



**Search for dark matter
particles in space:
International experiments
PAMELA and GAMMA-400**

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RUSSIAN-ITALIAN ASTROPARTICLE EXPERIMENT «RIM - PAMELA» - THE FIRST REALIZED PROJECT FOR SEARCH AND STUDY OF DARK MATTER NATURE IN SPACE



Leader investigators:
from Russian side professor A. Galper
from Italian side professor P. Picozza

Launched in orbit on June 15, 2006, on board of the DK1 satellite by a Soyuz rocket from the Baikonour launch site.

8,5 years in orbit

The amount of data collected is ~ 20 TB, corresponding to more than 5×10^9 events.

PAMELA Collaboration

ITALY



RUSSIA



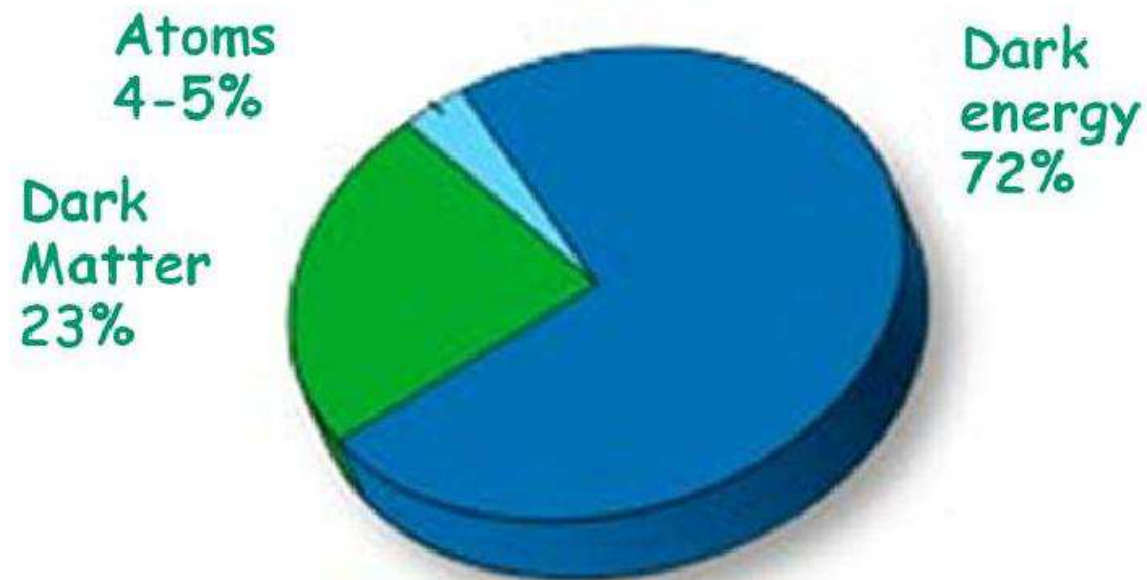
GERMANY



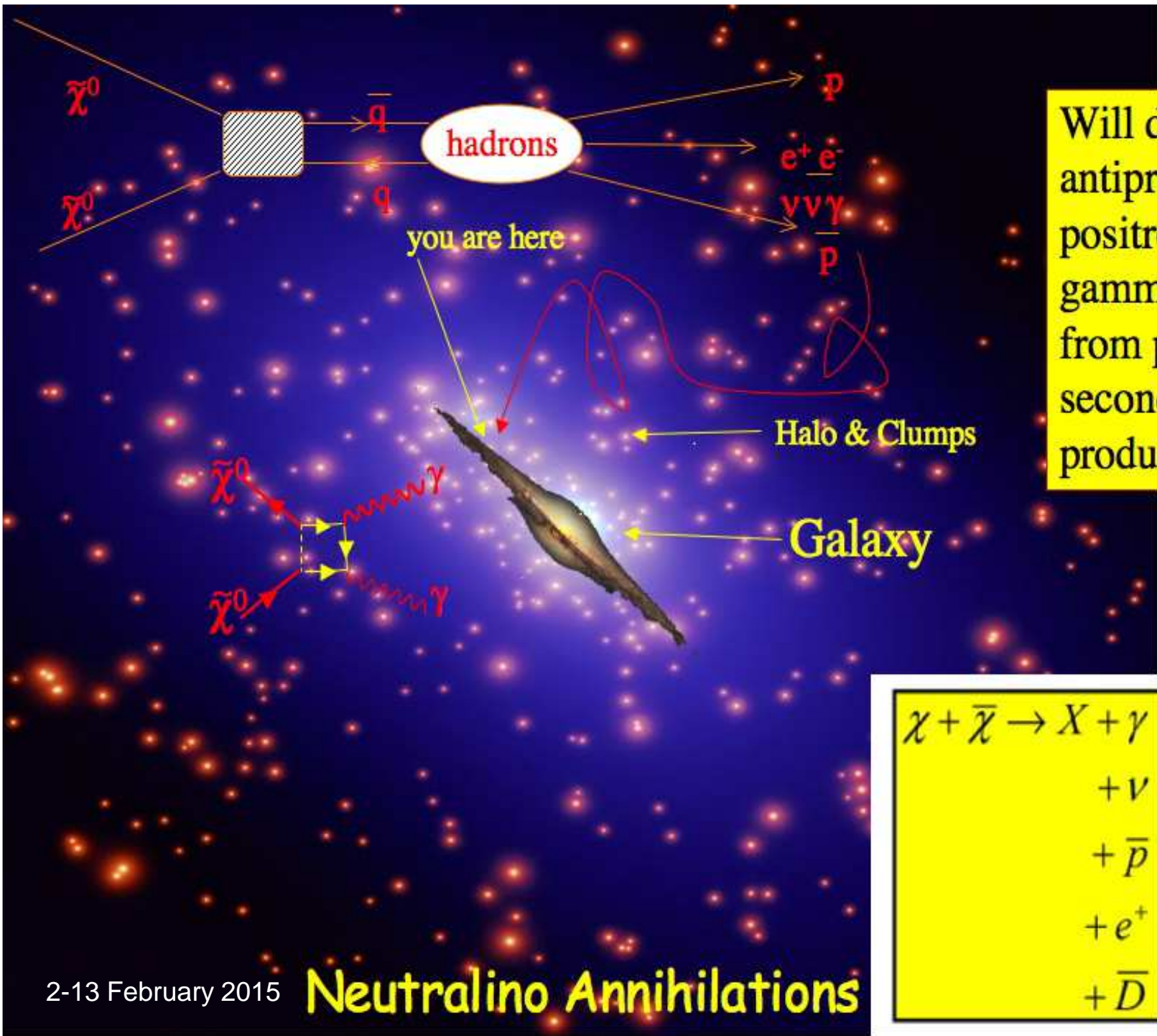
SWEDEN



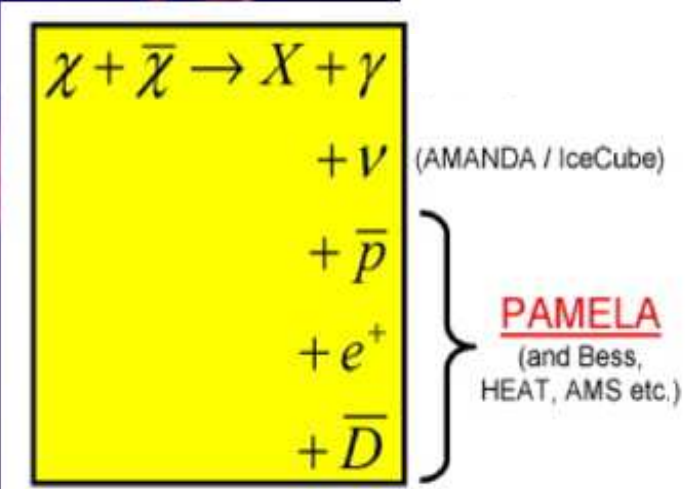
The content of our Universe



The Λ CDM standard model

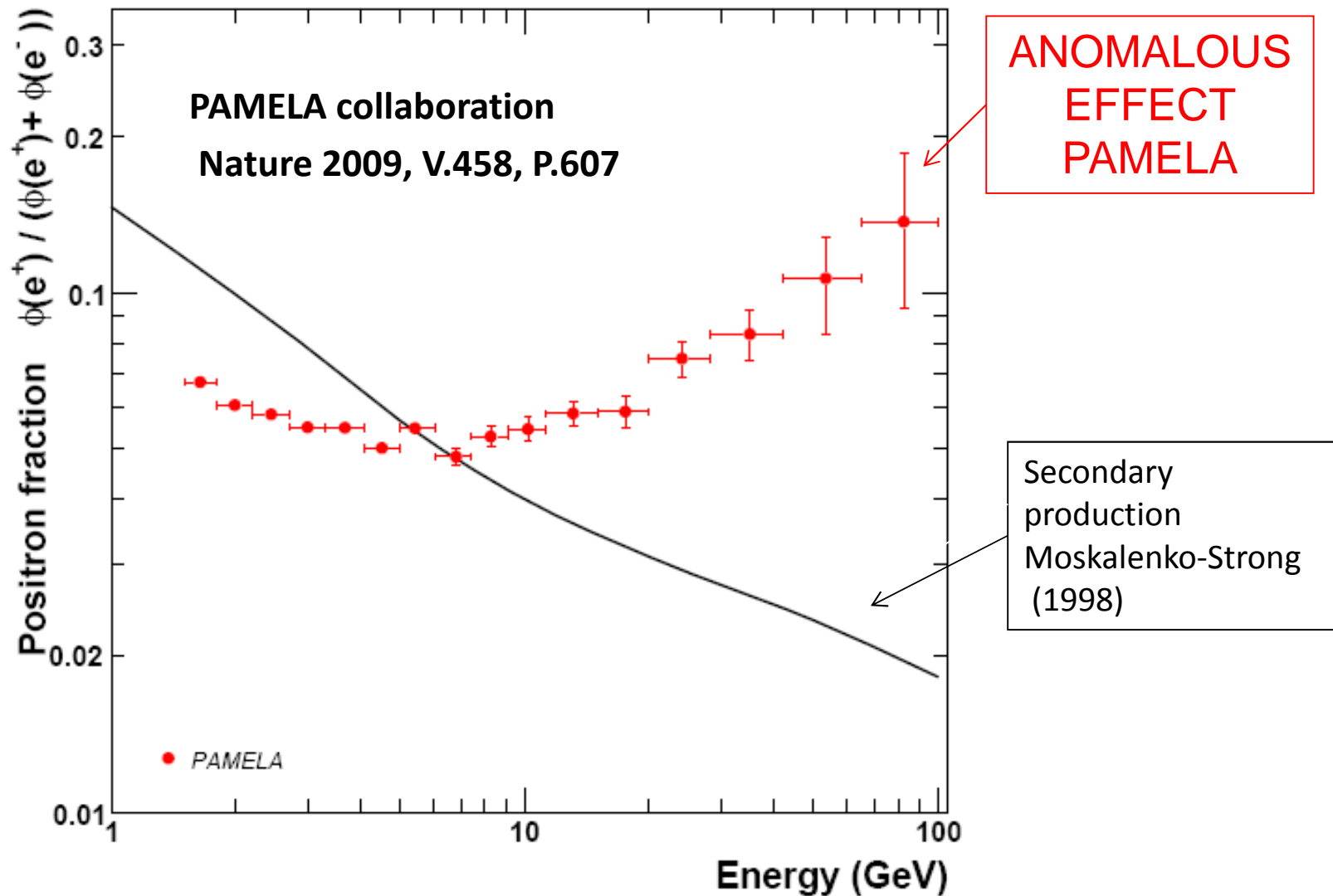


Will distort the antiproton positron and gamma spectra from purely secondary production



Study of dark matter origin

positron fraction



The main results:

1. PAMELA obtained an increase of galactic positron/electron flux ratio for energy range from 10 GeV up to 150 GeV. This contradicts to mechanisms of secondary electron and positron production.
2. In the same time measured values of antiproton/proton flux ratio is in agreement with model of secondary production.
3. These experimental facts can be explained by
 - **annihilation and/or decay** of hypothetical particles, that **dark matter** can consist.

It is the first positive indirect observation of dark matter particles.

THE SCIENTIFIC GOALS OF GAMMA-400 PROJECT

Study of the dark matter origin by gamma rays, electrons and positrons from annihilation and decay of the dark matter particles.

Study of processes of in active astrophysical objects including the center of Galaxy

Study of generation and propagation of cosmic ray electrons and positrons

Study of high energy gamma-ray bursts

Precise measurements of discrete astrophysical sources

GAMMA-400 Collaboration



Russian scientific organizations

Foreign scientific organizations

Lebedev Physics Institute RAS —
main collaborator

Istituto Nazionale di Fisica Nucleare (Italy)
— strip detector and calorimeter

National Research Nuclear University
MEPhI — detectors

Istituto Nazionale di Astrofisica (Italy) —
strip detector

Research Institute for Electromechanics
design, temperature control system

Taras Schevchenko National University
(Ukraine) — Ukrainian main collaborator

Scientific and technical Institute of system
research RAS — electronics

Lviv Center of Institute for Space Research
(Ukraine) — magnetometer

Ioffe Physics-Technics Institute —
Konus-FG burst monitor

Institute for Scintillation Materials (Ukraine)
— scintillators

Institute of high energy physics —
calorimeters, scintillators

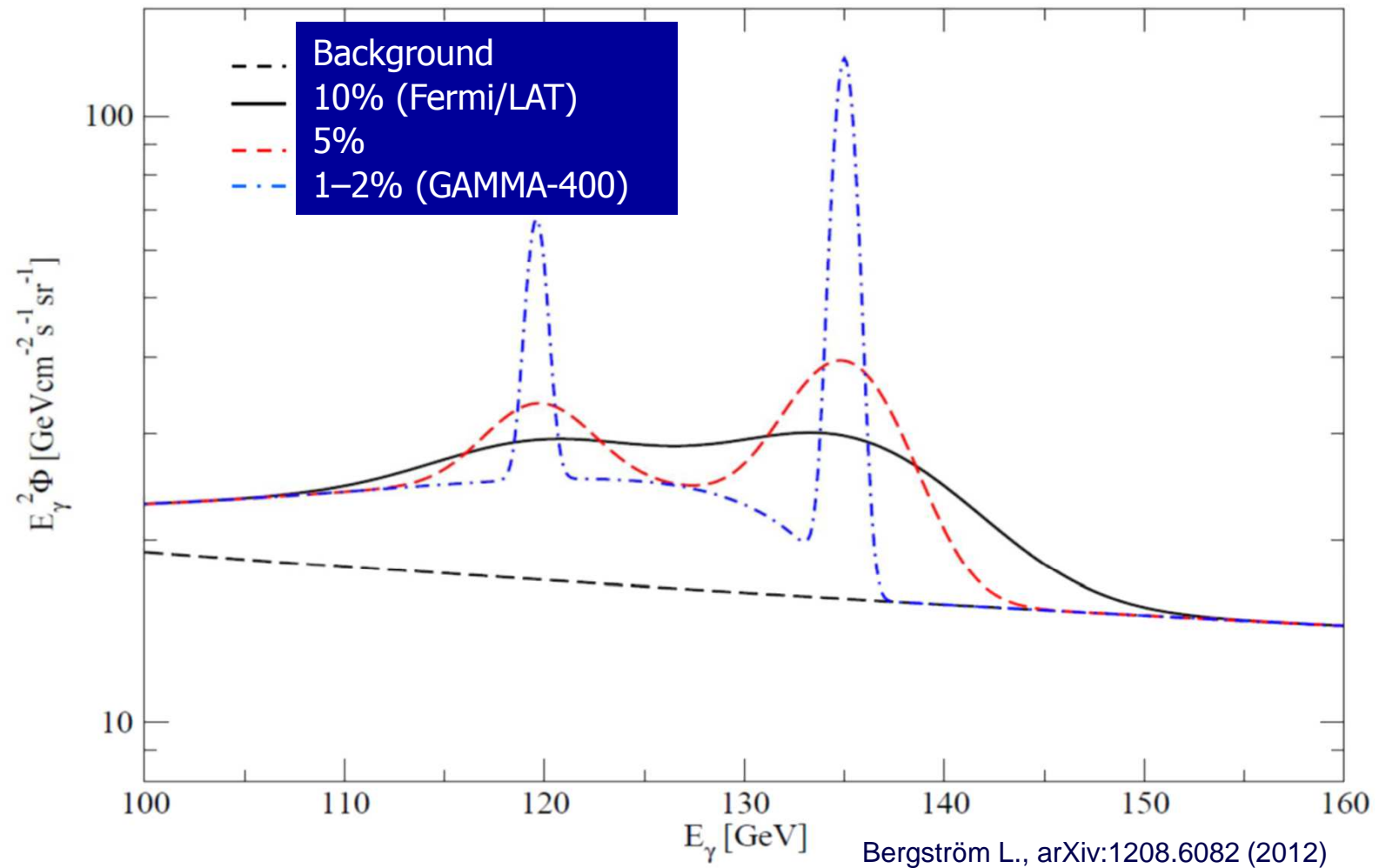
Royal Institute of Technology (Sweden) —
anticoincidence

Scientific and technical Institute of
Mechanical Engineering — qualification

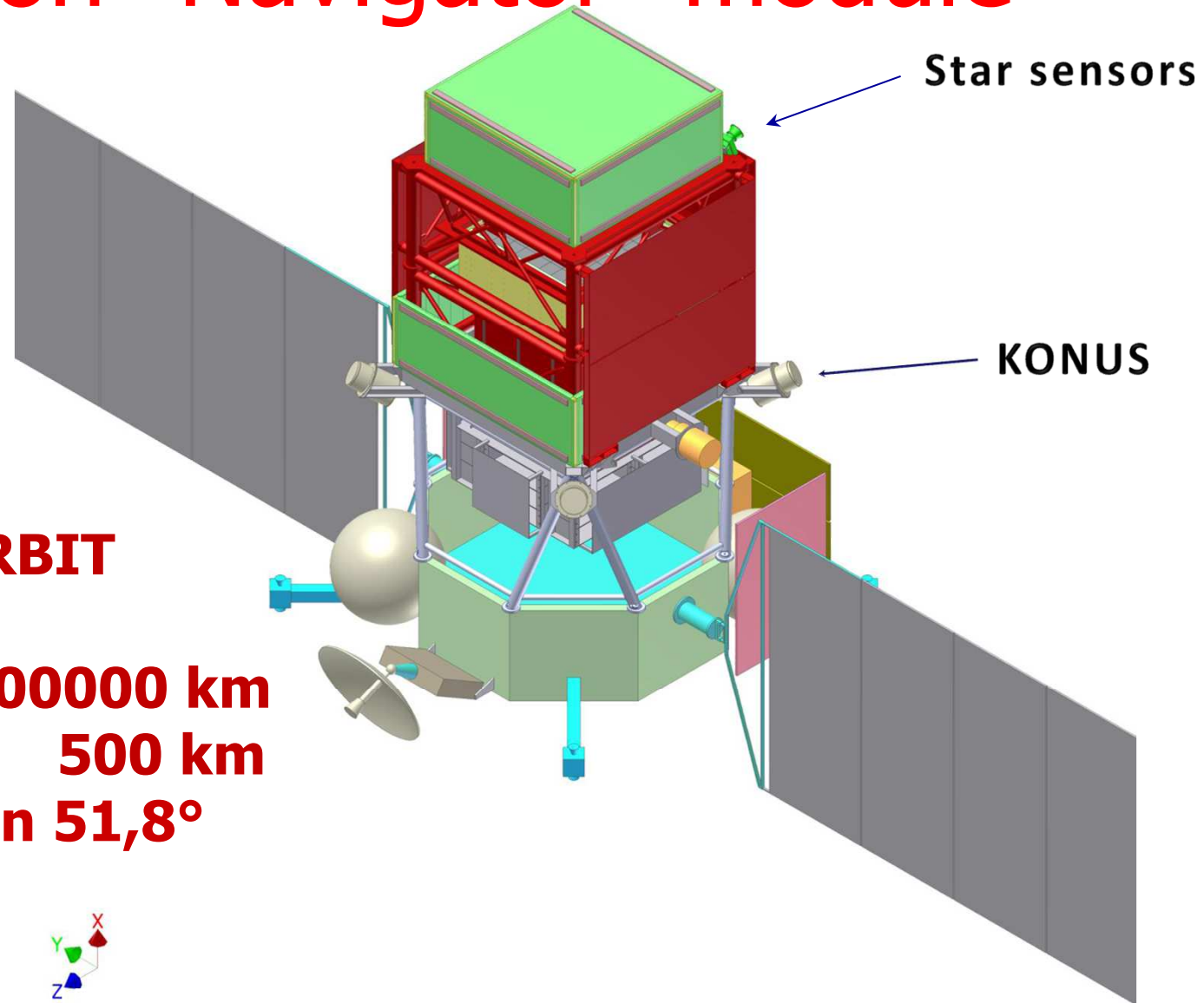
MAIN PERFORMANCES OF GAMMA-400 TELESCOPE

Energy range	0,1-3000 GeV
Angular resolution ($E_\gamma > 100$ GeV)	$\sim 0,01^\circ$
Energy resolution ($E_\gamma > 100$ GeV)	$\sim 1\%$
Rejection of charged particles	$\sim 5 \times 10^5$
Surface	
- anticoincidence system	1,44 m ²
- calorimeter	0,64 m ²
Thickness	
- convertor	1,0 rad. length
- calorimeter	25 rad. Lengths
Mass	2600 kg
Power consumption	2000 W
Volume of transmitted information	100 GBytes per day
Detected particles	Gamma photons, electrons, positrons, protons, nuclei

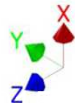
High energy resolution



GAMMA-400 telescope on "Navigator" module



ORBIT
Apogee 300000 km
Perigee 500 km
Inclination 51,8°



Conclusion

1. The first registration of dark matter particles was done by PAMELA instrument.
2. The new instrument GAMMA-400 for dark matter particle study by gamma-astronomy methods is under developing

Thanks!