

# ***EDELWEISS at LSM***

Stefanos Marnieros - IJCLab

LSM experiments meeting

14 January 2022



# EDELWEISS 2021 status

- 2021-2022 is a transition period for EDELWEISS
- No cryogenic run at 2021 (and 2022)
- Decision taken to definitively stop EDW-3 cryostat operation.
- EDW-III cryostat may be used by other projects before disassembly.
- The next EDELWEISS run at LSM will be hosted in the BINGO cryostat (similar cryogenic and background requirements for both projects)
- Next EDELWEISS physics run foreseen at 2023, with new detectors.

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## 2021 highlights

- Data analysis and new results from the long 2018-2020 LSM run.
- Start developing a new cryogenic Ge-detector technology with single-electron threshold and efficient low-energy background rejection.
- Development of a Ge single-electron laser calibration (with optical fibers).
- Ongoing development of low noise HEMT-GaAs cryogenic amplifiers.

# Towards single-electron Ge detectors

Since 2018, EDELWEISS strategy focused to light dark matter ([SubGeV project](#))

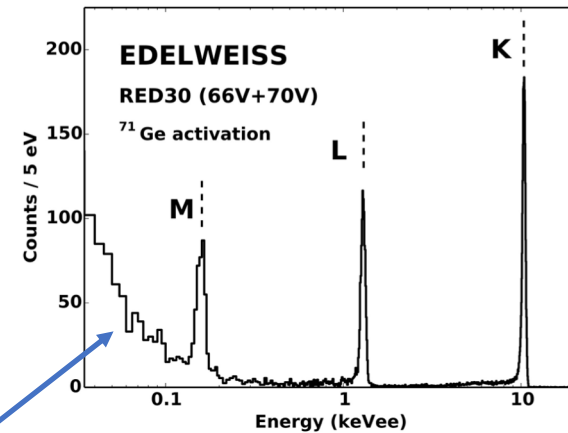
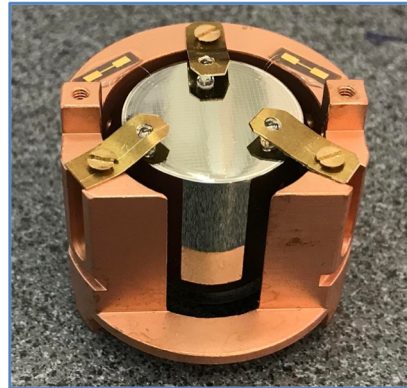
From high-mass Ge bolometers to low-threshold single-electron detectors :

800 g Ge crystals 1 keV threshold  $\rightarrow$  40 g Ge crystals  $<$  10 eV threshold

PRL 125, 141401 (2020)

33 g Ge operated at 78V

Resolution  $\sigma=0.53$  e<sup>-</sup>-h pairs



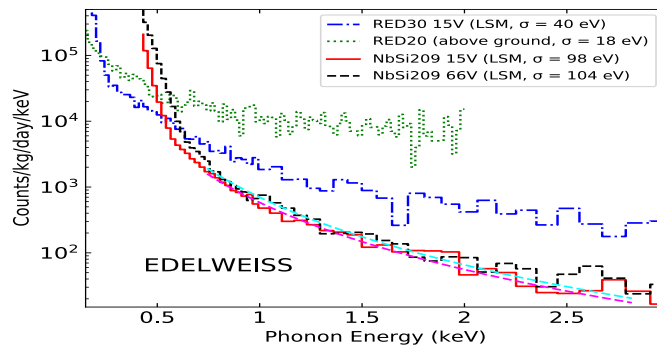
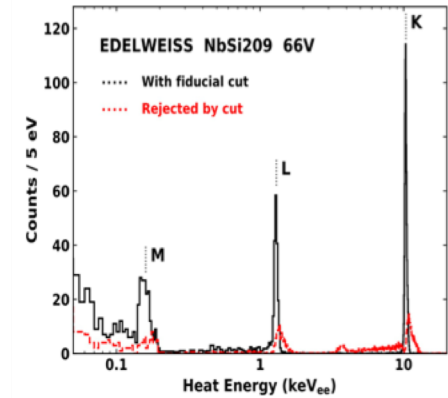
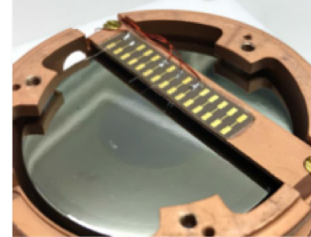
Since 2021, EDELWEISS strategy is focused to a new detector technology able to achieve both single-electron threshold and low energy background rejection

# Physics highlight 2021 (from long 2019-2020 LSM run)

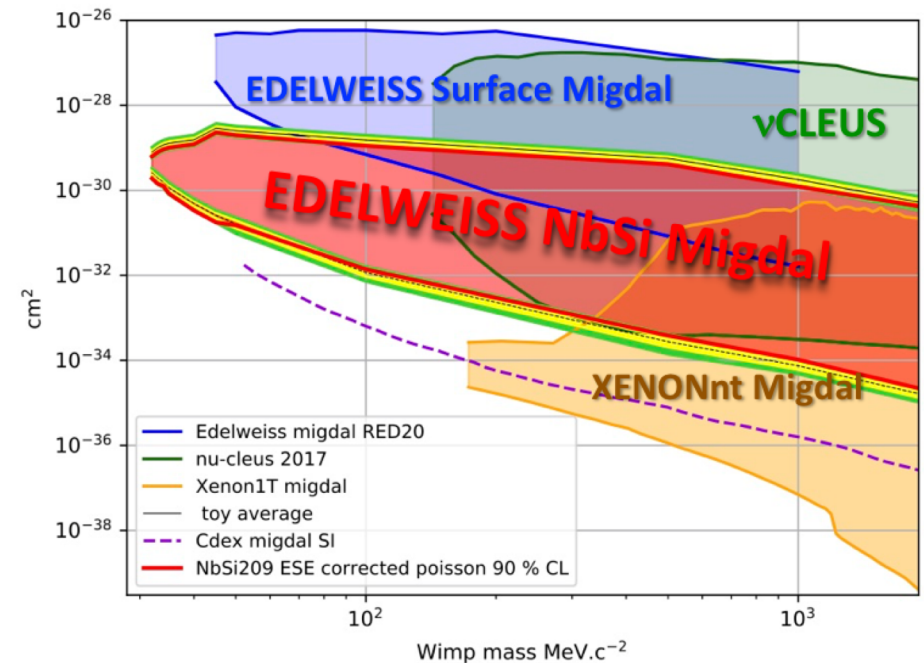
- **First underground constraints on DM interactions on nuclei for  $m < 40 \text{ MeV}/c^2$**

- **NbSi209** : new type of TES phonon sensor (made @IJCLAB) :  $\sigma = 5 \text{ eV}_{ee}$  @LSM
- Poster LTD, JLTP paper
- **Reduction of « heat-only » background (relative to all previous EDW detectors)**
- **Exploring a new zone of DM models**
- Unblinded 08/11, article submitted soon

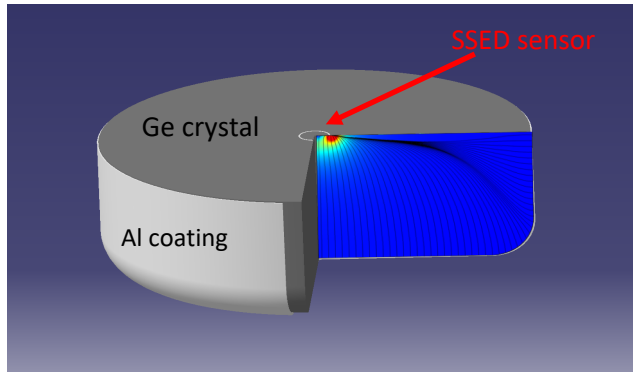
200 g Ge  
20 mm NbSi spiral  
100 nm thick,  $T_c = 44 \text{ mK}$



- **Contribution to EXCESS workshop on identification of low-energy background in sub-GeV DM searches**

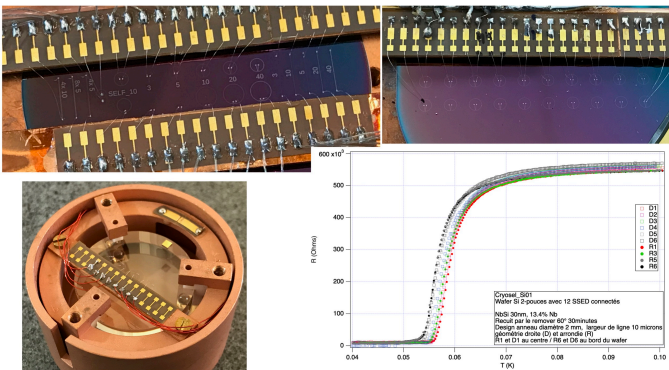
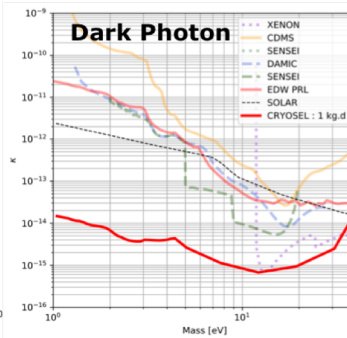
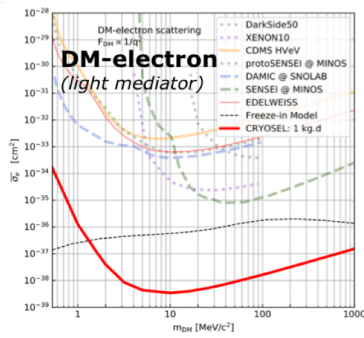
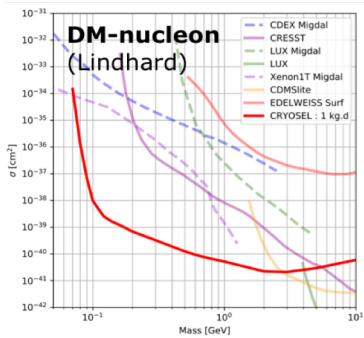


# EDELWEISS Cryosel-ANR (approved, 2022-2024)



Point contact Ge detector with superconducting SSED charge sensor

- 1 kg-d demonstration of high-voltage EDELWEISS-SubGeV detectors
- *1 month x 40 g detector sufficient to cover important phase parameter space for DM*
- Preparation of physics run in BINGO cryostat at LSM for 2023-2024
- 2021: production of first SSED sensors with NbSi films (IJCLAB)
- *IP2I: confirmation of single-electron sensitivity of cryogenic Ge detector*



R&D on SSED detectors

EDELWEISS Collaboration meeting - Oct 2021

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# 2022 EDELWEISS at LSM planning

- No EDELWEISS cryogenic run at 2022.
- Support to the preparation of the BINGO cryostat for EDELWEISS hosting.
- Discussions about EDELWEISS-III setup used by other projects before total disassembly (take profit of the shielding without running the cryostat).
- Partial disassembly of the EDW-III setup (cabling, electronics...)
- Start thinking about the future total disassembly of the EDELWEISS-III setup (need of a clean space for detector storage, disassembly access restricted by the NEMO experiment, low radioactivity Pb storage...)

# EDELWEISS @ LSM Papers

- J. Gascon et al (EDELWEISS Coll.) ***Low-mass Dark Matter searches with EDELWEISS***, <http://arxiv.org/abs/2112.05467> (to appear in JLTP)
  - S.Marnieros et al (EDELWEISS Coll.) ***Ge bolometers with high impedance TES for the EDELWEISS dark matter experiment***, <http://arxiv.org/abs/2201.01639> (to appear in JLTP)
- + CUPID-Mo papers to be added to the scientific production @LSM