***Abstract No: 290*** ***Physical sciences***

# CONSTRUCTION AND APPLICATION OF A PORTABLE MUON DETECTOR

**S. A. K. D. Senadheera*, T.P. Ranawaka, J.A.C.P. Jayalath and D.R.A. Mendis**

*Department of Physics, University of Peradeniya, Peradeniya, Sri Lanka*
**s16473@sci.pdn.ac.lk*

Particle physics studies the fundamental aspects of nature, the very building blocks of the universe, and has revolutionized the way we observe our known universe. Even though working with powerful accelerators and sophisticated detectors is ideal, not all institutions have such facilities. Therefore, a low-cost muon detector was built according to the design of the desktop muon detector by the Massachusetts Institute of Technology. A plastic scintillator is used as the scintillation material in the detector due to its low cost and ability to be shaped into the required shape and size. A silicon photomultiplier is used as the electronic light sensor as it is much cheaper, smaller, and better at detecting the excitation energies of charged particles compared to the photomultiplier tubes. Other components include basic electronic components such as an Arduino nano, operational amplifiers, resistors, capacitors, and inductors. The detector was used to obtain count rates in Colombo, Sri Lanka. Under several approximations, the muon flux obtained in Colombo at sea level is $9.6 \times 10$ $m^{-2}$ $s^{-1}$ $sr^{-1}$. During calibration, the triggering threshold was set so that the detector would trigger for particles with higher energies compared to typical surface background radiation energies. Therefore, to calculate the approximate total muon flux, a correction was made to account for the muons with lower energies than the trigger threshold. The correction was done by comparing two count rate vs silicon photomultiplier voltage graphs. One graph was plotted using a detector that was not calibrated, and the other graph was obtained from the literature. The graph obtained from the literature contains a plot obtained using detectors of the same design operated in coincidence mode. This is the major approximation used to calculate the muon flux. The flux value obtained was 4% lower relative to the muon flux recorded at higher latitudes, according to the literature. This observation is justifiable because Colombo is close to the geomagnetic equator and muon flux varies with the geomagnetic latitudes. Moreover, the data obtained from the detector follows a Poisson distribution where the theoretical and experimental distributions closely correlate, thereby confirming the detection of truly random events. This detector provides a new avenue of research as there are numerous applications in various fields.

**Keywords:** Cosmic ray muon flux, Geomagnetic equator, Particle physics, Poisson distribution of cosmic rays, Portable muon detector