# InDark @ Roma Tre

# Cosmic Structures as a pathway to Dark Energy and Dark Matter

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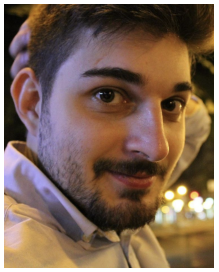
University Roma Tre

INFN Sezione Roma Tre
July 6th

# INDARK @ ROMA TRE: WHO

## NEW MEMBERS



M. Guidi
PhD

M. Di Bella
PhD

E. Sarpa
AdR

## OLD MEMBERS

E. Branchini
P.A.

A. Veropalumbo
AdR

## LEFT IN 2020

R. Pandit
PhD

J. Koda
AdR

# InDark @ Roma Tre: WHAT

Investigate the nature of Dark Energy, Dark Matter and test General Relativity on cosmological scale using current and next generation datasets from both ground-based observatories and space-borne missions.

# Presentazione delle attivita' della sezione INFN Roma Tre

**Dark Energy**

**Dark Matter**

**and**

**Gravity tests**

- Extract scientific information encoded in cosmic structures.
- Mostly focusing on the dataset from the upcoming Euclid satellite mission
- We develop statistical tools, data analysis pipelines, theoretical models and simulations.
- Computationally demanding

# CURRENT/FUTURE DATASETS

LSST
DES
SKA
J-PAS
DESI
Prime Focus Spectrograph
HETDEX
4MOST
WFIRST
SPHEREx
EUCLID

# Euclid in a nutshell

- Coverage: 30% sky.
- # objects: 30M + 1B.
- Volume: 6.5x10$^3$ GPc.
- Launch: 8/2022.
- Operation: 6 years.
- ~2000 scientists (30% IT)
- All major IT universities (including RM3) and institutes (INFN) involved

# Presentazione delle attivita' della sezione INFN Roma Tre

Within Euclid RM3-InDark generates **science-ready Data Products**.

This involves ingesting **large** amount of data and effectively **compress information** into a few statistical quantities

The Team is ~200 strong. **RM3 leads this activity**.

Computationally demanding. Our group enjoys the availability of the **RM3 cluster** and strongly supports its upgrade.

Ancillary activities include : theoretical modeling, generation of simulated data, model vs. data comparison and scientific exploitation, analysis of existing datasets.

# Major Achievements: Technical Aspects.

- We successfully passed a key ESA milestone (Technical Keypoint) last fall. The work of the RM3 team was paerticularly appreciated (Euclid star prize 2020 for best management to EB).
- We started integrating our codes in the pipeline (ongoing major effort in 2020).
- We dramatically reduced (factor 100x) the CPU requirement of the most computationally demanding codes.

## Major Achievements: Scientific aspects.

- We developed and applied to real data a new method to minimize nonlinear effects and extract cosmological signal from 3D maps.
- We detected an intriguing large scalke anomaly in the spatial distribution of extragakactic radio-sources
- We proposed a joint 2- and 3-point statistical analysis of the large scale structures and applied to existing datasets to constrain DE.

# InDark: What Next

- Euclid Data Analysis Pipeline: Production phase
- Keep upgrading codes. Explore new methods.
- Prepare for scientific exploitation (likelihood analysis, setting General Relativity test, etc)
- combine different cosmological probes
- Develop, test and apply techniques to optimally extract the underlying cosmological signal.