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Results from the CUPID-Mo Experiment

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CUPID-Mo has served as a successful demonstrator experiment for CUPID (CUORE Upgrade with Particle ID), the planned next-generation upgrade of CUORE (Cryogenic Underground Observatory for Rare Events), a ton scale cryogenic calorimetric $0\nu\beta\beta$ decay experiment. CUPID-Mo operated at Laboratoire Souterrain de Modane (LSM) in France as an array of 20 enriched Li_2MoO_4 (LMO) cylindrical scintillating crystals (~200g ea.) each featuring a Ge light detector (LD) to collect scintillation light from the LMO. A dual mode of energy collection (heat from LMO and light from LDs) allows for event-by-event discrimination of α vs β/γ's which reduces the background from degraded α's. CUPID-Mo has an energy resolution of ~7.4 keV (FWHM) at 3034 keV, complete α vs β/γ discrimination and very low radioactive contamination.

Here we show the recent results of the analysis on the full CUPID-Mo exposure, showcasing improved analysis techniques with a focus on the development of the CUPID-Mo background model and latest results relating to the $2\nu\beta\beta$ decay half-life and spectrum. The background model was validated on a ^{56}Co calibration dataset and is shown to describe the data quite well. We demonstrated the radiopurity of the LMO crystals meet CUPID goals and has an exceptionally low background index in the 3 MeV region of interest of ~2.7 x 10^{-3} counts/keV/kg/yr. Owing to the relatively fast half-life and exceptionally well performing background model we also are able to show an updated result on the half-life of ~7.07 x 10^{18} yr with a relative precision of 1.6% making it the most precise measurement to-date in ^{100}Mo. Owing to the relatively fast half-life we are able to comment on the $2\nu\beta\beta$ decay spectral shape, constraining higher order corrections. CUPID-Mo also performed a novel measurement of the shape factor, and extracted a value for the axial vector coupling constant.

Given name

Pia

Surname

Loaiza

First affiliation

IJCLab - IN2P3

Gender

Female

Institutional email

loaiza@ijclab.in2p3.fr

Poster prize

No

Second affiliation

Collaboration (if any)

Presenter: LOAIZA, Pia (IJCLab - IN2P3)

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