

SWISSNEX SAN FRANCISCO



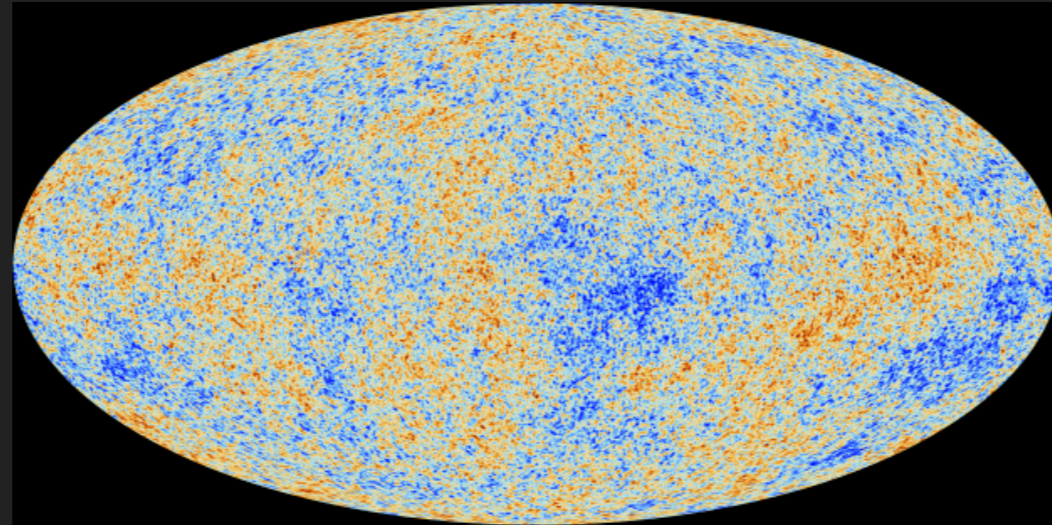
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Zurich^{UZH}

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MARCH 18, 2020

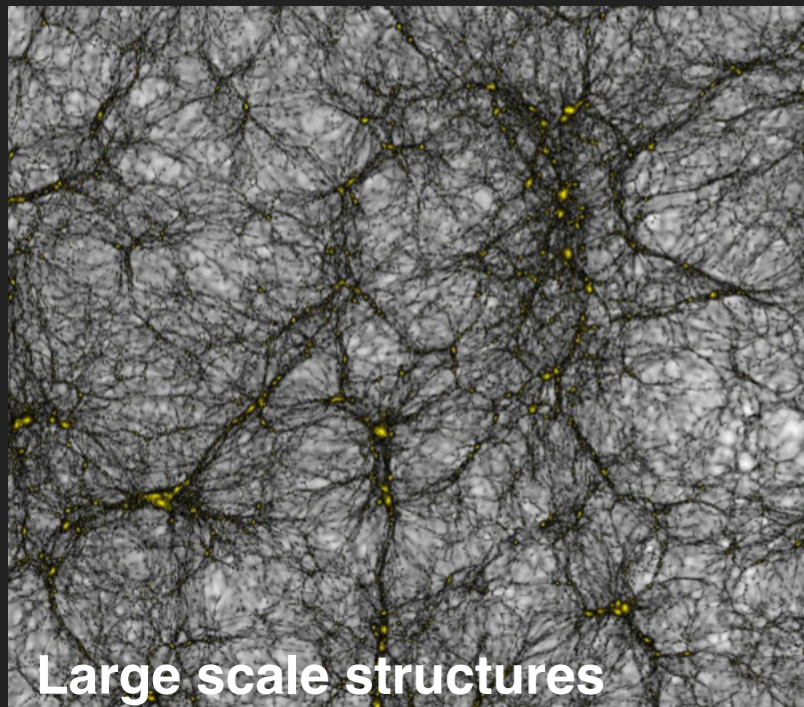
<https://www.physik.uzh.ch/en/groups/baudis.html>

DARK MATTER SEARCHES WITH XENON AND DARWIN

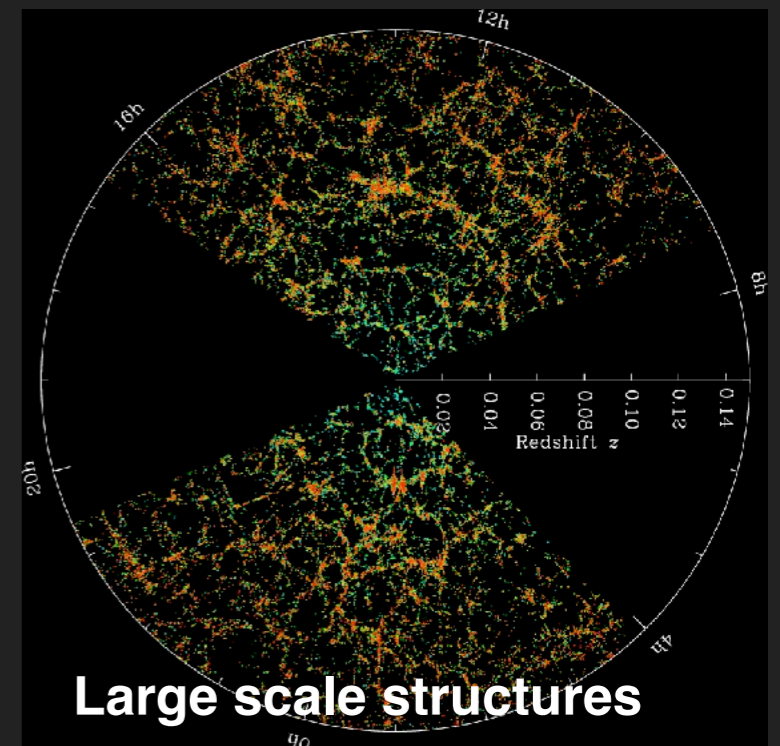
OUR UNIVERSE TODAY



Cosmic microwave background



85% of the matter content is non-luminous, or dark



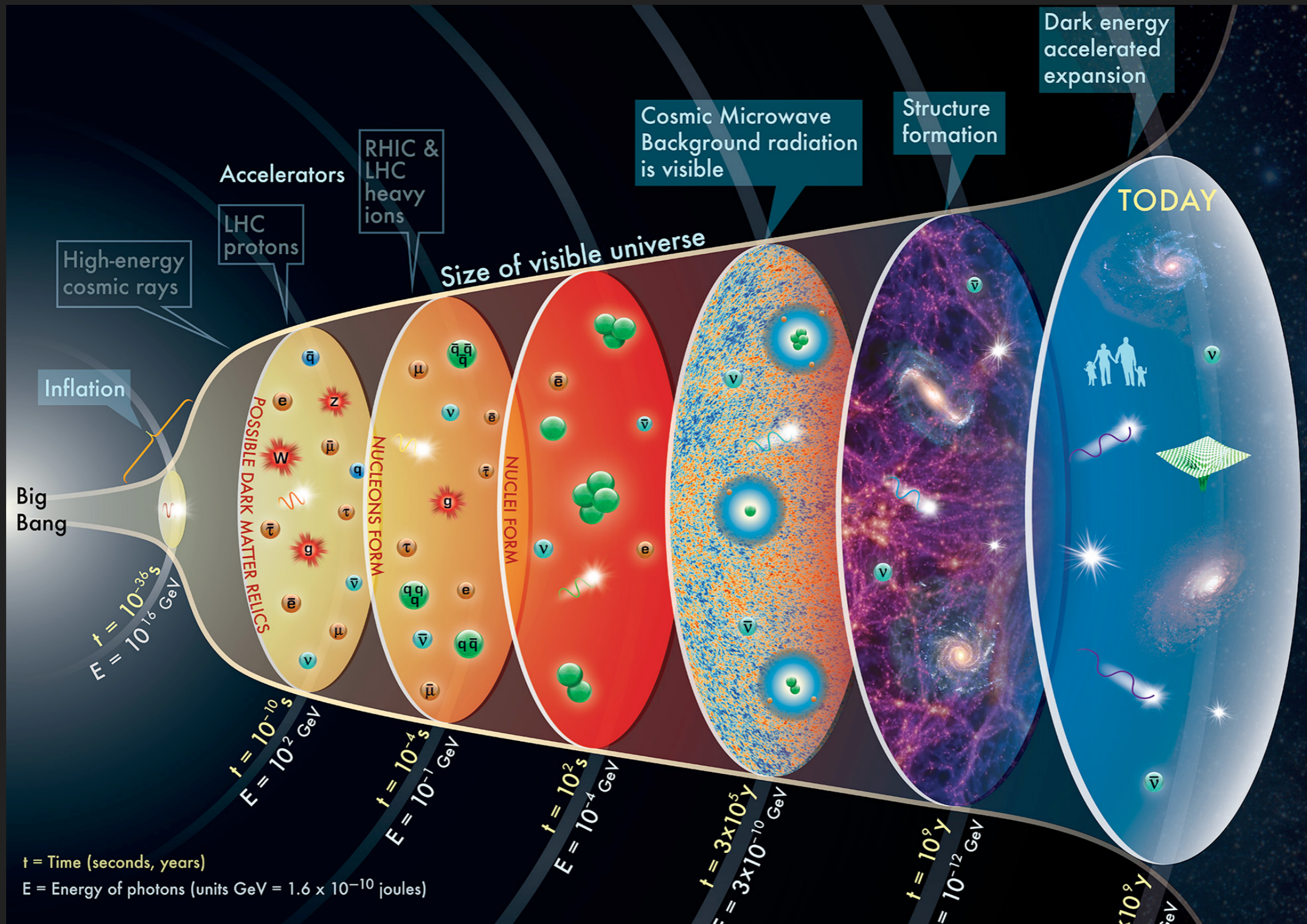
DARK MATTER IN THE UNIVERSE AND IN GALAXIES

- ▶ Dark matter forms galaxies and all the structures we observe today



- ▶ But: what is it made of?

PARTICLES FROM A VERY EARLY PHASE OF OUR UNIVERSE



THESE COULD FORM THE DARK HALO OF OUR GALAXY



Dark matter

=

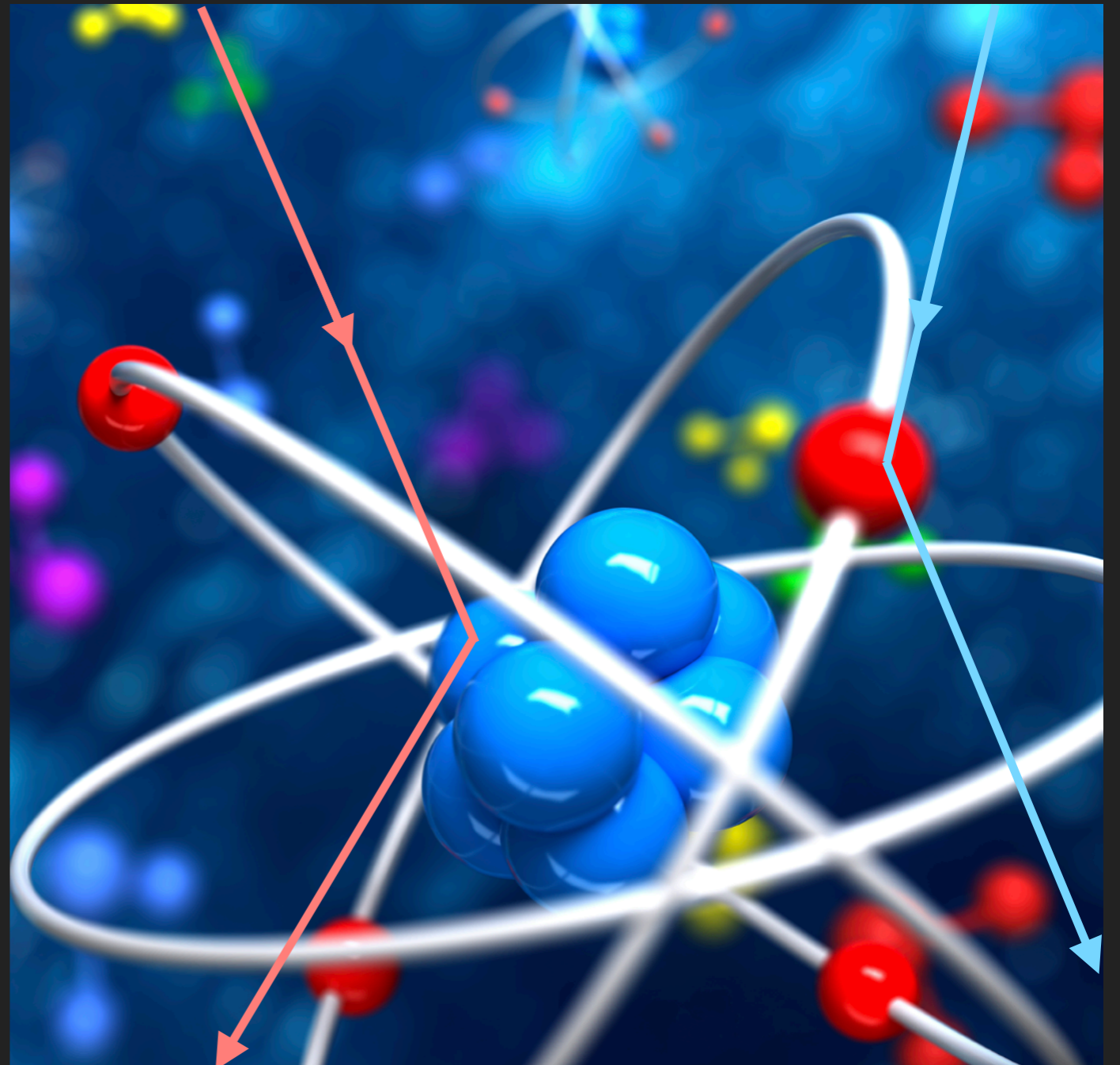
A new particle, which does not
emit nor absorb light

HOW TO MAKE THESE PARTICLES VISIBLE?

Via collisions with atomic nuclei

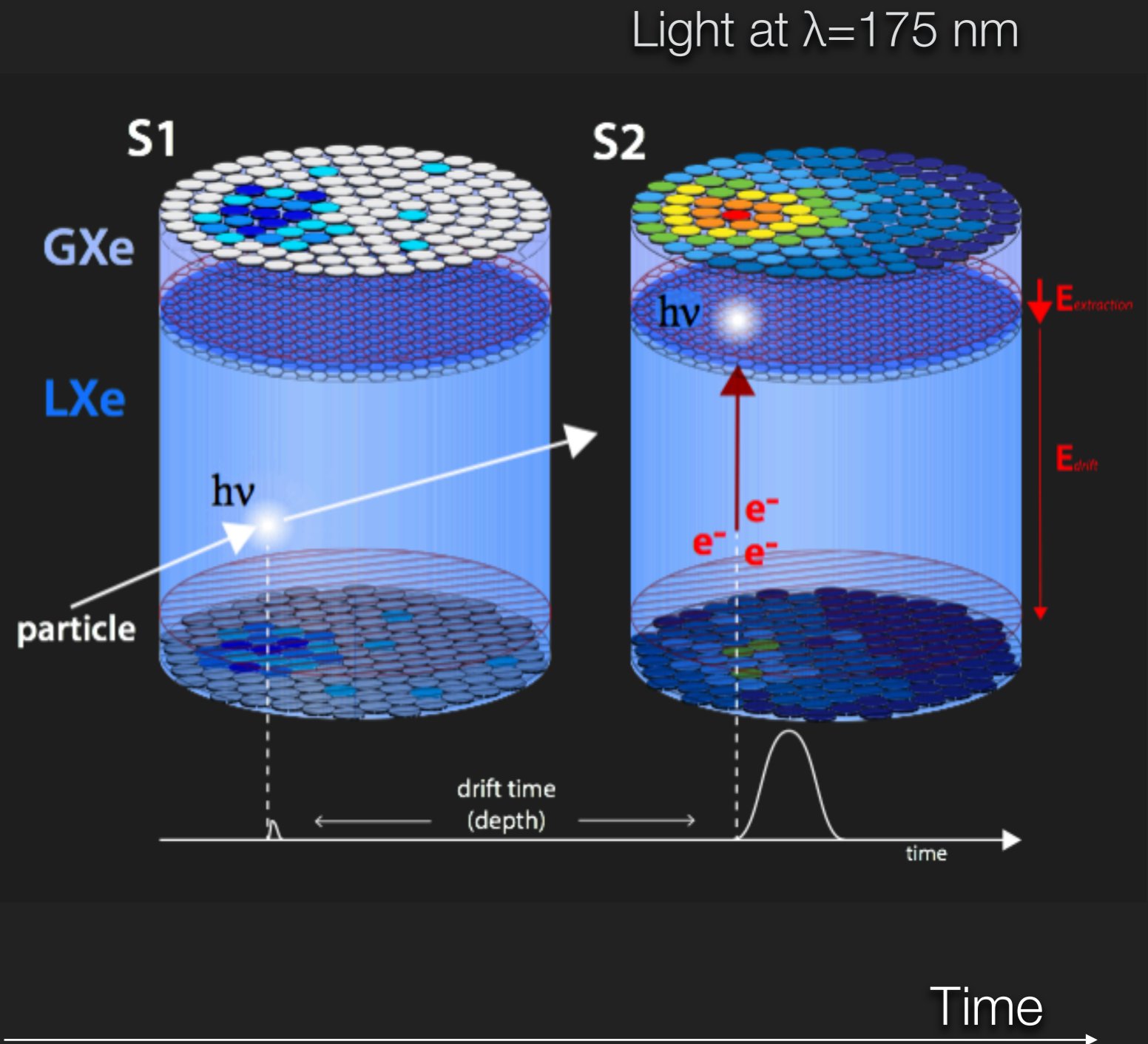
These are very rare events

Happen at very low energies



A XENON DETECTOR AT $-100\text{ }^{\circ}\text{C}$

- ✦ Measure VUV light and charge
- ✦ 3D position of an interaction
- ✦ Example: 3.2 t of liquid xenon at -100°C



BACKGROUND: COSMIC RAYS

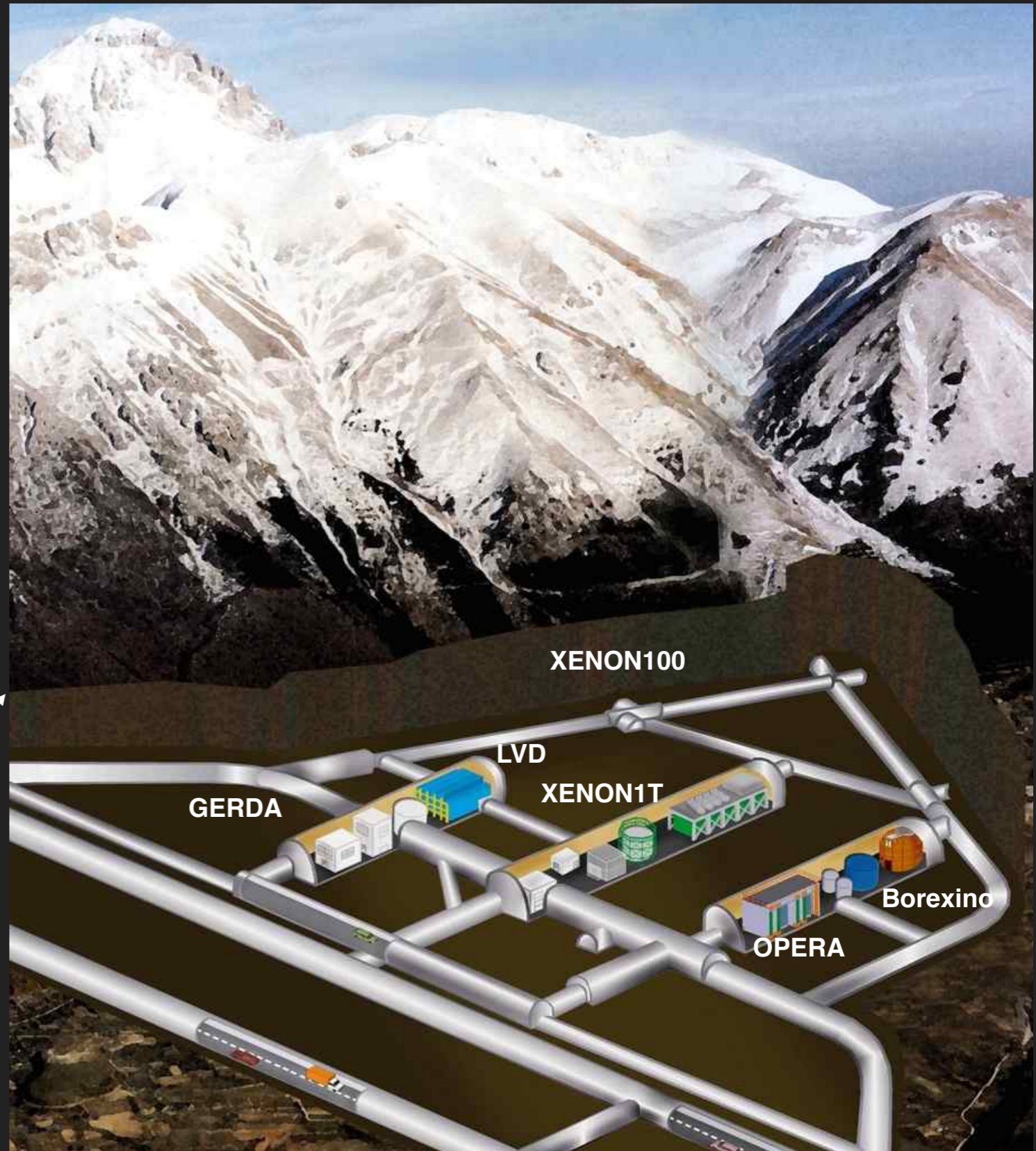
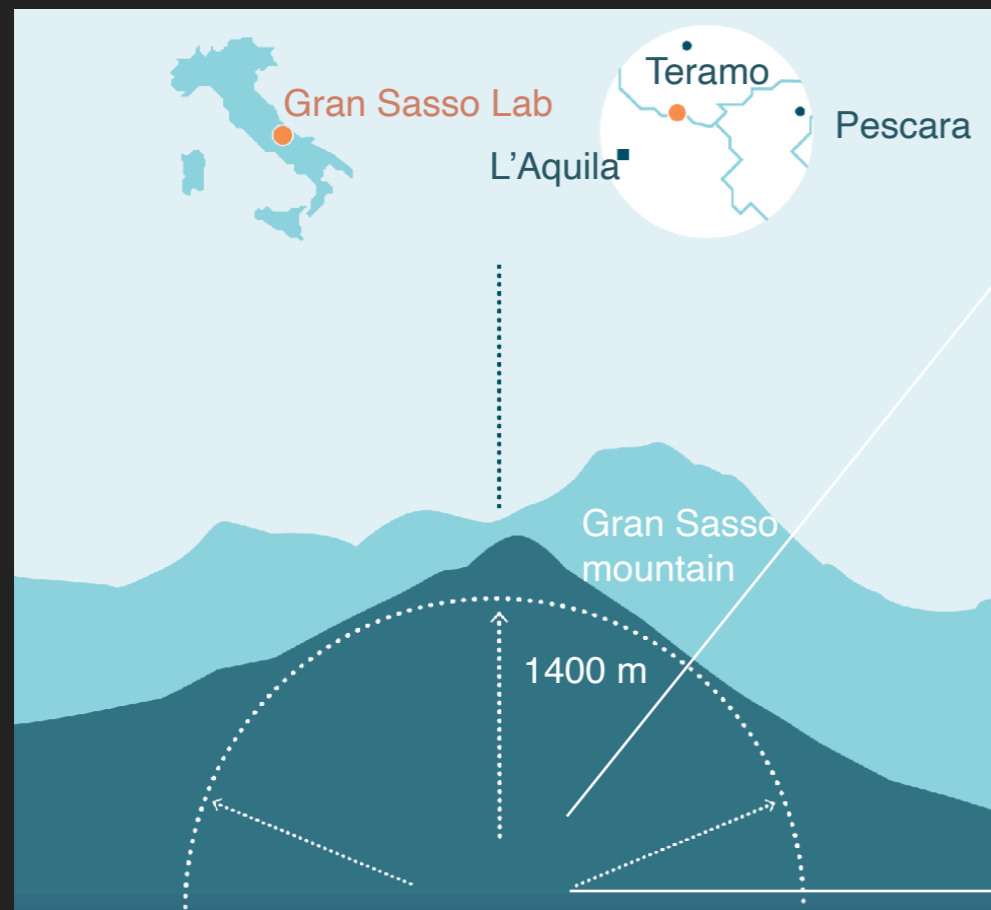


=> much higher interaction rates than expected from dark matter particles!

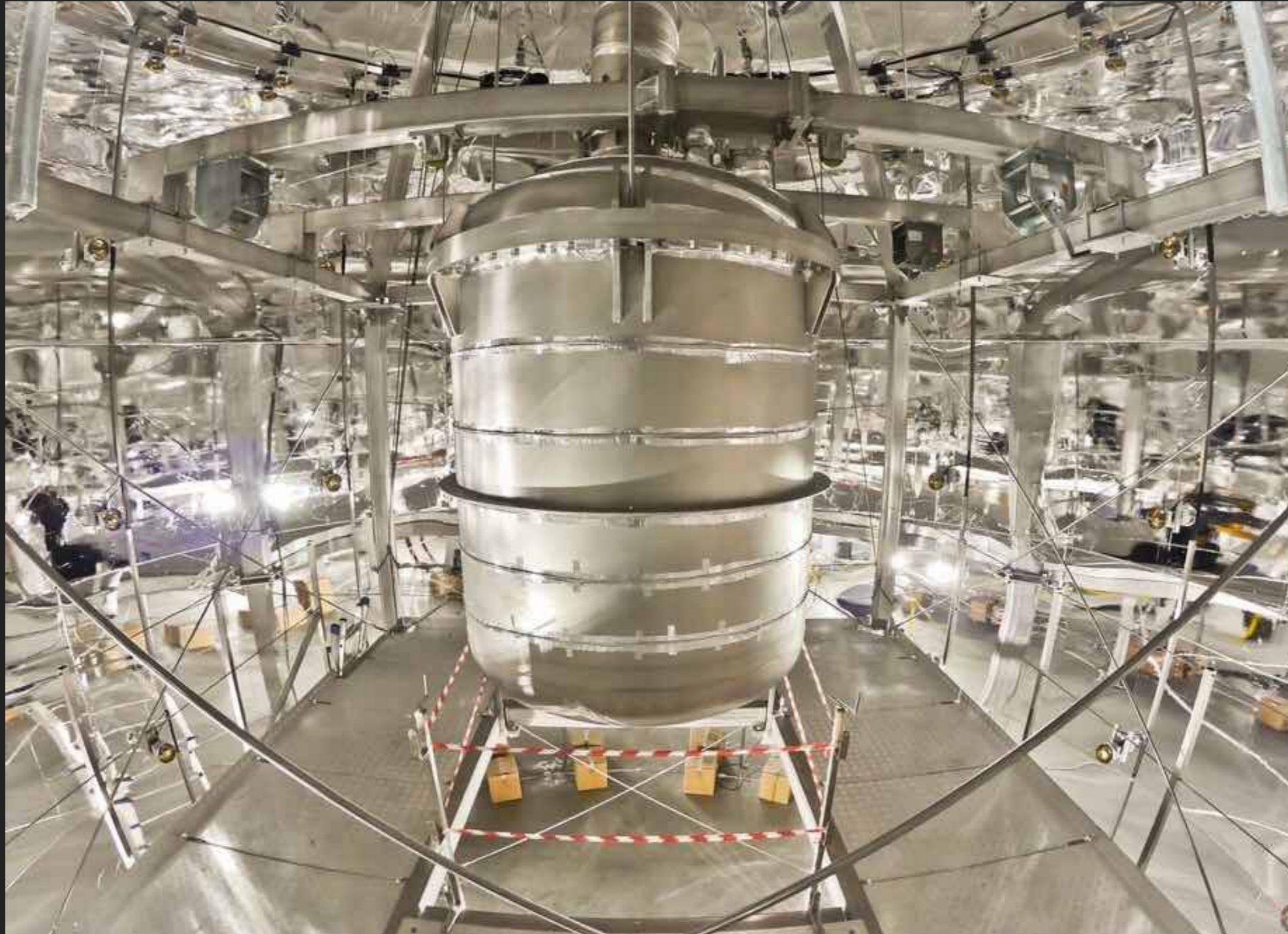
THE GRAN SASSO LAB IN ITALY

UNDERGROUND LABS

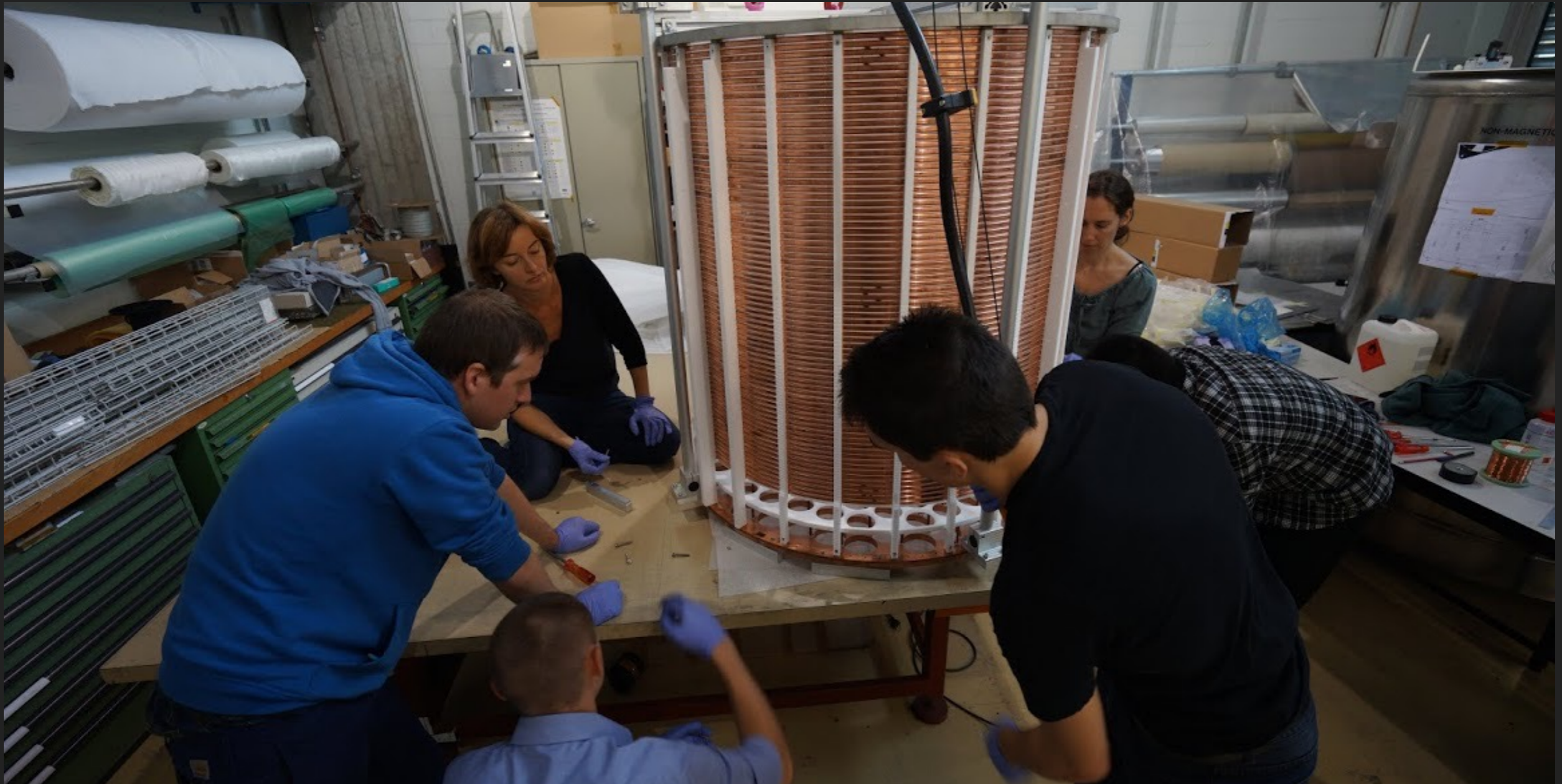
- ▶ Dark matter experiments are deep underground
- ▶ To shield from cosmic rays and their secondary particles



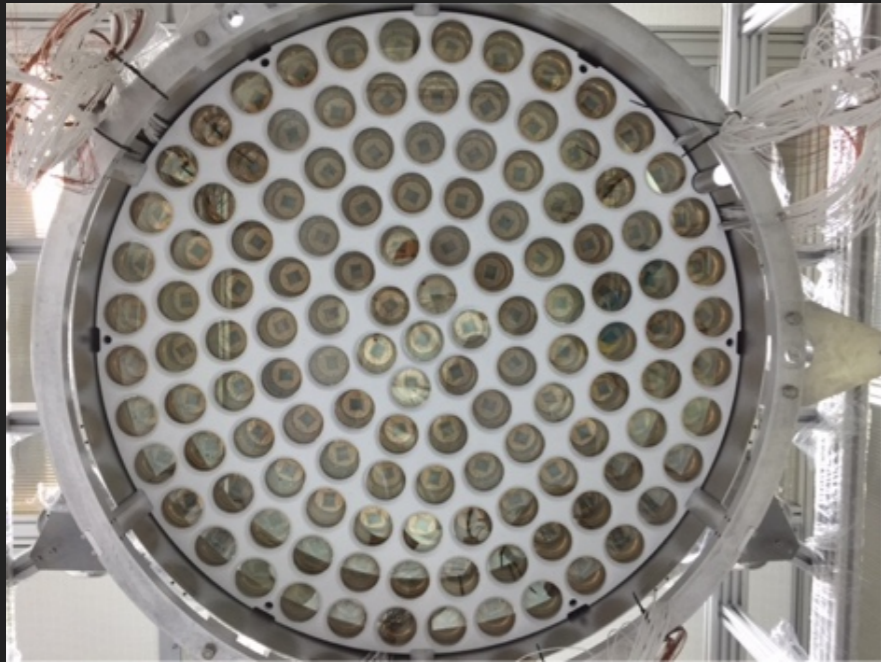
THE XENON1T EXPERIMENT: 3 TONNES LIQUID XENON



INNER DETECTOR TESTS IN ZURICH



THE INNER DETECTOR IN THE CLEAN ROOM

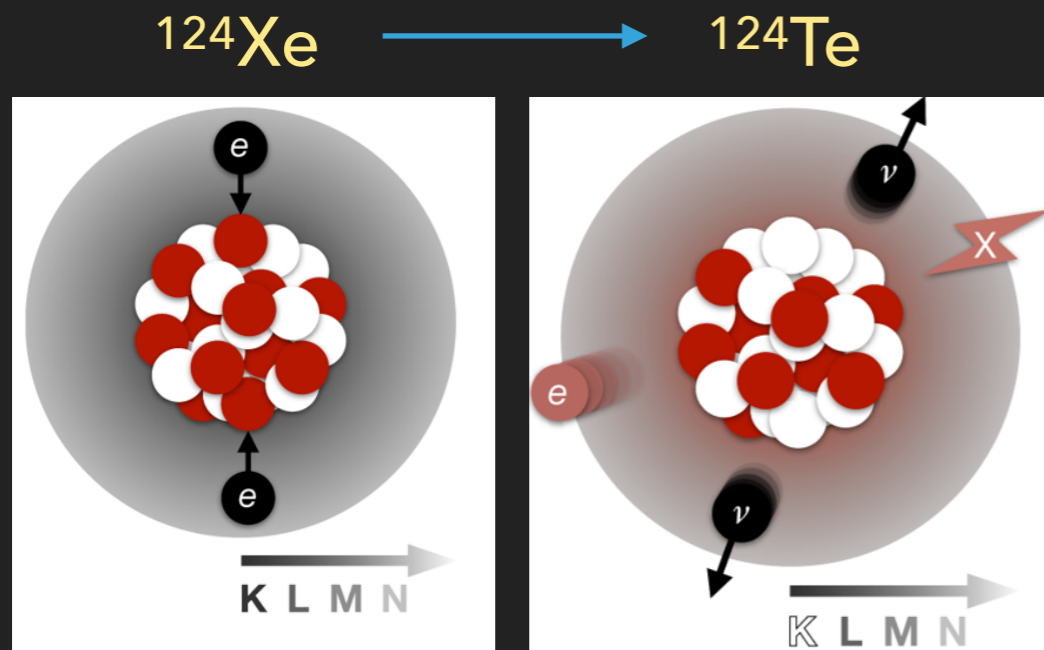


THE ENTIRE DETECTOR AT THE GRAN SASSO LABORATORY



OBSERVATION OF THE DOUBLE ELECTRON CAPTURE IN ^{124}Xe

25. April, 2019



+ 2e⁻

+ 2ν_e

$$T_{1/2} = 1.8 \times 10^{22} \text{ a}$$



The rarest decay process ever measured in the Universe

IN CONSTRUCTION: XENON-NT UND DARWIN

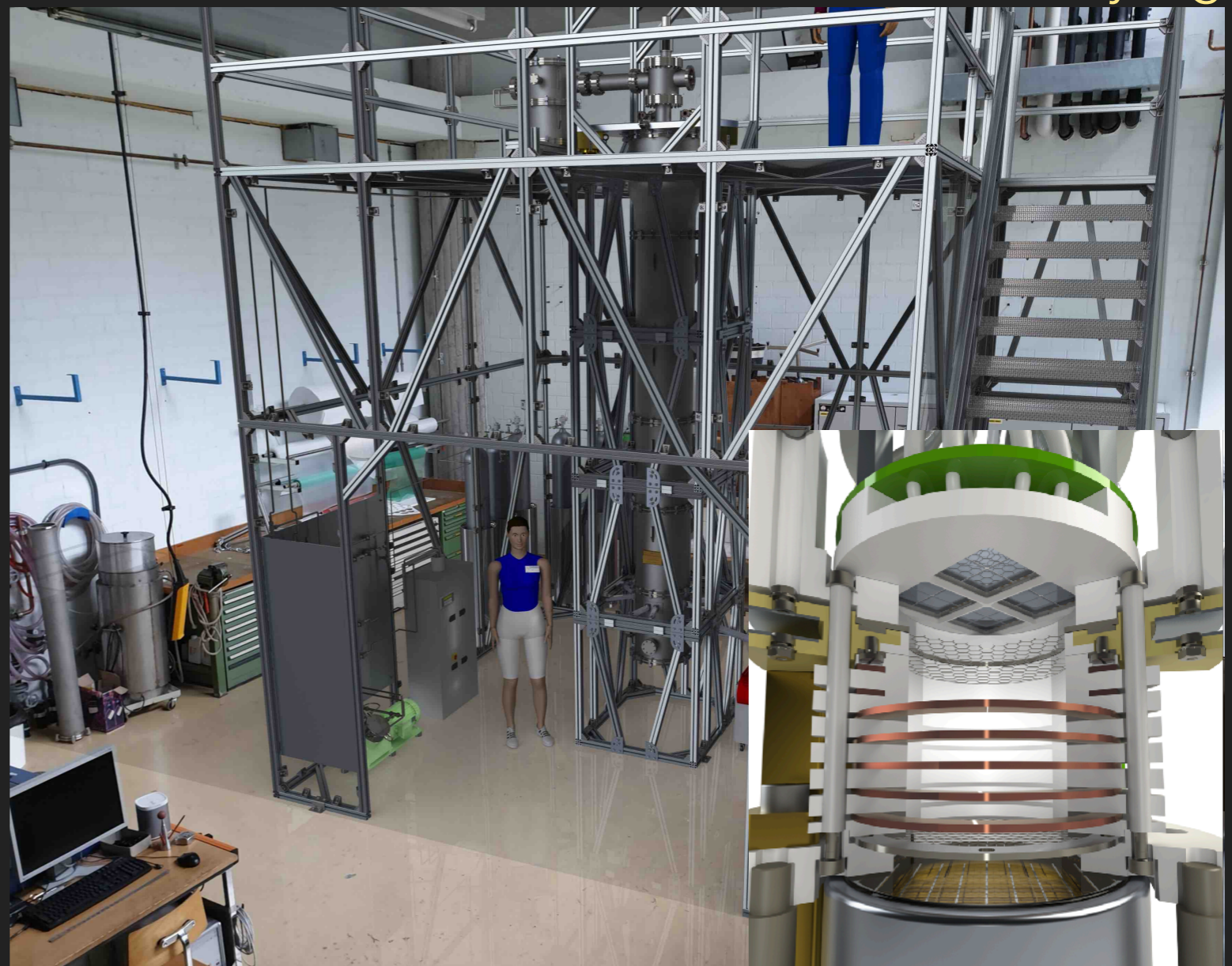


XENONnT at the Gran Sasso Lab

darwin-observatory.org



8.4 tonnes liquid xenon



Darwin demonstrator (2.6 m tall TPC) in our lab at UZH

Zurich detector

THE SEARCH FOR DARK MATTER CONTINUES...

Is the DM really made of new, weakly interacting massive particles?

What are the properties of these particles?

Are there more than one type of dark matter particles?

What is their detailed distribution in the Milky Way?

