Abstract

Author:	Mgr. Patrik Čechvala
Title:	Simulations of the interactions of cosmic rays with matter and analysis of observations of gamma rays
University:	Comenius University in Bratislava
Faculty:	Faculty of Mathematics, Physics and Informatics
Department:	Department of Astronomy, Physics of the Earth and Meteorology
Supervisor:	doc. RNDr. Juraj Tóth, PhD.
Consultant:	prof. RNDr. Jozef Masarik, DrSc., RNDr. Roman Nagy, PhD. and Alicia López-Oramas, PhD.
Type of thesis:	Dissertation thesis
Place:	Bratislava
Number of pages:	128

The presented work deals with the topic of the study of the interaction of cosmic-ray particles with meteoritic material and the sources of gamma rays and their energy spectra. Bombardement of minor bodies of Solar system by cosmic-ray particles leads to the spallation reactions within these bodies and to the generation of cosmogenic radionuclides. Studying the production rates of these nuclides, it is possible to gather valuable information about the exposition of the bodies to the cosmic-ray environment, shielding of the material and in case of meteorites also about the time which it took from a fall of the sample to the Earth. Nowadays, there are simulation softwares which can simulate the bombardement of predefined material by high-energy particles. The results from these softwares can be compared with the actual data. We present the simulations of *Knyahinya* meteorite using Monte Carlo simulation software *Geant4*. This meteorite was well studied in history using simulation toolkit MCNP. We have calculated the production rates for different cosmogenic nuclides and compared our results with the actual measurements and with the results from previous simulations. Observations in the gamma-ray domain of the electromagnetic spectrum open the unique "window" to the Universe through which the humanity is capable to observe the most violent phenomena taking place in the Universe. Gamma photons can be emitted through different mechanisms which are described in this work. These photons once emitted propagate through the Universe and are influenced by different processes. New technologies enabled the development of different observation techniques. We pay a specific attention to the analysis of the data taken by a pair of MAGIC Cherenkov telescope. We analysed two archival datasets taken by MAGIC telescopes. The data contains the information about the interesting Galactic source 2FHL J1839.5-0705.

Preliminary results are presented. In the end, we conclude our results and present the future plans for our work.