Cosmology and Fundamental Physics
New Actors for New Scenarios

- *Keywords:* nature of DM, nature of DE, gravity on cosmological scales
- *Strategical Targets (DM):*
  - dwarfs, groups and clusters dynamics (VLT, LBT)
  - WL and SL (HST, VLT, JWST, Euclid, LSST, E-ELT)
  - DM annihilation (Fermi, NuStar, Athena, CTA)
- *Strategical Targets (DE):*
  - cosmic expansion through SNeIa (VLT, E-ELT)
  - BAO and RSD (Euclid, LSST, SKA)
  - cosmic shear tomography (Euclid, LSST, SKA)
- *Necessary manpower:*
  - theoretical and numerical cosmology
  - gravitational lensing and SKA precursors
  - astroinformatics and astrostatistics

New Actors for New Scenarios
An Updated Critical Review

Dark Matter

- Recently released (and next to come) GAIA catalog for dwarfs studies
- High quality data for clusters studies available (CLASH, XXL)
- Good perspectives for high energy probes (in collaboration with INFN?)

Dark Energy and Gravity on Cosmological Scales – Optical Astronomy

- Euclid (2020) and LSST (2022) as primary observational projects
- So many things already done for the preparation of the mission
- So many things still to do before launch (both theory and observations)
- So many people (and computing power) needed if we want to be main actors

Dark Energy and Gravity on Cosmological Scales – Radio Astronomy

- SKA as future lead project but do not forget SKA precursors
- SKA + Euclid vs SKA x Euclid (the total is more than the sum of the parts)
- Radio astronomy and theoretical cosmology: a tale of two cities
- Big financial investment in SKA but are we ready for it?

Cosmology and Fundamental Physics
Still to Come Actors for New Scenarios

- *New Promising Probes :*
  - galaxy – galaxy lensing (DM and DE)
  - peculiar velocities (distance scale and DE)
  - Sandage – Loeb test (background expansion)
  - cosmic chronometers and H(z)
  - GRB and quasars as standardizeable candles
  - standard sirens (gravitational waves and DE)

Galaxy – Galaxy Lensing

- DM maps on galaxy
- Cosmology dependent
- Baryons and bias
- Euclid, E-ELT

Peculiar Velocities

- SNe position velocity cf
- Growth of structures
- Distance measurement
- LSST, E-ELT

Sandage – Loeb Test

- Redshift drift
- Easy to model
- Tiny signal on long time
- Espresso, HiRes

Cosmic Chronometers

- Differential galaxy age
- H(z) measurement
- Galaxy evolution
- VLT, JWST, Euclid, LSST

GRBs and Quasars

- Very high – z probes
- Matter dominated era
- Standardizeable?
- Fermi, Euclid, LSST

Standard Sirens

- GWs up to large z
- Well known physics
- A needle in the stack
- GRAWITA