

# Pillar 3: Astroparticle + Cosmology

## Scientific scopes:

- 1) **Multi-messenger** studies of the astrophysical sources and their mechanisms for accelerating particles to extreme energies. Understanding how accelerated **cosmic rays** influence star formation and galaxy evolution.
- 2) **Indirect** and **direct detection of dark matter**
- 3) Understand the nature of dark matter, **dark energy** and **inflation**.

## Methods and Instruments:

- 1) Establishment of the Swiss IKC to **CTA Observatory** construction and **LHAASO** participation;
- 2) Ground based direct detection DM program:
  - Preserve leading role in **XENON/DARWIN** towards 50 ton LXe two-phase in 2020+
  - Participation in **DarkSide20k** programme. Future goal: ARGO 300 t LAr program
  - Participation to **DAMIC** CCD detector in Modane optimised for low mass WIMPs
- 3) Support a vibrant program on cosmic ray spectrometers and gamma-ray calorimeters and through the exploitation of **AMS** and **DAMPE**, and the preparation of next generation missions **HERD** and **PAN/mini-PAN**
- 4) Establishment of a **data processing and long term preservation** framework capable to handle up to  $O(10)$  Pbytes/yr (CTA, LSST, SKA) to serve the **astrophysical community** in Switzerland which includes CHAPS projects (Euclid, DESI, LSST) which will play an important role on neutrino masses, dark energy, structure formation,.... Cosmology is based on observations and hence inherently model dependent, hence it requires **theory** connected also to accelerators and astrophysics.

## Main logistic Challenges

- Long term operation of Observatories (CTA, SKA) on time scales typical of astronomy observations (~30 yrs) not directly supported by established entities such as ESO and ESA.
- Secure technical and computing support.