

## PREFACE

The work presented in this thesis has been done in the cosmic ray Physics Laboratory, North Bengal University since 1982 under a project sponsored in 1979 by the Department of Atomic Energy, Govt. of India. The aim of the project work has been to study muons of different energies simultaneously in air showers in the size range  $10^4$ - $10^6$  particles. For the purpose, two solid iron magnetic spectrographs each of m.d.m. 500 GeV/c, have been set up and have been in operation in conjunction with a basic air shower array of 21 detectors. The candidate, a Research Fellow in the DAE project, has worked with other members in the group at NBU. His contribution is stated below :

1. The setting up of neon flash tubes as detecting elements of the spectrograph of height 7 m (chapter III).
2. Each neon tube was instrumented separately for detecting its flash by LED and hence of the particle trajectory by using probe method (chapter III).
3. The setting up of an alternative photographic arrangement for recording of flashed neon tubes in the spectrograph (chapter III).
4. Control electronics for the operation of two magnetic spectrograph units (chapter III).

5. Maintenance of the two spectrograph units, air shower array and the air shower data handling system (chapter III).
6. Operation of two spectrographs in conjunction with air shower array (chapter IV).
7. Developing of computer programme and its use for air shower data analysis (chapter IV).

A part of the work done so far has been published. Some of the reprints of the published papers are submitted with the thesis as an additional support to the candidature. The papers published and under publication are listed below.

1. Low-Energy Muons in Extensive Air Showers (EAS). D.K.Basak, N.Chaudhuri, S.K.Sarkar, B.Bhattacharya and B.Ghosh, *IL Nuovo Cim.* (1987).
2. A New Multidetector System with Magnetic Spectrograph for study of Cosmic Ray Extensive Air Shower Components. D.K. Basak, N.Chakraborty, B.Ghosh, G.C.Goswami, N.Chaudhuri, N.Mukherjee, M.Ghosh and S.K.Sarkar, *Nucl.Inst.Meth.*, 227(1984)167.
3. A New Study of Muons in Air Showers by NBU Air Shower Array. N.Chaudhuri, N.Mukherjee, S.K.Sarkar, D.K.Basak and B.Ghosh, *Proc. 19th ICRC, La-Jolla*, 7(1985)105.

4. Neon Flash Tubes as charged Particle Detectors. N.Mukherjee, S.K.Sarkar, D.K.Basak and N.Chaudhuri, Instrumentation Bulletin, WRIC, Bombay, India, 4(No.4)(1985)20.
5. Cosmic Rays at North Bengal University. 1.High Energy Particle Interaction Processes. N.Chakraborty, B.Ghosh, N.Mukherjee, D.K.Basak, S.K.Sarkar and N.Chaudhuri, North Bengal Univ. Review (Sci & Techno.), India, 5(No.1 & 2) (1984)21.
6. Detection Techniques in the High Energy Region & Nuclear Interactions of Hadrons in Air Showers. N.Chakraborty, D.K.Basak, B.Ghosh, S.K.Sarkar and N.Chaudhuri, Presented at National Workshop on Fixed Target Physics at High Energy, Dept. of Physics, Jadavpur University, India, February 1986.
7. Hard X-rays and Gamma Rays to the study of Atomic Innershell interactions. N.Chaudhuri, N.C.Paul, S.K.Sengupta, J.B.Bose, N.Chakraborty and S.K.Sarkar, Proc. 6th Symposium on X-rays and Gamma-rays Sources and Applications, Albion, USA, May 1985.
8. New Results on Energy Spectrum of Muons in EAS. S.K.Sarkar, N.Mukherjee, M.K.Roy, M.K.Ghosh, B.Ghosh, D.K.Basak and N.Chaudhuri. (accepted for inclusion in the Proc. of 20th ICRC, Moscow) HE3.2-4 + HE3.2-5, 1987.
9. Primary Composition of Cosmic Rays from EAS measurements. S.K.Sarkar, N.Mukherjee, M.K.Roy, B.Bhattacharya,

N.Chakraborty and N.Chaudhuri, (accepted for inclusion in the Proc. 20th ICRC, Moscow) HE3.1-19 + HE3.1-20, 1987.

10. Primary Cosmic Radiation in the Energy Range  $10^{14}$ - $10^{16}$  eV.  
N.Chaudhuri, G.Goswami, B.Ghosh, N.Mukherjee, D.K.Basak,  
S.K.Sarkar, N.Chakraborty, M.Ghoshdastidar, M.K.Roy,  
B.Bhattacharyya, M.K.Ghosh and S.Sengupta Submitted for  
National Seminar on Frontiers of Astronomy and Astrophysics,  
Calcutta University, India, February, 1987.