**Status of the CUPID-Mo bolometric experiment:** searching for neutrinoless double-beta decay of $^{100}$Mo

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### $^{100}$Mo double-beta decay

- **Standard Model two-neutrino decay** ($2\nu\beta\beta$)
  - $327$ yr ($\Delta m^2_{31} = 7.1 \times 10^{-5} \text{eV}^2$)

- **Beyond Standard Model neutrinoless process** ($0\nu\beta\beta$)
  - $T_{1/2} > 10^{26}$ yr ($\Delta m^2_{31} = 2.2 \times 10^{-3} \text{eV}^2$)

### Advantages of $^{100}$Mo $0\nu\beta\beta$ searches

- One of the highest $Q_{\beta\beta}$-values
- Reasonably high natural abundance and industrial enrichment to >95%
- Favorable theoretical predictions
- Developed technology (LUMINEU) of $^{100}$Mo enriched crystals batch production
  - Purified molybdenum & ultra-pure lithium carbonate
  - Double crystallization using LTG Cz technique
- High performance & radiopure scintillating bolometers
  - Source-Detector technique: ~100% $0\nu\beta\beta$ detection efficiency
  - High energy resolution: 0.2% FWHM close to $^{100}$Mo $Q_{\beta\beta}$
  - Particle identification: >99.9% $\beta$-ray rejection in 0$
u$ββ ROI
  - High crystal radiopurity: < 6 mBq/kg of $^{40}$K

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### CUPID-Mo goals & prospects

- At least six-months-long live-time measurements @LSM
- Investigation of $^{199}$Li-$^{100}$MoO$_4$ crystals bulk / surface radiopurity
- New $^{100}$Mo $0\nu\beta\beta$ half-life limit & improved $2\nu\beta\beta$ study
- Extension @LNGS or & @LSC
- Extensive demonstration of the $^{199}$Li-$^{100}$MoO$_4$ scintillating bolometer technology, selected for CUPID project (CUORE follow-up; a ton-scale 0$
u$ββ bolometric experiment)

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### CUPID-Mo background

- Combined spectrum of 19 detectors
  - 3.5 keV FWHM

- Median parameters
  - $P_{\text{FWMH}}$ (keV) 1.37
  - Rise time (ms) 24
  - Decay time (ms) 297
  - Signal (keV/MeV) 17.5
  - $\text{LY}_{\gamma}$ (keV/MeV) 0.75

- $\alpha/\gamma$ separation around $^{100}$Mo $Q_{\beta\beta}$
  - 15$\sigma$

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### CUPID-Mo installation & operation

- Assembly @CSNSM & @LAL: Autumn 2018
- Installation into the set-up @LSM: January 2018
- Delay due to cryogenic problems: Spring 2018
- First commissioning: Summer 2018
- Serious cryostat failure: August 2018
- Delay due to cryogenic problems: January 2018
- Second commissioning: Winter 2019
- Continuous data taking at 20.7 mK: since Spring 2019

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