P R E F A C E

In continuation of the endeavour to explore the great asset of cosmic ray air showers the group at North Bengal University concentrated their efforts to study smaller air showers near sea level under a project of the Department of Atomic Energy, Government of India. The project was sanctioned late in 1979. The author of the thesis shares the accomplishment of the group in developing this new air shower observation facility at this place (latitude $26^{0}45'$N and altitude 91m.a.s.l.) Although the development on the experimental side made so far will take more time to reach the stage of full implementation of the objectives, a part of the work so far done is incorporated in this thesis. The contribution of the author to this work is stated below:

1. The development and construction of detectors of air showers and participation in setting up of two magnetic spectrograph units and one neon flash tube chamber.

2. The development and construction of air shower recording system.

3. Testing and calibration of detectors

4. The development of the monitoring and testing system for the performance of all the detectors.

5. A study of the sensitivity of the air shower array to showers of various sizes as a function of shower size and core distance.

6. Operation of the air shower array to record air shower data and computerisation of the data to obtain shower parameters.

7. Analysis of air shower data presented in this thesis.

New results on the characteristics of smaller showers in the size range 10^4 - 10^5 particles detected by the closely packed array are presented. A critical comparison of the existing theoretical electron lateral distributions in air showers is given to indicate their present status in relation to the present experimental data and some other more recent data (e.g. Hara et al[74] and Khristiansen et al[75]) on

1. average shower age parameter
2. local shower age parameter
3. shower size spectrum
4. electron lateral distribution.

The results are discussed in the light of similar such results obtained by a small air shower array (e.g. Buckland Park Air Shower Array of 12 detectors of Adelaide group[92]).

The following papers are submitted as an additional support to the candidature:

1. A new multidetector system with magnetic spectrograph for study of cosmic ray extensive air shower components; D.K.Basak, N.Chakravorty, B.Ghosh, G.C.Goswami and N.Chaudhuri Nuclear Instruments and Methods, (1984).

2. Observations on air showers in the size range 10**4 -10**6 particles; D.K.Basak, N.Chakravorty, B.Ghosh, G.C.Goswami and N.Chaudhuri; Proc. 18th Int. Conf. on Cosmic Rays, Bangalore, 6(1983)1.

3. A pulse height recording system for small air shower arrays; G.C.Goswami, B.Ghosh, M.R.Ghoshdastidar, D.K. Basak and N.Chaudhuri; Proc. 17th Int. Conf. on Cosmic Rays, Paris, 8(1981)165.

4. A critical evaluation of the single particle inclusive cross-sections used for describing particle production in high energy cosmic ray interactions; M.R.Ghoshdastidar, G.C.Goswami, B.Ghosh, D.K.Basak and N.Chaudhuri; Proc. 17th Int. Conf. on Cosmic Rays, Paris, 5(1981)1.

5. Nuclear shadowing in leptoproduction and photoproduction of hadrons; B.Ghosh, M.R.Ghoshdastidar, D.K.Basak, G.C. Goswami and N.Chaudhuri; Proc. 17th Int. Conf. on Cosmic Rays, Paris, 7 (1981)82.

6. Prospect of study of muons in extensive air showers; Bhaskar Bhattacharyya, Dhiraj Kumar Basak and N.Chaudhuri; Proc. 18th Int. Conf. on Cosmic Rays, Bangalore, 6 (1983)66.

7. The present status of inclusive cross section data for calculation of nuclear cascading at cosmic ray energies; D.K.Basak, N.Chakravorty and N.Chaudhuri; Proc. 18th Int. Conf. on Cosmic Rays, Bangalore, 5(1983)9.

8. Cosmic rays at North Bengal University Part I : High energy particle interaction processes; N.Chakravorty, D.K.Basak, B.Ghosh, N.Mukherjee, M.K.Ghosh and N.Chaudhuri; Journal of the University of North Bengal (1984).

9. Cosmic rays at North Bengal University Part II : Spectral analysis and deductions; N.Chakravorty, D.K.Basak, B. Ghosh and N.Chaudhuri; Journal of the University of North Bengal (in press).

10. Cosmic Rays at North Bengal University Part III : Air Showers:Detection Techniques and Preliminary Measurements; N.Chakravorty, D.K.Basak, S.Sarkar and N.Chaudhuri; Journal of the University of North Bengal (in press)

Copies of some of the publications are attached.