

FERMI

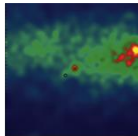
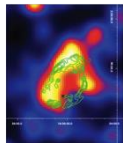
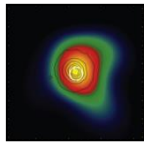
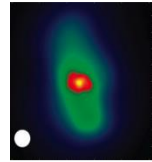
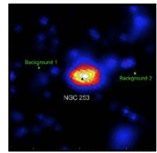
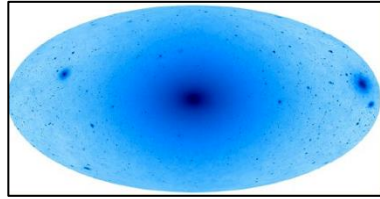
F. Loperco

Fermi status

- NASA Senior Review in 2019:
 - Fermi will keep taking data (at least) until 2022
 - Next SR in 2021 (possible extension beyond 2022)
- Fermi LAT papers (@March 2020):
 - 631 papers published (Cat. I + Cat. II)
 - 230 Cat. I papers

The Fermi Science

Dark Matter searches



Moon

Earth Limb

Local

Novae

SNRs & PWN

Globular Clusters

Starburst Galaxies

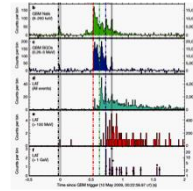
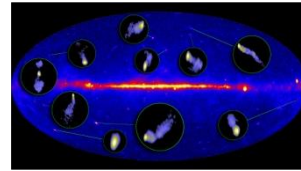
Radio Galaxies

Galactic

Sun: flares & CR interactions

Terrestrial γ -ray Flashes

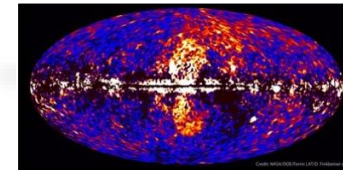
Unidentified Sources



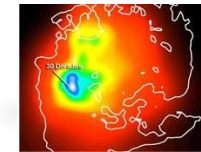
Blazars

GRBs

Fermi Bubbles

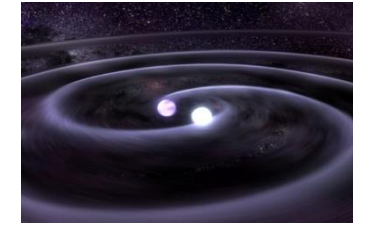
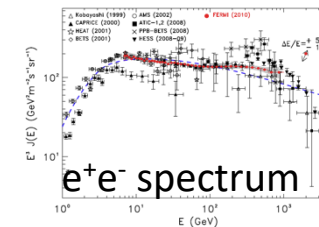
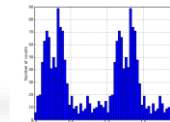


LMC & SMC



γ -ray Binaries

Pulsars: isolated, binaries, & MSPs



NEW!
Gravitational waves

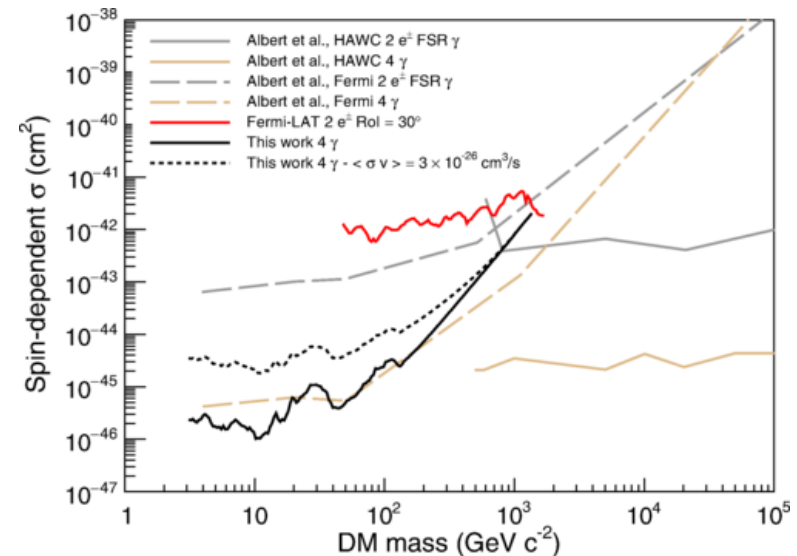
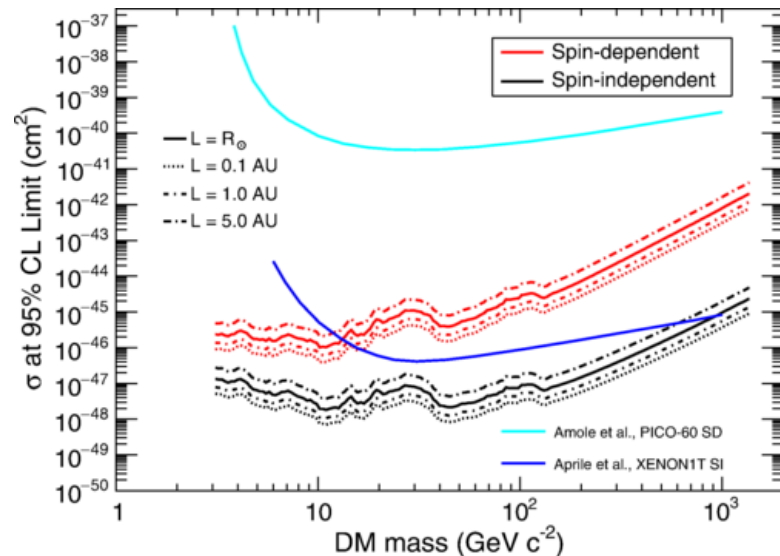
Extragalactic

Bari Group activities and responsibilities in 2020-21

- The members of the Bari Group are heavily involved in the various science groups within the LAT Collaboration, covering responsibility roles and leading several analyses
 - Instrument calibration and performance
 - Pass 8 validation for science analysis
 - Sources in the Solar System (coordinator M. N. Mazziotta)
 - High gamma ray energy emission studies from the Moon/Sun/Earth Limb/Solar System Bodies
 - Study of solar flares
 - Dark matter
 - Study of dSph Galaxies
 - Cosmic ray electron energy spectra and anisotropies
 - Search for spectral lines and features
 - Search for DM signatures with gamma and CREs from the Sun
 - Galactic sources
 - SNR catalog
 - Cosmic ray origin, acceleration and gamma ray production
 - Gamma-ray bursts (GBM GRB coordinator: E. Bissaldi)
 - GRB catalog
 - BA shifts responsibility
 - Multi-messenger analysis (LIGO/VIRGO O3 run from April 2019)
 - Diffuse
 - Diffuse models with Pass 8
- Starting from 2021 **M. N. Mazziotta** will be the **new Fermi INFN national responsible**

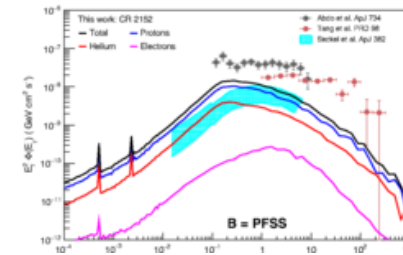
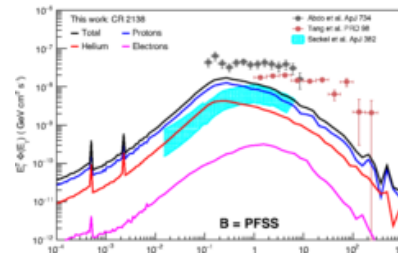
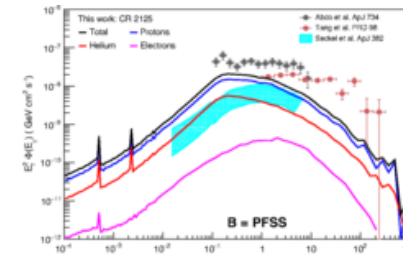
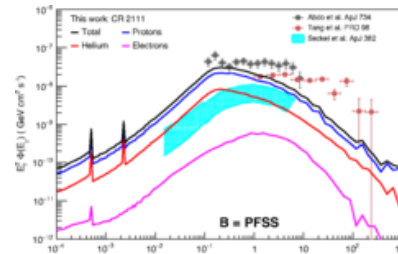
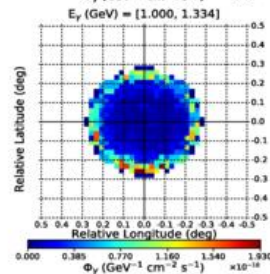
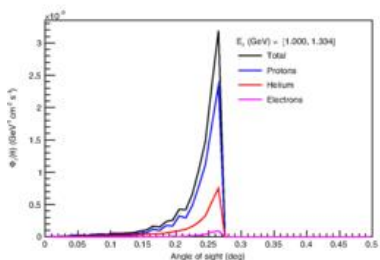
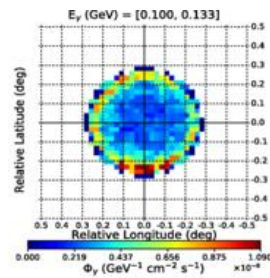
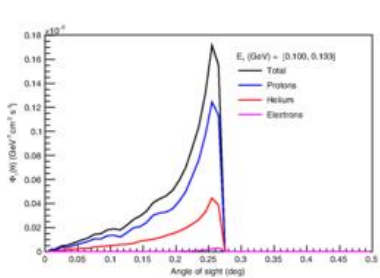
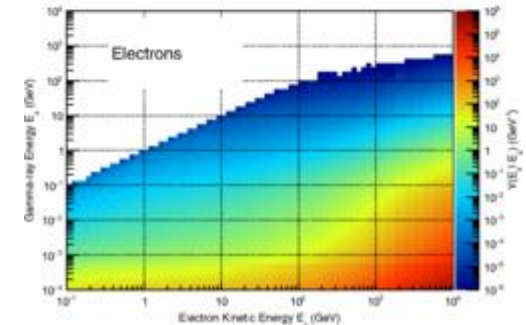
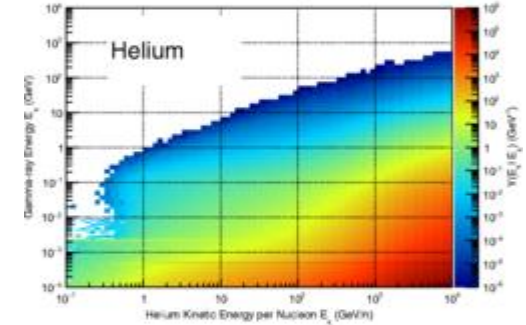
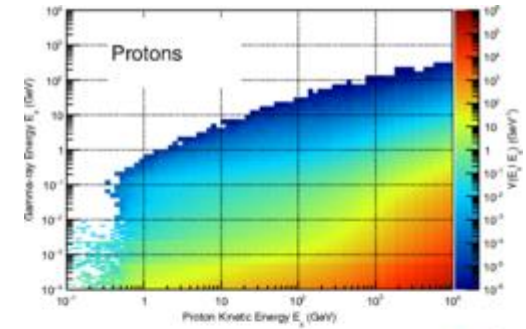
Searches for Dark Matter from the Sun

- Searches with gamma rays and electrons:
 - M. N. Mazziotta, F. Loparco, D. Serini, A. Cuoco, P. De La Torre Luque, F. Gargano, M. Gustafsson, “Search for dark matter signatures in the gamma-ray emission towards the Sun with the Fermi Large Area Telescope”, PRD 102(2020) 3, 022003
 - A. Cuoco, P. De La Torre Luque, F. Gargano, M. Gustafsson, F. Loparco, M. N. Mazziotta, D. Serini, “A search for dark matter cosmic-ray electrons and positrons from the Sun with the Fermi Large Area Telescope”, PRD 101(2020) 2, 022002
- Physics scenarios:
 - DM particles captured in the Sun annihilate into long-lived mediators, which decay into $\gamma\gamma$ or e^+e^- pairs outside the Sun
 - Photons/CREs from DM are expected to yield a box-like feature in the spectra
 - DM particles orbiting around the Sun annihilate directly into $\gamma\gamma$ or e^+e^- pairs
 - Photons/CREs from DM are expected to yield a delta-like feature in the spectra
- Analysis strategy:
 - Search for box-like or delta-like features in the spectra of solar gamma rays and electrons
 - No features found \rightarrow Limits on the feature intensities are converted into limits on the DM-nucleon cross sections



Simulation of cosmic-ray interactions with the Sun

- Paper details:
 - M.N. Mazziotta, P. De La Torre Luque, L. Di Venere, A. Fassò, A. Ferrari, F. Loparco, P.R. Sala, D. Serini, “Cosmic-ray interactions with the Sun using the FLUKA code”, PRD 101 (2020) 8, 083011
- We have used FLUKA to evaluate the yields of secondary particles (gamma rays, electrons, positrons, neutrons, and neutrinos) produced by cosmic rays interacting with the Sun
- Different models for the solar magnetic field have been implemented
- We have also estimated the fluxes of secondaries at the Earth
 - Needed to evaluate back/foregrounds in DM searches from the Sun with gamma rays, CREs and other SM particles



Anagrafica Fermi 2021

1	Bissaldi Elisabetta	Associato	RTDB	CSN II	50
2	De La Torre Luque Pedro José	Associato	Dottorando	CSN II	80
3	Fusco Piergiorgio	Associato	Ricercatore Universitario	CSN II	50
4	Gargano Fabio	Dipendente	Ricercatore INFN	CSN II	45
5	Giglietto Nicola	Associato	Prof. Ordinario	CSN II	30
6	Giordano Francesco	Associato	Prof. Associato	CSN II	50
7	Loparco Francesco	Associato	Prof. Associato	CSN II	50
8	Mazziotta Mario Nicola	Dipendente	Primo Ricercatore INFN	CSN II	60
9	Raino' Silvia	Associato	Prof. Associato	CSN II	45
10	Serini Davide	Associato	Dottorando	CSN II	70
11	Spinelli Paolo	Associato	Prof. Ordinario	CSN II	0
	TOTALE				5,30 FTE

Richieste servizi di sezione: calcolo farm, RECAS!

Beyond Fermi: projects for the next decade

- New generation MeV-GeV gamma-ray observatories
 - AMEGO (All-Sky Medium Energy Gamma-ray Observatory)
 - Proposal for the next NASA decadal survey
 - e-Astrogam
 - Proposal submitted to the ESA M5 Mission
 - New proposal of a scintillating fiber tracker within the CSN5 call for ideas
- Call for ideas ESA European large logistic lander - EL3
 - Mission scheduled in the late 2020s
 - GRAAL (Gamma Ray Astronomy and Astrophysics on the Lunar surface)
 - gamma-ray detector on the lunar surface in the 10keV-100MeV energy range
 - cosmic-ray detector to study cosmic rays or lunar-soil induced ionizing radiation