Dissertation

on

"THE DAILY VARIATION OF COSMIC RAY INTENSITY AT AHMEDABAD"

presented

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STATEMENT

The study of the daily variation of cosmic ray intensity provides a unique tool for the evaluation of the anisotropy of the primary cosmic radiation, and changes occurring in it. The bulk of the published work relates to studies at high latitudes and relates to measurements with instruments of omnidirectional sensitivity, but in recent years the Physical Research Laboratory has been conducting a comprehensive investigation at several stations in low latitudes where the daily variation can be studied with advantage.

The thesis presents the results of investigations conducted at Ahmedabad ($\lambda = 13^{o}N$, h = 180 ft.) on the daily variation of meson intensity in the east and the west directions and a comparative study of the daily variation of meson intensity with vertical telescopes of different semiangles in the E-W plane.

The results of the present investigations establish the following,

(1) The nature of the daily variation of meson intensity in the east and the west directions has been determined. Comparison of the daily variations with telescopes pointing to the vertical, the east and the west directions indicates that the time of maximum in the

vertical direction lies between those of the east and the west, the east showing an earlier maximum than the west, but the spread of times of maxima in the three directions is much less than expected.

(2) The amplitude of the daily variation depends very much on the directional sensitivity of the measuring instrument. When observed with narrow angle telescopes pointing to the vertical at low latitudes, it is found to be as high as 1% and thus comparable to that observed by neutron monitors.

(3) The amplitude of the daily variation depends on the period for which data are averaged. The ratio of the daily variation in narrow angle telescopes to that in wide angle telescopes varies from period to period. It is larger on magnetically disturbed days than on quiet days.

(4) The nature of the daily variation of meson intensity on individual days is highly variable in character. In low latitudes it is due to the presence of at least two different types of anisotropies, one producing a maximum during day and the other at night.

(5) There exists a 27 day recurrence tendency in the daily variation.

An attempt has been made to present a possible interpretation to explain these various features of the

daily variation on the assumption that it is caused by the anisotropy of the primary radiation produced by ionized beams emitted by the sun. It is found that the broad features as well as many of the reported discrepancies can be understood.

The author has included at the end of his thesis a list of 139 references to original papers published in different parts of the world. The thesis mentions the specific information derived from each of them.

PREFACE

The thesis describes the part of the investigation conducted by the Physical Research Laboratory, Ahmedabad for studying the time variation of various components of cosmic rays in low latitudes. In particular, it deals with the results of studies at Ahmedabad of the cosmic ray meson intensity measured with (1) inclined telescopes in the east and the west azimuths and (2) vertical telescopes with different angles of opening.

The apparatus described in Chapter II has been built entirely by the author. The author wishes to thank all his colleagues and the technical staff of the Laboratory for their kind cooperation during the course of the investigation and in particular to Mr.P.D.Bhavsar, M.Sc. for his assistance in preparing the diagrams of the thesis.

The project under which the present investigation was carried out, has been supported by the Atomic Energy Department, Government of India for which the author is extremely grateful. The author is very much indebted to the Gujarat University for an award of a Research Scholarship in the initial stages of the work.

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