The DAMPE space mission: status and main results

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PARTICLE PHYSICS



The DAMPE space mission



The **DA**rk **M**atter **P**article **E**xplorer (DAMPE) is a satellite-based experiment

DAMPE was successfully launched in a Sunsynchronous orbit on **December 17th 2015** from the Jiuquan Satellite Launch Center



- → ALTITUDE: 500 km
- → INCLINATION: 97°
- → PERIOD: 95 minutes
- → ORBIT: Sun-synchronous

The DAMPE collaboration involves several institutes in China and Europe



CHINA

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- Purple Mountain Observatory, CAS, Nanjing
- University of Science and Technology of China, Hefei•
- Institute of High Energy Physics, CAS, Beijing
- University of Chinese Academy of Sciences, Beijing
- National Space Science Center, CAS, Beijing
- Institute of Modern Physics, CAS, Lanzhou
- University of Hong Kong, Hong Kong

ITALY

- INFN Perugia and University of Perugia
- INFN LNGS and

Gran Sasso Science Institute

- INFN Bari and University of Bari
- INFN Lecce and University of Salento
 SWITZERLAND
- University of Geneva

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DAMPE scientific objectives





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The DAMPE experiment

PSD

STK-







	DAMPE	AMS-02	Fermi LAT
e/γ energy res.@100 GeV (%)	1.2	3	10
e/γ angular res.@100 GeV (deg)	0.2	0.3	0.1
e/p discrimination	10⁵-10 ⁶	10 ⁵ -10 ⁶	10 ³
Calorimeter thickness (X_0)	32	17	8.6
Geometrical accep. (m²sr)	0.3	0.09	1



Detector structure





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ICRC 2021, 12-23/07/2021

Measurement of the light component (p+He) energy spectrum with the DAMPE space mission



Particle selection and identification







structure can be found

DAMPE energy resolution for photons < 1%

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95% confidence level constraints on the annihilation cross section or decay lifetime with systematic uncertainties included

DAMPE 5-year **results comparable with** 5.8-year results of **Fermi-LAT**

For the decaying DM, DAMPE **lower limits on the decay lifetime** are stronger for DM with mass ≤ 100 GeV







5-years gamma-ray data



120 M seconds livetime and more than 220'000 photons above 2 GeV

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Electron IDentification





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All-electron spectrum



LETTER

doi:10.1038/nature24475

Direct detection of a break in the teraelectronvolt cosmic-ray spectrum of electrons and positrons

Measurement of the spectrum in the energy range 25 GeV – 4.6 TeV

~ **530 days** of data (27 Dec 2015 – 8 Jun 2017)

Proton **contamination** < 3% @ [50 GeV – 1 TeV]





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Proton spectrum





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Helium spectrum





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Conclusions



- The DArk Matter Particle Explorer, was launched in December 2015 in a sun-synchronous orbit and it is smoothly taking data since then
- Searching for **gamma-ray lines** we obtained constraints on the Dark Matter annihilation cross section comparable with other experimental results and **lower limits on DM decay lifetime**
 - Found ~ 220 gamma-ray sources with a preliminary 5-year analysis
 - Direct detection of a **break** at ~1 TeV in the **electrons and positrons** spectrum
 - Detection of a **softening** at ~14 TeV in the **proton** spectrum
 - First detection of a **softening** in the **helium** spectrum at ~34 TeV, suggesting a Z dependence
 - Ongoing the **p**+**He** analysis, to reach higher energy and build a bridge between direct and indirect measurements
 - Many analysis are ongoing including primary (**C**, **O**, **Fe**, ...) and secondary (**Li**, **Be**, **B**, ...) spectra, along with their ratio (**B**/**C**, ...)

Thank you for the attention!