

# ELECTRON AND POSITRON SPECTRA FROM PAMELA BY MULTIVARIATE DATA ANALYSIS METHODS

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For 10 years, since 2006 to 2016, PAMELA, a satellite-borne experiment, had been conducting measurements of cosmic rays [1]. Currently, one of the open problems is researching cosmic-ray electron and positron energy spectra, also their time dependencies. The apparatus is estimated to measure these spectra combined from 50 MeV up to 1–2 TeV (600–700 GeV to determine the sign of charge) [2,3]. By the moment, the PAMELA collaboration has published results on 2006–2009 electrons and positrons spectra [3,4], complementing which with the data for the rest period of the measurements with the PAMELA instrument is the priority goal of the ongoing work.

This work presents a new approach to processing the PAMELA experimental data, and preliminary results obtained using it. Besides the previously used complex analysis of parameters extracted from the detectors systems, particular attention is given to machine learning methods to process this data. As such a tool, the TMVA package of the ROOT software is used [5], which is applied for multivariate data analysis. By means of preliminary program training on the test sets of parameters derived from modeling electrons and positrons passing through the PAMELA detectors with GEANT4 package [6], this method enables optimizing the experimental data processing while raising its selection efficiency due to the 1.5 times, compared to the ones obtained before. As an example of the application of the method, this approach has been used to obtain the electron and positron fluxes and their time dependencies, such as the flux ratios of positrons and electrons, positrons and protons, for the whole PAMELA data collection period.

1. O. Adriani et al., *La Rivista del Nuovo Cimento* 10, 473–522 (2017)
2. P. Picozza et al., *Astroparticle Physics* 27, 296–315 (2007)
3. O. Adriani et al., *Physical Review Letters* 106(20), 201101 (2011)
4. O. Adriani et al., *Physical Review Letters* 111(8), 081102 (2013)
5. <https://root.cern/manual/tmva/>
6. <https://geant4.web.cern.ch/>

## The speaker is a student or young scientist

Yes

## Section

1. Neutrino physics and nuclear astrophysics

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