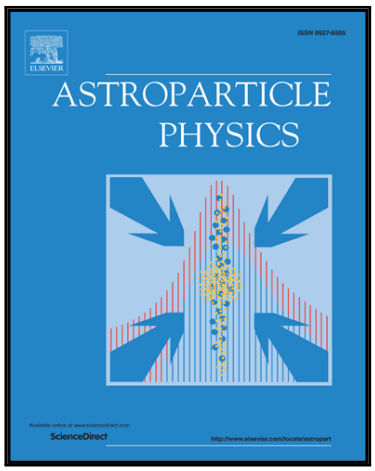

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Improving the discrimination capability of heavy nuclei based on direct Cherenkov light

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Abstract

The accurate measurement of individual species of cosmic rays (CRs) is very important to solve the problem of their origin. CR spectra with energies >100 TeV can be evaluated only by detecting extensive air showers on the ground. Thus, identifying the primary components of CRs depends highly on hadronic interaction models. Direct Cherenkov light (DC-light) emitted by the primary components of CRs prior to first interaction in the atmosphere can be used to identify such primary components. The intensity of DC-light is proportional to the square of the charge of CRs primary components and independent of the hadronic interaction model. In this study, we investigate the characteristics of DC-light and its ability to discriminate heavy nuclei (iron and MgAlSi) from CR components by using the Wide Field-of-view Cherenkov Telescope Array of the Large High-Altitude Air-Shower Observatory (LHAASO-WFCTA) in the energy range between 50 TeV and 500 TeV. Results suggest that DC-light can be used in the LHAASO to improve the reconstruction accuracy of CR heavy components.

Keywords: cosmic rays, DC-light, EAS-light, composition discrimination, hadronic interaction model, LHAASO-WFCTA

1. Introduction

The origin of cosmic rays (CRs) has been extensively explored since their discovery more than 100 years ago. However, the precise origin of CRs re-