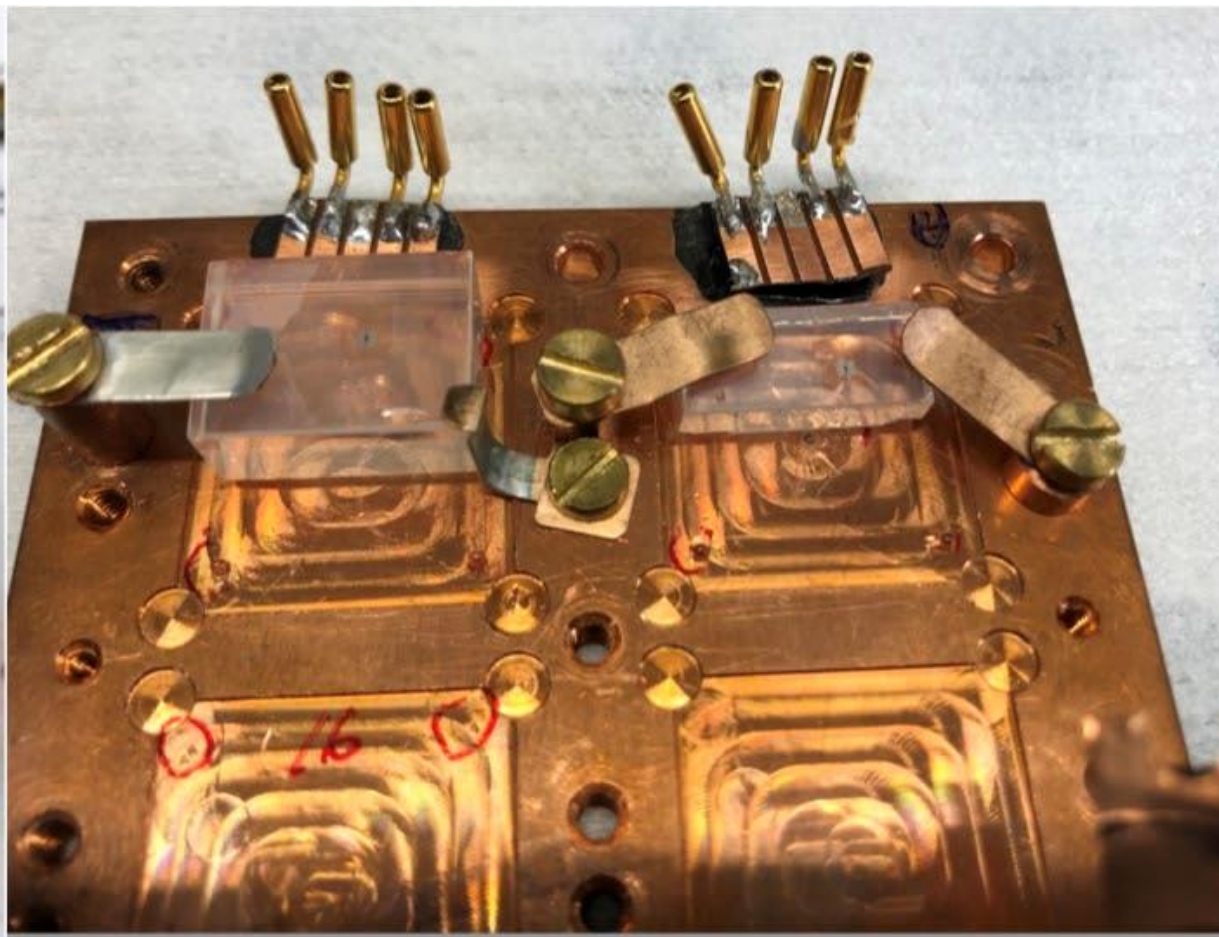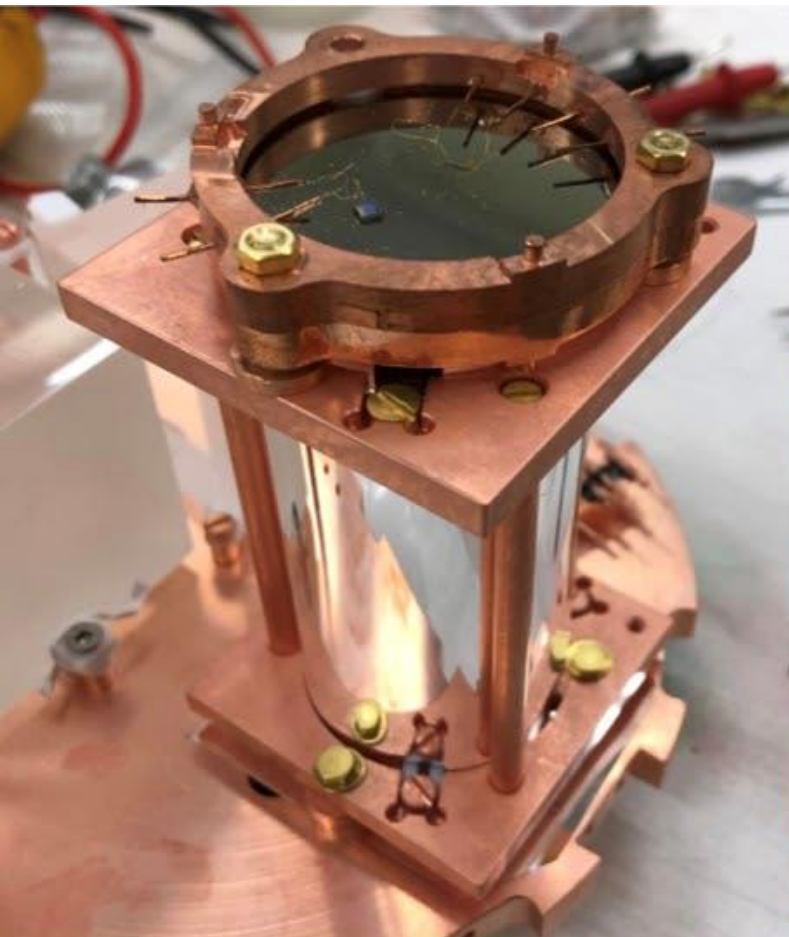
Assembly, operation and data analysis of detector prototypes with archeological Lead 🛰 (hardware)

Characterization of SQUIDs (Superconducting Quantum Interference Devixces) for detector readout 🧊 (hardware)

Study of cosmogenic activation in $PbWO_4$ crystals produced with Roman Lead for the RES-NOVA experiment ☢ (hardware + software)

Neutrion activation of archeological Lead at the nuclear reactor TRIGA MkII in Pavia 🌋 (hardware+software)

Sensitivity studies of rare processes: Dark Matter interactions, Supernova and Solar Axions searches, Solar neutrinos 🟠 💥 (software)

Development of a background model using Monte Carlo simulations 🎲 (software)

Linearization of the energy response of sensors operated in the superconducting transition (TES) for the RES-NOVA experiment 📈 (machine learning)

Development of a classifier for the identification of nuclear recoils and background suppression in the RES-NOVA experiment 🧩 (machine learning)

Contact us!
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