

PREFACE

The work presented in this thesis has been done in the laboratory of the High Energy and Cosmic Ray Centre of the North Bengal University (NBU). The aim of the NBU cosmic ray extensive air shower (EAS) work since 1980 has been to study the electron component simultaneously with the muon component in smaller air showers in the size range 10^4 - 10^6 particles. To study muons of different energies simultaneously in such showers two shielded solid iron magnet spectrographs each of maximum detectable momentum of about 500 GeV/c have been kept in operation in conjunction with the basic air shower array of 32 plastic scintillation detectors. Accurate measurements of (a) shower size, (b) shower age, (c) electron density over a radial range of ~ 100 m and (d) muon density over a wide range of muon energy between 2.5 and 220 GeV have been made, analyzed and published. Some of the results of this experiment are included in the thesis.

The author of the thesis, a member of the group working at the centre has worked for more than six years now. His contribution during the period of his work at the centre is stated below :

1. Setting up of the timing system for the measurement of arrival direction of individual EAS events.
2. Development of a computer program for the determination of air shower parameters and EAS arrival angle.
3. Determination of angular resolution of the array.
4. Determination of errors involved in various shower parameters.
5. An examination on tilt of the EAS array.
6. Measurement of systematic uncertainties.

7. Maintenance and operation of air shower array and data handling system.

8. Analysis of electron data and partial analysis of muon data and preparation of final spectral data for publication.

As an additional support to the candidature, the reprints of the following published papers are submitted with the thesis :

(i) Lateral distribution and energy spectra of high energy muons in cosmic ray air showers.

Basak D.K., Sarkar S.K., Mukherjee N., Sanyal S., Ghosh B. and Chaudhuri N.

Can. J. Phys., 68(1990)41.

(ii) New measurements and analysis of high energy muons in cosmic ray extensive air showers.

Sarkar S.K., Ghose B., Mukherjee N., Chhetri R., Sanyal S., Basak D.K. and Chaudhuri N.

J. Phys. G., 17(1991)1279.

(iii) An analysis of cosmic ray air showers for the determination of shower age.

Sanyal S., Ghosh B., Sarkar S.K., Bhadra A., Mukherjee A. and Chaudhuri N.

Aust. J. Phys., 46(1993)589

(iv) A new multidetector system for high energy cosmic gamma-ray work.

Chaudhuri N., Goswami G.C., Ghosh B., Sarkar S.K., Basak D.K., Chettri R. and Sanyal S.

Proc. IEEE '1989' Nucl. Sci. Symp., Livermore, USA.

(v) The dependence of muon size on shower size and the

composition of cosmic ray primaries.

Basak D.K., Sanyal S., Chaudhuri N., Sarkar S. and Mukherjee N.
Proc. 21st ICRC, Adelaide, 9(1990)102.

(vi) Lateral distribution and energy spectra of muons in the energy interval 2.5-500 GeV in air showers.

Sanyal S., Basak D.K., Chaudhuri N., Sarkar S. and Mukherjee N.
Proc. 21st ICRC, Adelaide, 9(1990)130.

(vii) Energy spectrum of primary cosmic rays from air shower observations at sea level.

Ghose B., Sarkar S., Chakraborty N., Basak D.K., Bhattacharya B., Chhetri R., Sanyal S. and Chaudhuri N.
Proc. 21st ICRC, Adelaide, 3(1990)133.

(viii) Studies on the lateral distribution of the soft component in the EAS.

Bhattacharyya B., Ghosh B., Sarkar S.K., Sanyal S., Bhadra A., Mukherjee A. and Chaudhuri N.
Proc. 23rd ICRC, Calgary, 4(1993)335.

(ix) Measurement of the charge ratio of high energy muons in cosmic ray extensive air showers.

Sarkar S.K., Ghosh B., Mukherjee N., Sanyal S., Bhadra A., Mukherjee A. and Chaudhuri N.
Proc. 23rd ICRC, Calgary, 4(1993)339.

(x) A study on the cosmic ray EAS age parameter.

Sanyal S., Ghosh B., Sarkar S.K., Mukherjee A., Bhadra A. and Chaudhuri N.
Proc. 23rd ICRC, Calgary, 4(1993)343.

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