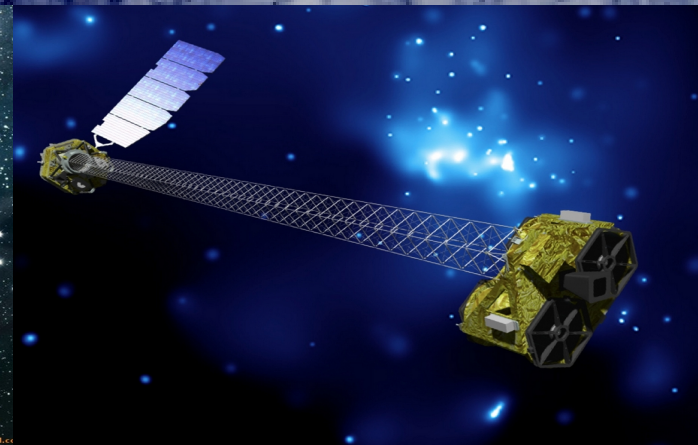


REPORT FROM THE TORINO RESEARCH UNIT



UNIVERSITÀ
DI TORINO

Marco
Regis

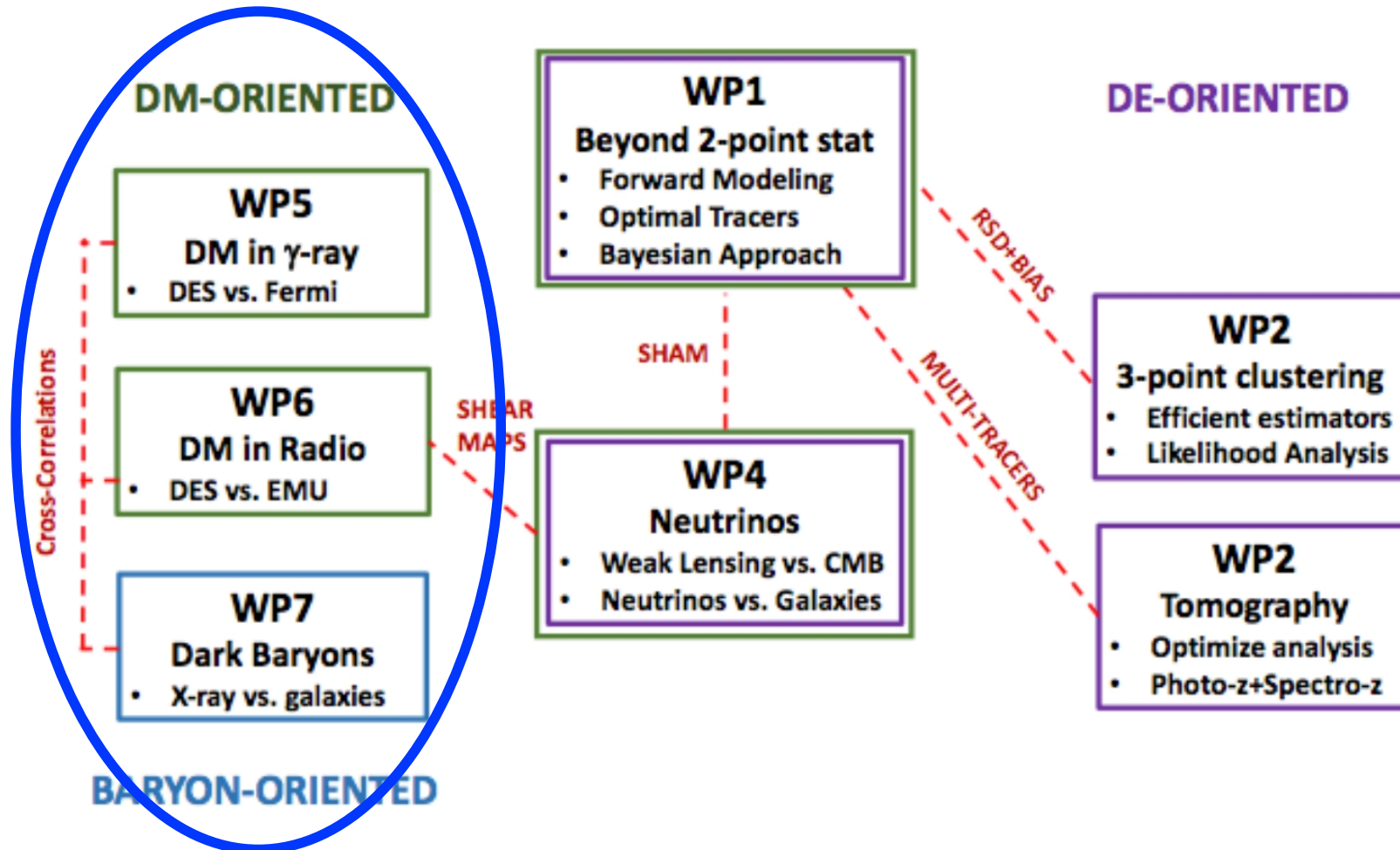


PRIN scheme

From Darklight to Dark Matter:

understanding the galaxy/matter connection to measure the Universe

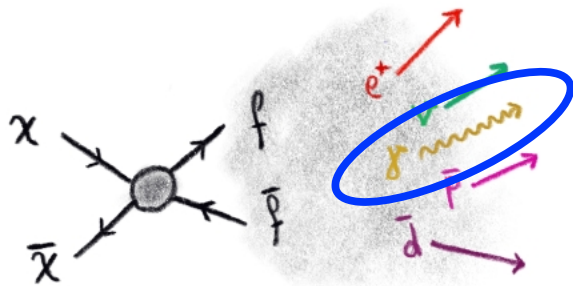
RU in Torino



WP 5: Dark matter signals from cross-correlation of optical-gamma data

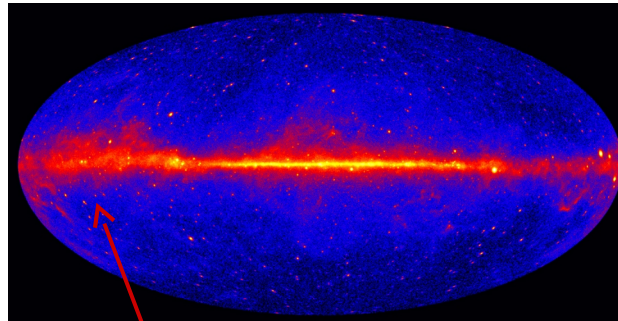
“to perform an angular cross-correlation study of the DES shear catalogues with the gamma-ray Fermi-LAT all-sky maps”

DM-induced emission

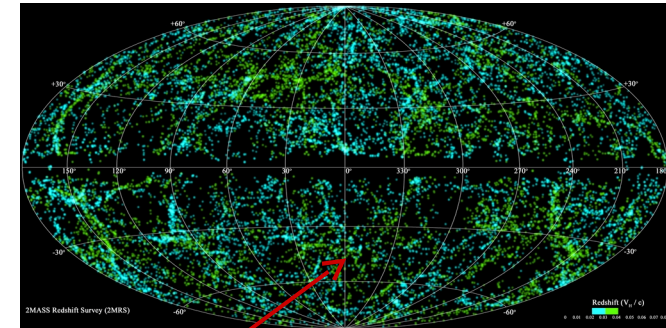


Map with a DM

non-gravitational signal



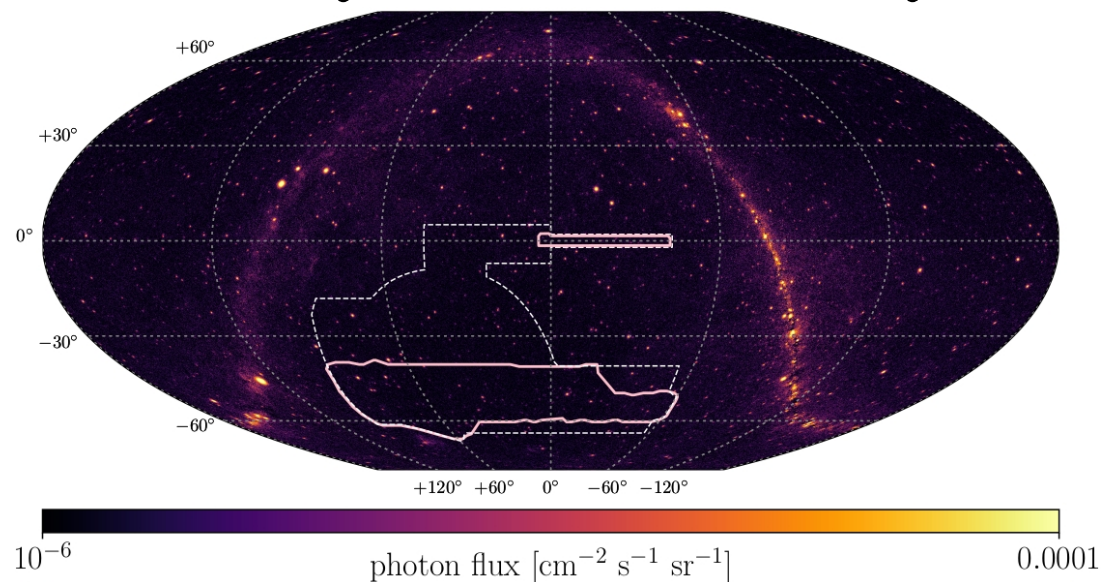
DM gravitational tracer



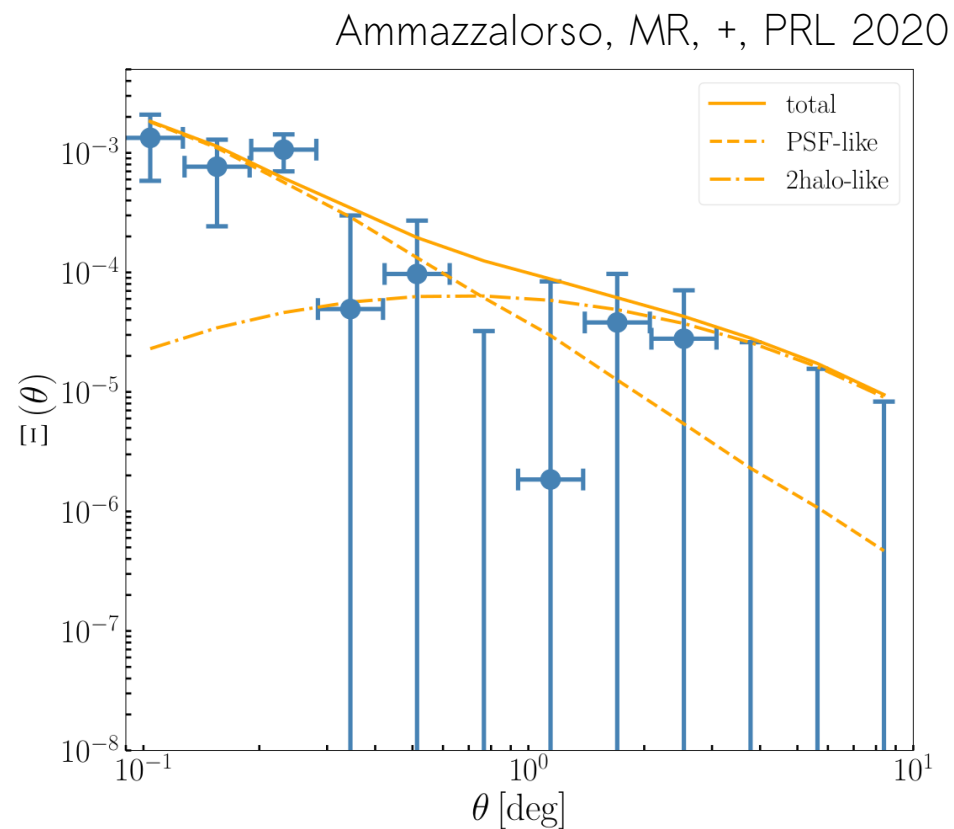
$$\langle \delta_a(\theta_1) \delta_b(\theta_2) \rangle \rightarrow \text{CCF}^{ab}(|\theta_1 - \theta_2|)$$

WP 5: DM signals from cross-correlation

DES 1yr X Fermi-LAT 9yr



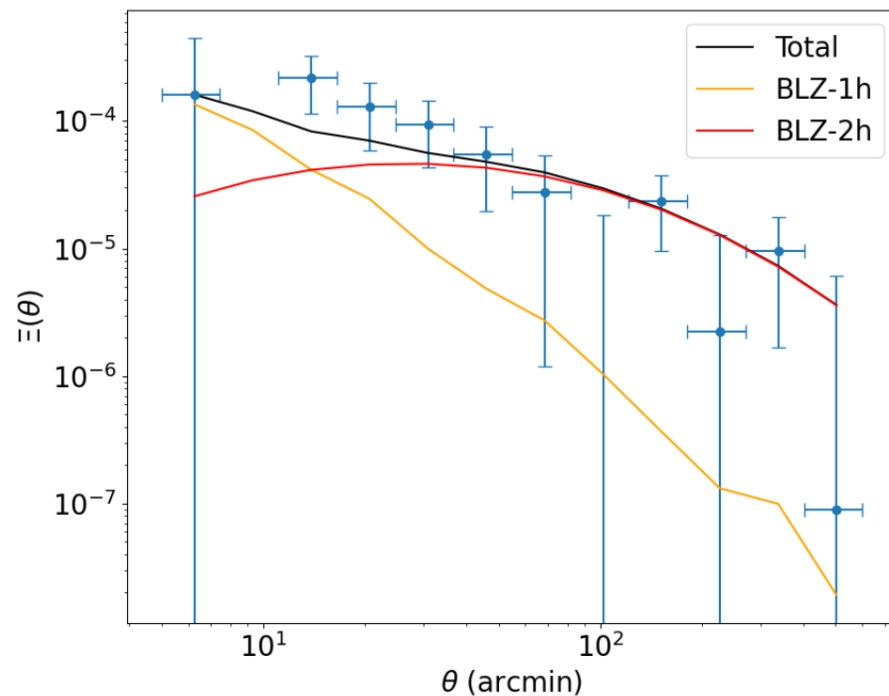
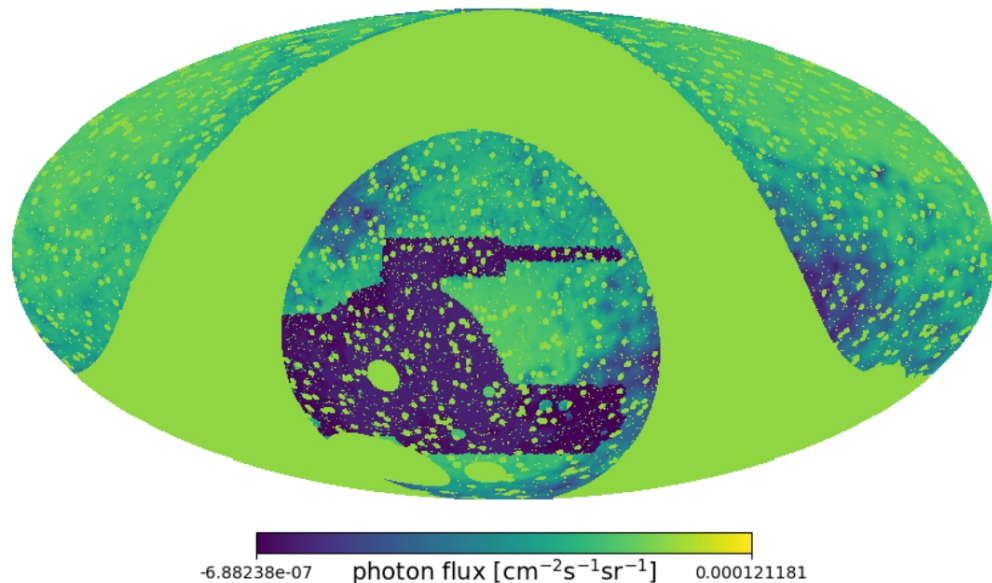
Signal detected with
signal-to-noise ratio
 $S/N = 5.3$
(first ever detection
cosmic-shear x unresolved γ -rays)



WP 5: DM signals from cross-correlation

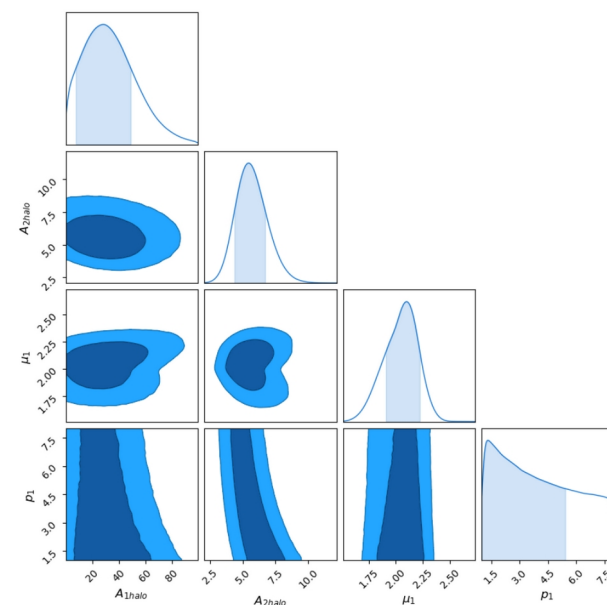
DES 3yr X Fermi-LAT 12yr

(Thakore, MR, Camera +, in preparation)



Signal-to-noise ratio $S/N = 8.9$

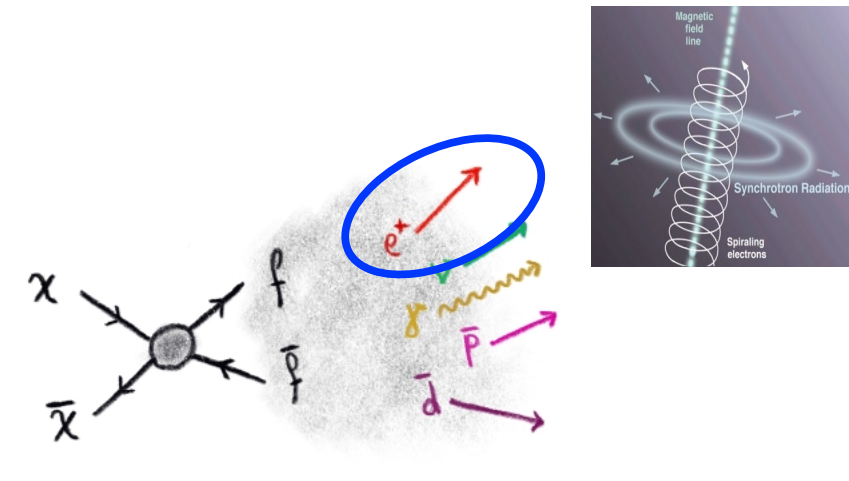
- γ -ray background follows LSS
- signals from blazars in cluster-size halos
- room for a particle DM contribution



WP 6: A DM signal in the radio band from the EMU Survey

“cross-correlation of the EMU data with DES maps and the Fermi-LAT gamma-ray sky” → NOT DONE

“look at diffuse emissions induced by particle DM in the halo of single nearby objects”



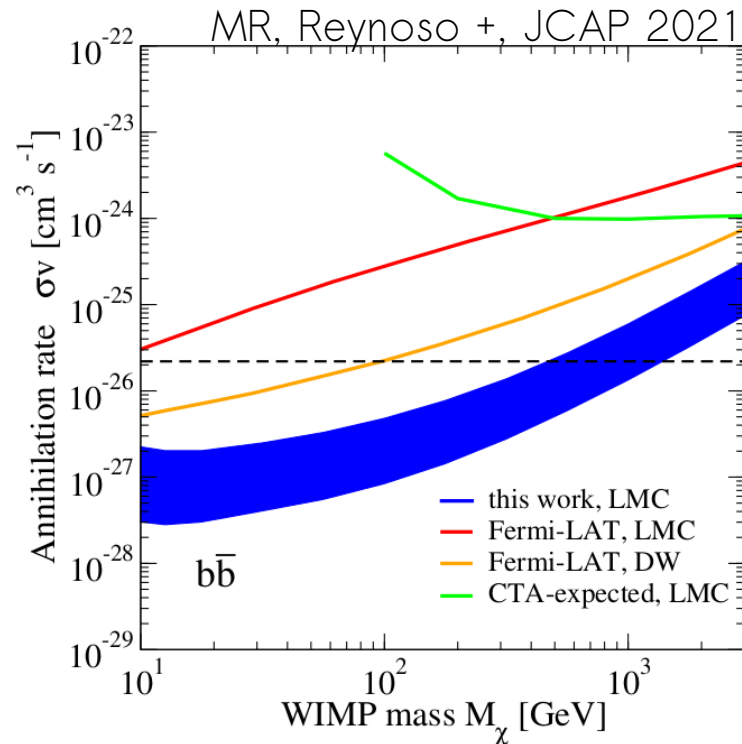
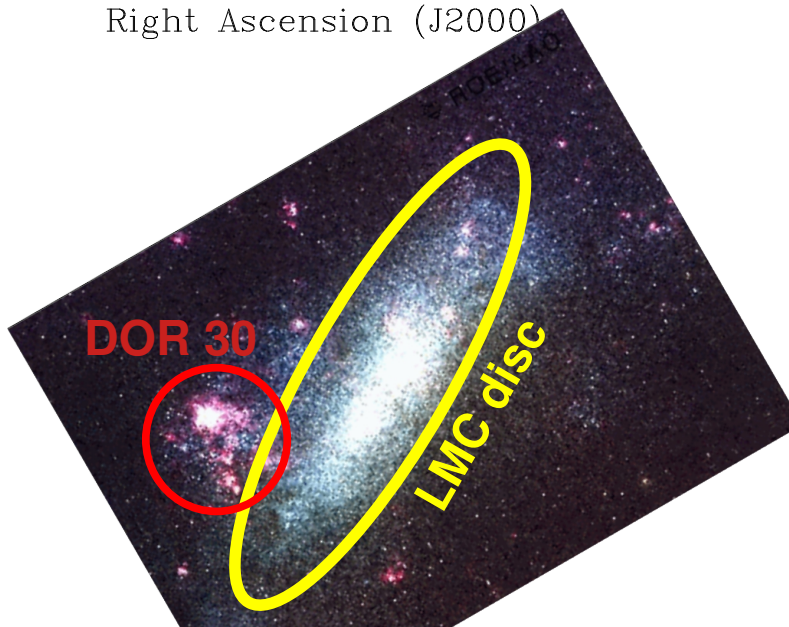
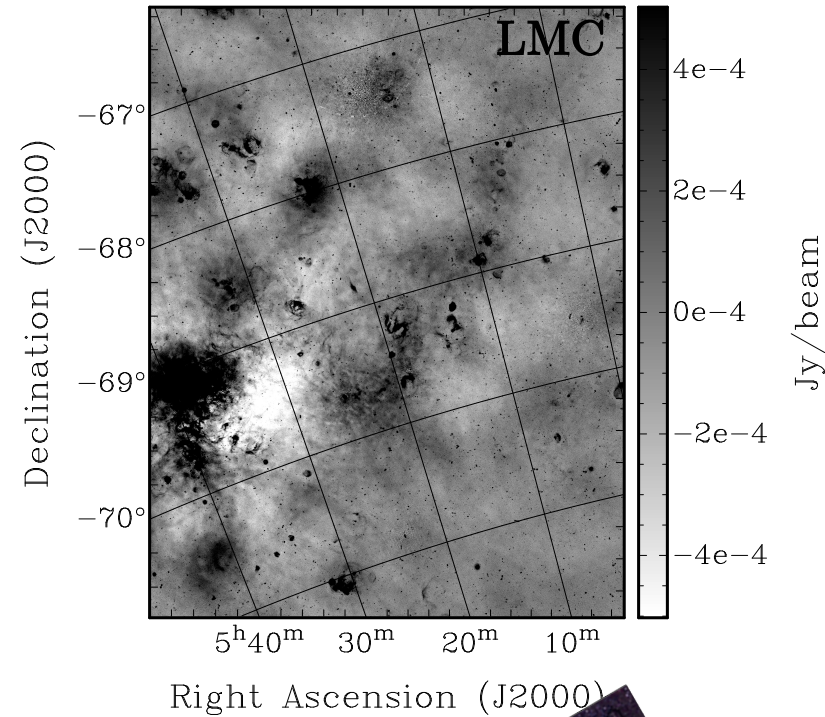
Australian Square Kilometre Array Pathfinder

36 antennas, 12 m diameter / commissioning and early science



Credit: ATNF-CSIRO

WP 6: DM signal in the EMU radio data

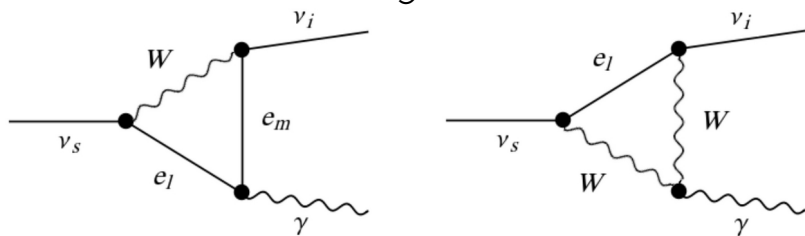


(Among the)
 most constraining
 bounds on
 WIMP DM
 from
 indirect searches

WP 7: “Dark baryons” through cross-correlation from future high-resolution X-ray surveys

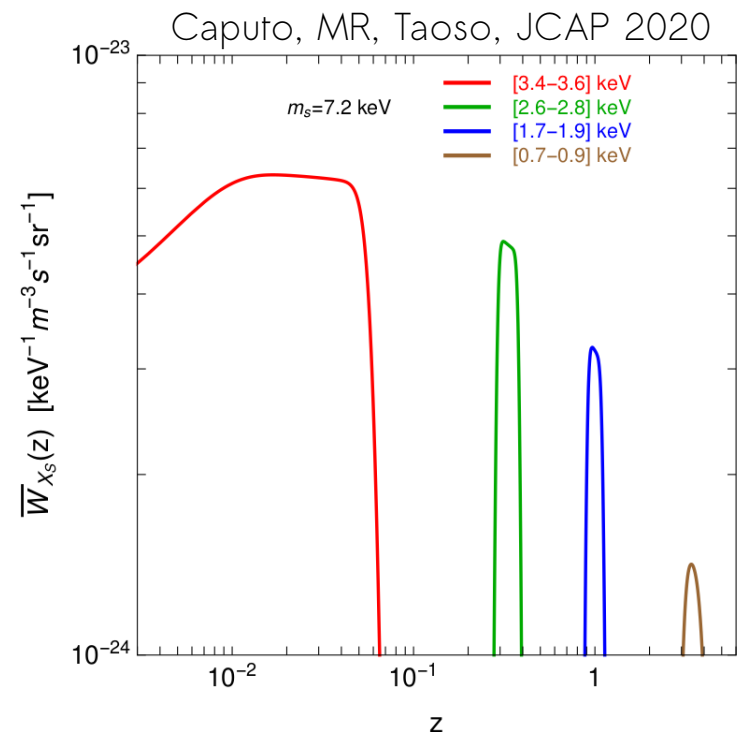
“We will study the cross correlation of the emission line signal collected by XIFU with the spatial position of galaxies in redshift surveys.”

Monochromatic signal



Cosmological X-ray emission from radiative decay of sterile neutrinos

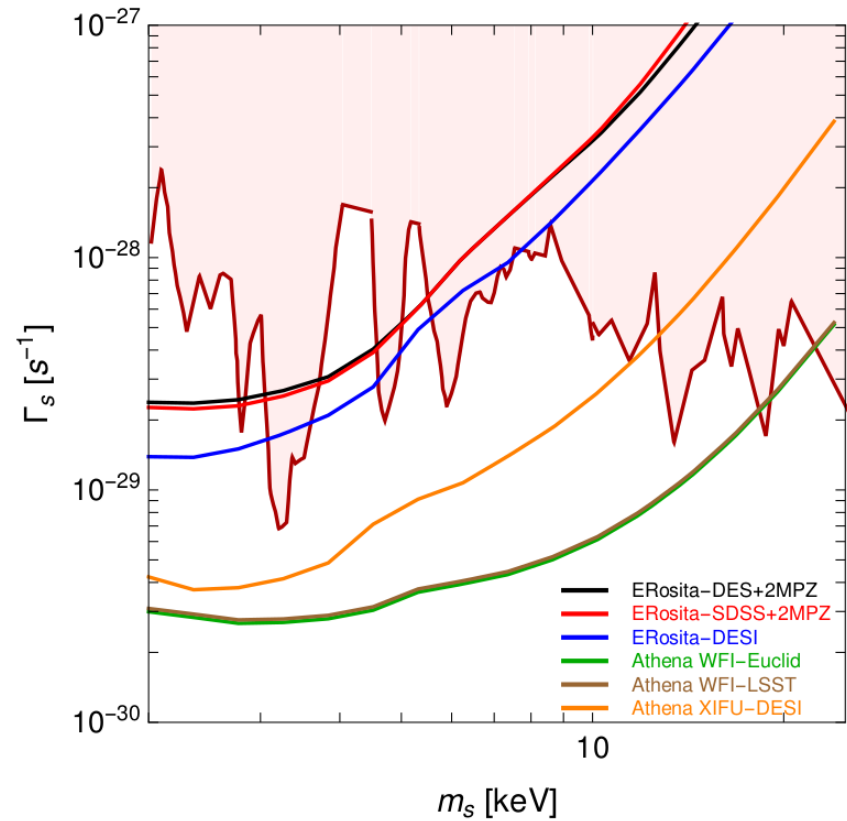
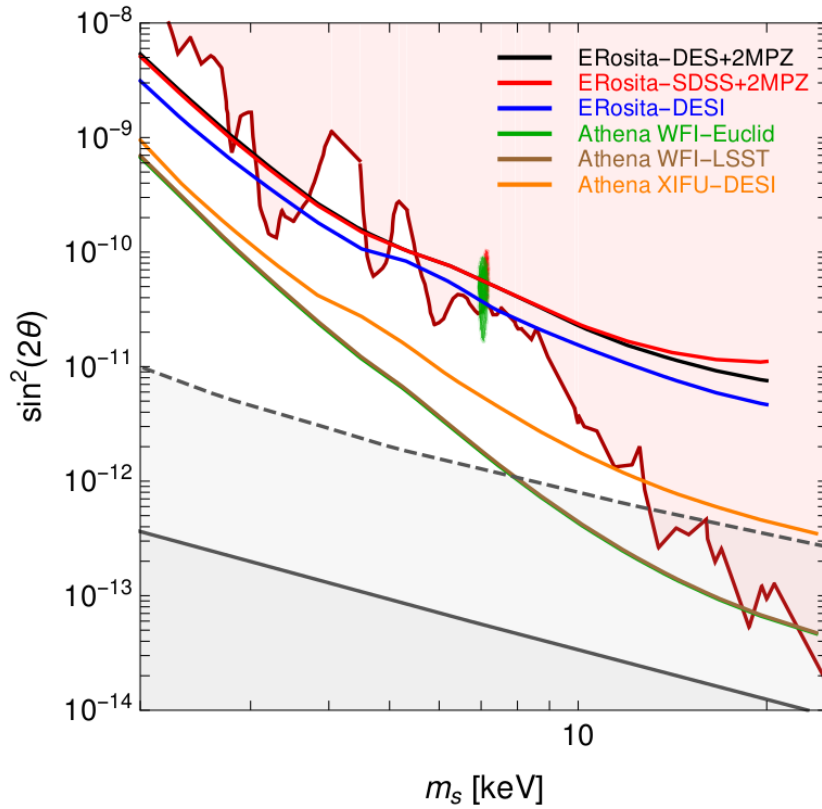
→ collection of lines at different energies and each line corresponds to a given redshift.



WP 7: DM cross-correlation and X-rays

Forecasts for cross-correlation of eROSITA and Athena with spectroscopic galaxy surveys

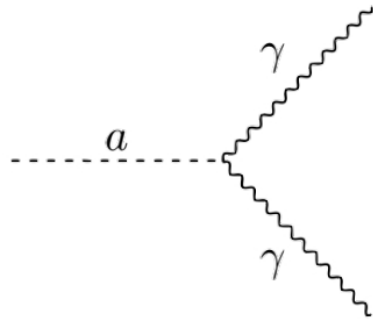
Caputo, MR, Taoso, JCAP 2020



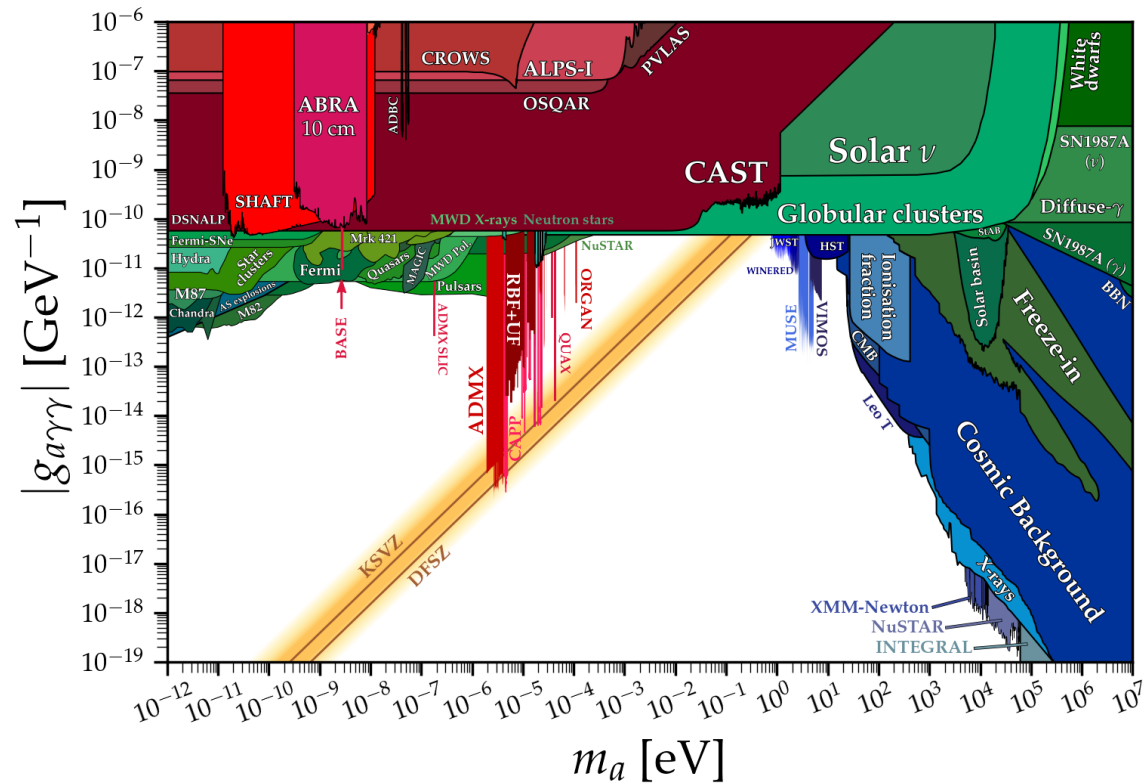
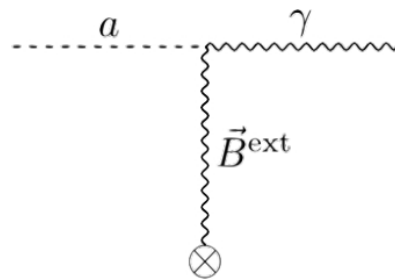
Additional WP: Axions

photon coupling: $\mathcal{L} = -\frac{1}{4}g_{a\gamma\gamma} a F_{\mu\nu} \tilde{F}_{\mu\nu}$

decay

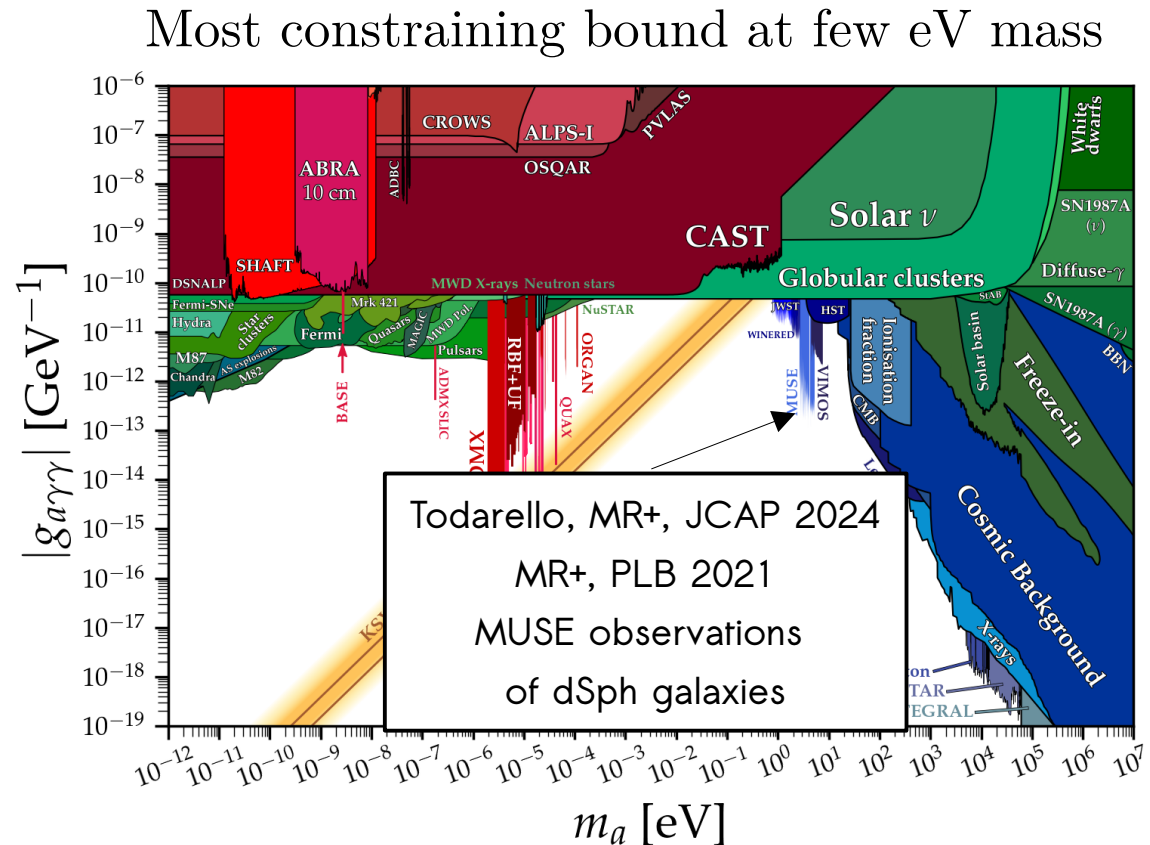
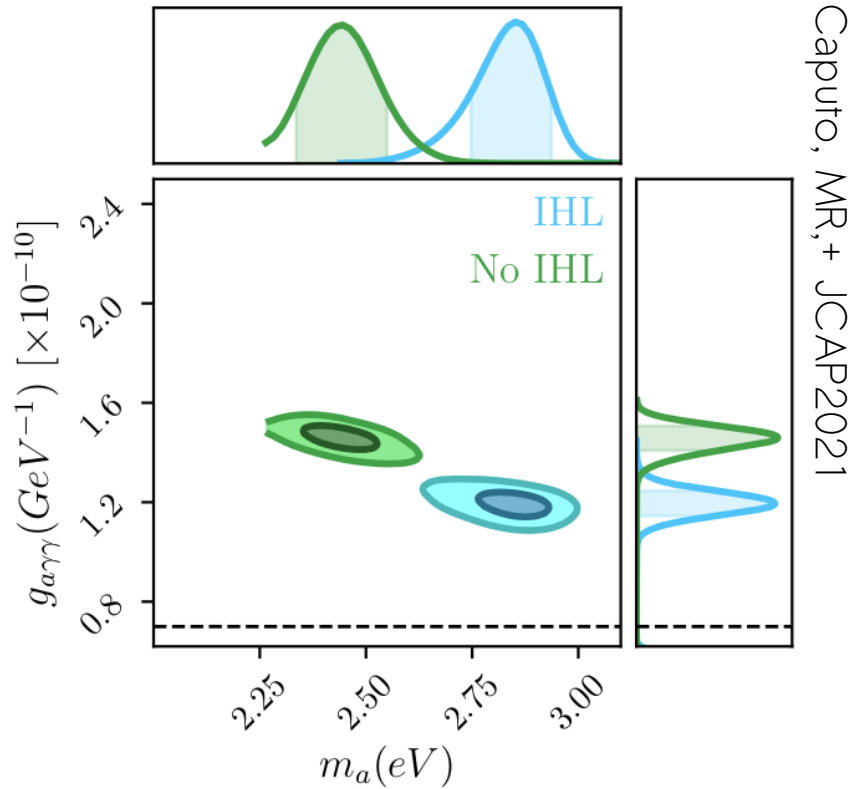


conversion



Additional WP: Axions in the optical and NIR

Ruling out axion decay as the interpretation of the NIRB excess in the angular autocorrelation.



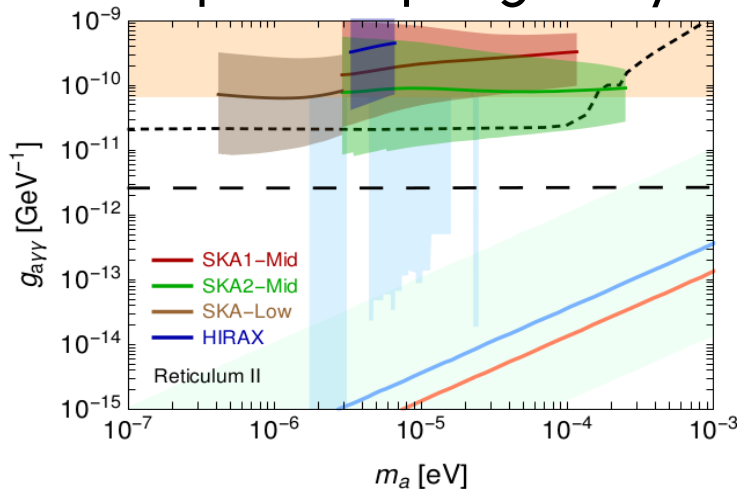
Additional WP: Axions in radio and X-rays

RADIO

Stimulated decay in DM halos.

Forecast for SKA for μeV axions.

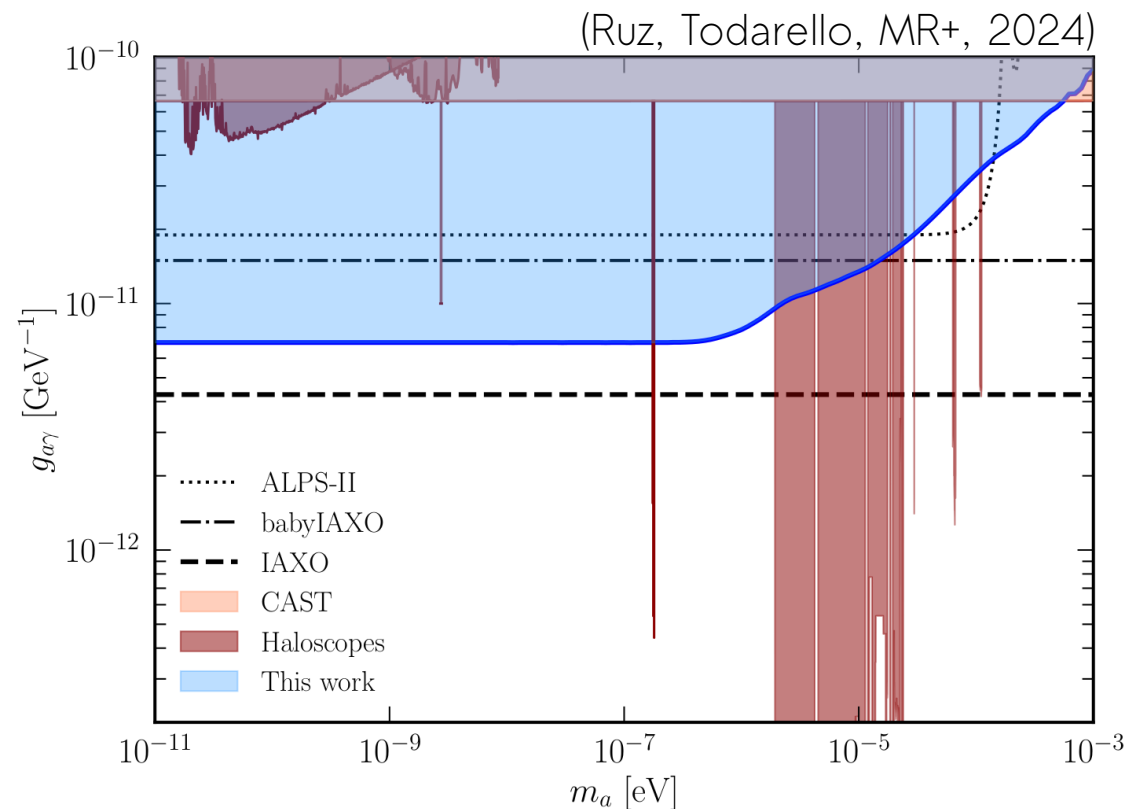
Example: dSph galaxy



X-rays

Axion conversion in the Sun magnetic field.

Data from Nustar.



Brief summary of the RU3 work

Post-doc fellowships:

Simone Ammazzalorso

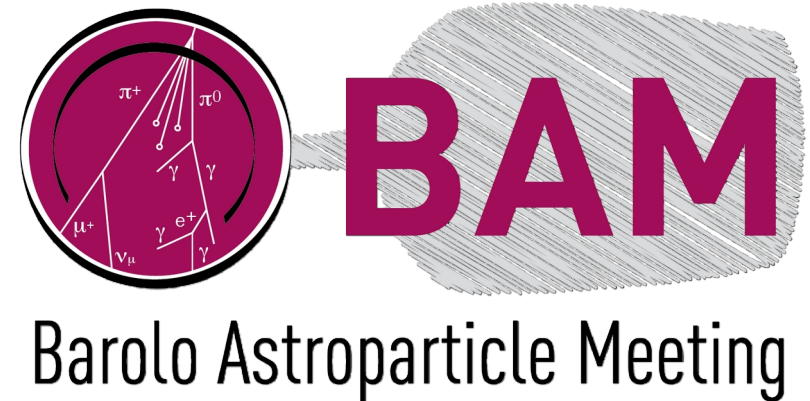
Javier Reynoso

Elisa Todarello

21 publications
~ 800 citations

An inebriating workshop

Sep 8-10, 2021 - Barolo



Conclusion

Within the network present at this meeting, there is **a not-so-common expertise about the connection between late-time cosmology and particle physics** (beyond the Standard Model)

The PRIN project “**From Darklight to Dark Matter: understanding the galaxy/matter connection to measure the Universe**” exploited this.

We should take advantage of this expertise and keep investing on the topic and our collaborations.