Pamela Goes to Space to Explore Dark Matter and Antimatter

June 13 2006

Searching for antimatter and dark matter in Space: this is Pamela's mission. Pamela will be launched into orbit on June 15th from the cosmodrome of Baikonur, in Kazakhstan. The launch will take place at 11.00 am local time.

Pamela, (Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics) will stay in Space for at least three years, on a quasi-polar elliptic orbit between 300 and 600 kilometres from the ground. Pamela is the result of a collaboration among Russian research institutes, Russian Space Agency and the Italian National Institute for Nuclear Physics, with the participation of Italian Space Agency and the contribution of German and Swedish space agencies and universities.

Antimatter and dark matter are some of the most controversial and fascinating issues that modern physics is facing. Actually, today we know that 5% only of the universe is constituted of the matter which is familiar to us, that is to say the one made up of protons, neutrons end electrons. It is estimated that 70% of what exists in the cosmos is constituted of an invisible and homogenous substance called "dark energy". The remaining 25% would be instead composed of dark matter, constituted of particles which are very different from ordinary matter. These particles, still unknown under certain respects, don't aggregate in celestial bodies. Antimatter is very rare in our universe, but according to the most reliable theories, after the Big Bang there was the same amount of antimatter and matter. Afterward, matter and antimatter would have been annihilated almost at once in a burst of energy. Surprisingly, a very

little percentage of matter was left over from this process: such a small quantity of matter now forms stars, planets, ourselves and everything we know. If the amount of antimatter was the same as the amount of matter, why did only a part of matter remain? What is the difference between the two? Casting light on these questions will be part of the challenges that Pamela is going to face into Space. But how will it do it?

Pamela will investigate on dark matter and antimatter by studying cosmic rays: energetic particles of different nature coming from Space and carrying important information on the cosmic source that generated them, and as a consequence, on its origin and evolution. In particular Pamela will measure flux, energy and characteristics of galactic, interplanetary and solar cosmic rays with a precision never reached before.

The instrument is nearly 500 kilos, its dimensions are the ones of a parallelepipedon 1.3 metres tall with a square base whose side is 75 centimetres long. It is essentially composed of a large magnet equipped with a remarkable number of detectors which can identify the particles that cosmic rays are made up of, can trace their trajectories and measure their energy. Finally, sophisticated electronic devices for detectors' reading, equipment management, and connection with communication systems of the satellite complete the apparatus.

Thanks to the sophisticated equipment of Pamela, it will be possible for the first time to make long period observations, avoiding atmosphere interference, with which cosmic rays interact. Only instruments settled on stratospheric balloon, and once also on the Space Shuttle, traced this kind of data, but only for a short period.

"The launch of Pamela is a very exciting moment for the whole collaboration. It represents the crowning achievement of long years of study realized by a large number of researchers, mainly young. At the

moment, Pamela is the most advanced instrument for this field of astrophysics. When Pamela will get into orbit, the second and most amazing part of its scientific adventure will begin, with the aim of discovering some of the most intriguing and complex mysteries of the universe" says Piegiorgio Picozza, director of Inf section of Tor Vergata, who coordinated the activity of Infn sections of Florence, Naples, Trieste, Bari, National Laboratories of Frascati, and of the international collaboration.

Simonetta Di Pippo, director of the Observation of the universe department at Italian Space Agency and actual president of the joined committee Asi/Infn, comments on the forthcoming launch: "Pamela is inserted in a very rich set of experiments and mission at Asi. This is a strategic line outlined in the National Aerospace Plan which intends to study high energy particles using the most powerful accelerator we have: our universe. I am talking about Swift, in orbit since a year and a half with a very strong contribution of Asi. And I am talking about the Ams observatory , which is the result of a collaboration with several countries. Amongst them Italy, with Asi and Infn, has a very important position. We have a strong synergy with Infn: we also collaborated for Glast, the Nasa observatory that will be launched next year. In this project Italy contributed with the 16 silicon towers of Lat (Large Area Telescope), again with Infn. A very important and surely successful collaboration. We expect many important results from the Pamela mission".

Source: Istituto Nazionale di Fisica Nucleare