Detecting Cosmic Rays by Self-Build Scintillation Detector and a Muon Telescope

Cabalkova, Barbora (School: Gymnazium Zamberk)

For the purpose of detecting cosmic ray flux and analyzing its behavior in relationship with latitude, altitude, solar cycle and meteorological conditions I built my own detector. It consists of two independent scintillation detectors with the construction based on the Cosmic Watch detector designed at MIT. These scintillators are sensitive to highly energetic particles, including muons, alpha, beta or gamma particles. Detecting specifically cosmic particles requires discrimination of radiation incoming from other sources. The key is to reduce it to muons, particles with a single natural source – primary cosmic rays decaying in the atmosphere with muons as the daughter product. As method of discriminating other, potentially terrestrial, particles I use coincidence of impulses. If events in both detectors happen at the exact same time, it means that its initiator had enough energy to penetrate both and followed the right trajectory to hit them. Adjusting distance between two scintillators using the telescope I limit the zenith angel of detected muons. I undertook hundreds of hours of measurement in the coincidence mode, through which I have tried to find all possible muon flux dependencies. I captured the altitude dependence during flights from Prague to Madeira and back, where the increase with latitude also showed. I have detected significant anticorrelation with the atmospheric pressure, although I cannot certainly substantiate relationship with other meteorological conditions yet. My data, including measurement performed at the mountain weather observatory Milesovka, have discovered strong dependence on the solar activity. I also observed the angle distribution of muon and the development of its energy influenced by all the phenomena.