

# The innovative Underground Argon Project: the path from procurement to purification for search of Dark Matter

*Friday 31 March 2023 18:00 (15 minutes)*

The search for Dark Matter is one of the most fascinating themes of modern physics and astrophysics, but also one of the most difficult to study. The innovative Underground Argon Project (UAr) is part of this context and a fundamental pillar of the Argon Dark Matter search program, led by the Global Argon Dark Matter Collaboration. The aims of the UAr project is to achieve the procurement of large amounts of low-radioactive UAr as detector target; currently three plants are in development to ensure this:

- Extraction of argon with a naturally low concentration of radioactivity  $^{39}\text{Ar}$  from an underground source (CO<sub>2</sub> wells) will be carried out at the Urania plant, in Cortez, CO (US). This is the same source of UAr used for the DarkSide-50 detector.
- UAr will be further chemically purified to detector-grade argon in the Aria facility, in a mine at Carbosulcis Spa, Sardinia (Italy); Aria will have a 350 m cryogenic distillation column, which is longer than the Eiffel tower and made up of about 3000 distillation stages.
- Assessing the ultra-low  $^{39}\text{Ar}$  content of the UAr is crucial for the GADMC projects. This is the goal of the DArT detector, using a small chamber placed at the center of the ArDM detector in the Canfranc Underground Laboratory (LSC) in Spain. It aims to measure  $^{39}\text{Ar}$  below the mBq/kg level with 10% precision in one week of run.

In this talk, we will discuss the status of UAr Project, the challenge for its production through the 3 plants above mentioned, their latest results, and the growing interest in the use of ultra-pure UAr as it has potential broader applications outside the GADMC, for measuring coherent neutrino scattering, environmental assay, neutrinoless  $2\beta$  decay, and large DUNE-like detectors and also outside the astro-particle physic for application in the field of the medical physics (new technology for PET).

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