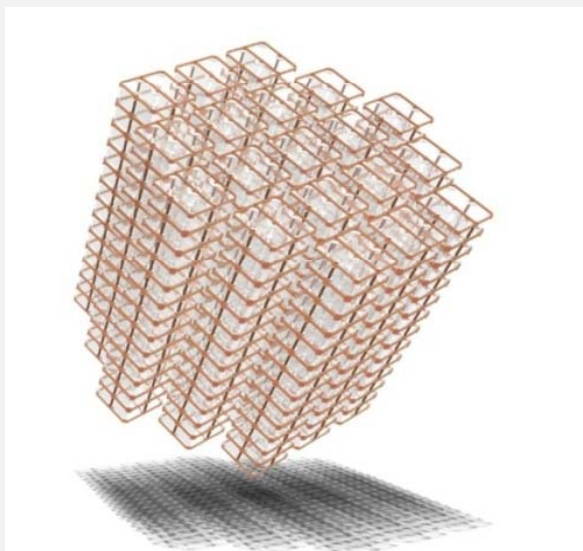


# Surface induced background in CUORE

## Cryogenic Underground Observatory for Rare Events

The CUORE experiment aims to search for neutrinoless Double Beta Decay (0νDBD) of  $^{130}\text{Te}$  with an array of 988  $\text{TeO}_2$  bolometers.

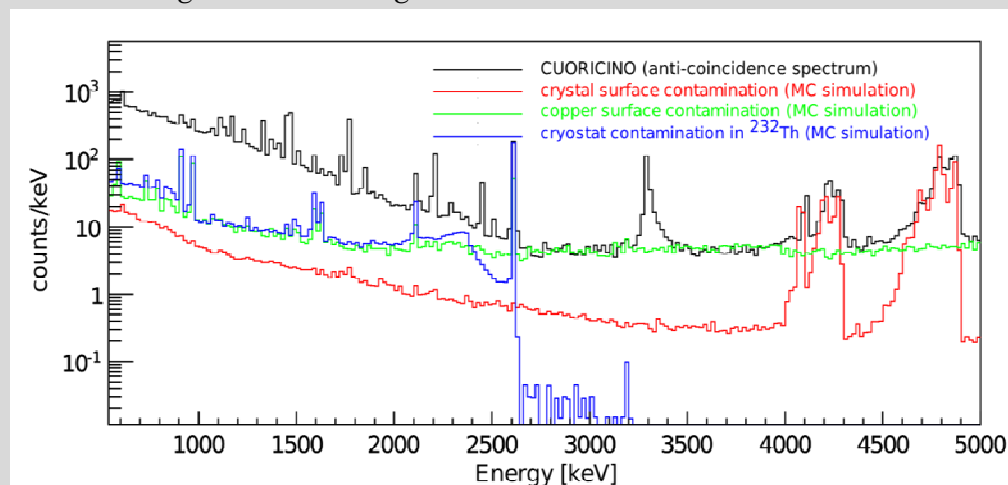
Discovery of 0νDBD will provide outstanding insight into neutrino mass and nature (Dirac or Majorana).



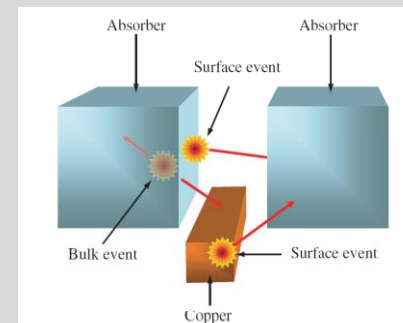
The CUORE background model is based mainly on the knowledge acquired on the bolometric technique thanks to Cuoricino.

## Cuoricino background

The Cuoricino detector was built as a prototype for the CUORE experiment. Cuoricino counting rate in the region of interest:



## Alpha surface contaminations



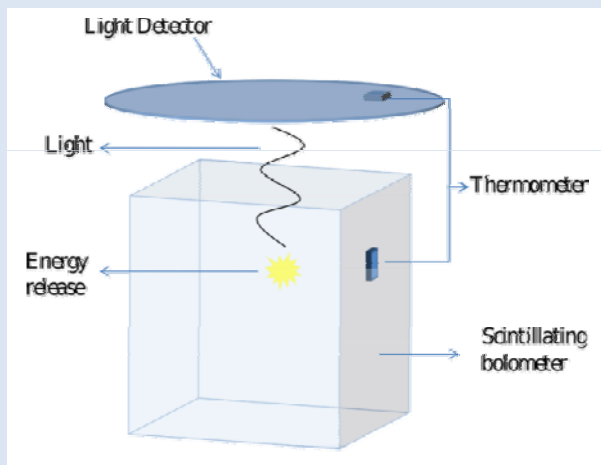
$\alpha$  particles give contributions the region of interest only if they lose a limited fraction of their energy in the bolometer. This condition happens whenever the contamination is localized on the surface of the crystal or of the material facing the detector.

# Surface induced background in CUORE

## Surface contaminations studies with scintillating bolometer

### Working principle of scintillating bolometers

Scintillating bolometer: a bolometer coupled to a light detector.

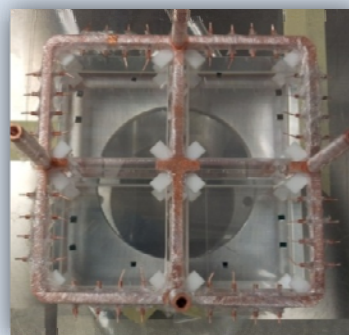


The leading idea: to combine the two available information (heat and scintillation light) to distinguish the nature of the interacting particles, exploiting the different scintillation yield of  $\beta/\gamma$ ,  $\alpha$  and neutrons.

Thanks to the capability to recognize the nature of the interacting particles, scintillating crystals can be used to study surface contaminations of materials faced to the detector with a much higher sensitivity than conventional techniques

### Array of 4 BGO crystals ( $5 \times 5 \times 5 \text{ cm}^3$ ) + Light detector (Ge, $\text{Ø} = 6.6 \text{ cm}$ )

BGO crystals ( $\text{Bi}_4\text{Ge}_3\text{O}_{12}$ ) are particularly suitable because of their very high light yield and commercial availability.



Surface inert material  $\approx 450 \text{ cm}^2$

Live time = 1364 h

$\alpha$  background (3-8 MeV)

$\approx 0.0001 \text{ count/h/cm}^2$



The assembly is the same (except for the light detector) of the one used for studies of surface contaminations done with  $\text{TeO}_2$  crystals.