

Study of Microwave Radiation from the Electron Beam at the Telescope Array Site

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The Telescope Array (TA) experiment installed the electron accelerator in order to calibrate the fluorescence detector by shooting 40 MeV electrons into the atmosphere. This accelerator also works to investigate the radio detection techniques used for the cosmic ray observations. Using this accelerator, four experimental groups have studied individual radio detection methods at different frequency bands ranging from 50 MHz to 12 GHz. All of these experiments have observed the microwave radiation from the electron beam itself. We have studied the radiation by combining all the measured results and constructed a model of this phenomena. Results of four experiments and model expectation are in good agreement within the systematic uncertainty.

KEYWORDS: radio emission, electron beam, accelerator

1. Introduction

The Telescope Array (TA) experiment [1], located in the west desert of Utah, US, installed the electron linear accelerator, so called Electron Light Source (ELS) [2]. The aim of this accelerator is for the absolute calibration of the Fluorescence Detector (FD). This accelerator, shooting the electrons to the atmosphere, also works to investigate the radio detection techniques used for the cosmic ray or neutrino observations. Four of the experimental groups have studied individual radio detection techniques at the different frequency bands ranging from 50 MHz to 12 GHz. All of these experiments have observed the microwave radiation. We have studied the radiation by combining all of measured results and constructed a model of this phenomena.

The configuration of the electron beam from the ELS is shown in Section 2. The details of four experiments are described in Section 3. The expectation from the constructed model and comparison with the experimental results are discussed in Section 4.