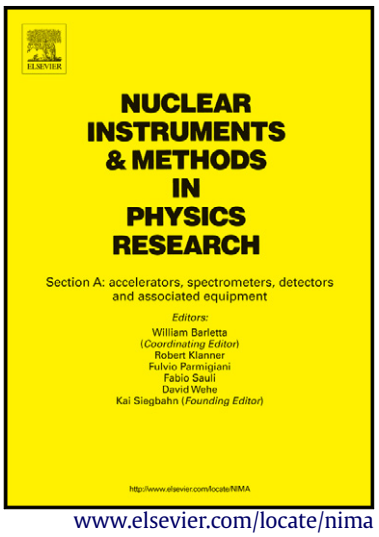

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Point spread function due to multiple scattering of light in the atmosphere

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Abstract

The atmospheric scattering of light has a significant influence on results of optical observations of air showers. It causes attenuation of direct light from the shower, but also contributes a delayed signal to the observed light. The scattering of light therefore should be accounted for, both in simulations of air shower detection and reconstruction of observed events. In this work a Monte Carlo simulation of multiple scattering of light has been used to determine the contribution of the scattered light in observations of a point source of light. Results of the simulations and a parameterization of the angular distribution of the scattered light contribution to the observed signal (the point spread function) are presented.

Keywords: Ultra-high energy cosmic rays, extensive air shower, multiple scattering, point spread function

1. Introduction

The observation of light produced by an extensive air shower is one of the established methods of detection of ultra-high energy cosmic rays. As the cascade of energetic charged particles of an air shower, initiated by a highly energetic primary cosmic ray particle, moves through the air, it produces a large number of fluorescence and Cherenkov photons [1, 2, 3]. The intensity of the fluorescence light [4, 5] is proportional to the size of the air shower at any point of its trajectory, therefore observations of light along the shower

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