

P R E F A C E

The main part of the work in the thesis was carried out during 1977-1980 in the area of cosmic ray muons at sea level in the Nuclear Physics Laboratory of North Bengal University. The important results of the investigation have been published earlier. The author was then employed on a new project sponsored by the Department of Atomic Energy, Govt. of India, for the development of Cosmic ray air shower experiment in conjunction with two magnetic spectrographs. Due to the circumstances prevailing at the stage of planning and development of the air shower array, the candidate was not able to present his earlier work on muons in the form of a thesis. However, he has gained by working in the air shower project during the period 1980-1985 and his contribution to this development has been incorporated in addition to his earlier work on muons using a multiplate cloud chamber.

In 1977 he took active part in setting up the multiplate cloud chamber experiment for the study of electromagnetic interaction of cosmic ray muons with matter. He was responsible for the operation, maintenance and analysis of the multiplate cloud chamber data on direct pair production by muons [J.Phys.G : Nucl.Phys. 7(1981)687 and Proc. 16th Int.Conf. on Cosmic rays, Kyoto, Japan, 10(1979)261]. Simultaneously he carried out an analysis of the atmospheric muons and gamma-ray

data. The results were published in *Il, Nuovo Cimento, Vol.1C, No.5(1973)439.*

He joined early in 1980 the air shower project that was started with the work of development of electronics and detectors in the laboratory. He was actively involved in the design of the electronics and organisation of detectors. He worked hard to build up two magnetic spectrographs for the study of muons in air showers. In addition he built up a neon flash tube detector and used it in an experiment on low energy air shower muons. He was responsible for the analysis of the air shower data. The initial work on the air shower project was published by the NSU group in *Nuclear Instruments and Methods [Nucl. Inst & Methods; 192(1982)375 and 199(1982)506]*. Besides, the candidate participated in other research activities and contributed to the experimental work.

A list of published papers in collaboration with others in the group is given below and are submitted as additional support to the candidature.

1. Direct electron-pair production by muons in the energy transfer range 3 MeV - 10 GeV; M.R. Ghoshdastidar, G.C.Goswami, B.Ghosh, A.Paul, N.L.Karmakar and N.Chaudhuri; *J.Phys.G : Nucl. Phys* 7(1981)637-695.
2. Primary Cosmic-ray nucleon spectrum from the atmospheric gamma-ray and muon data; M.R. Ghoshdastidar, B.Ghosh and N.Chaudhuri; *Il, Nuovo*

Cimento, Vol.1C, No.5(1979)439-449.

3. Studies on direct production of electron-positron pairs by muons; A.Paul, N.L.Karmakar, B.Ghosh, M.R.Ghoshdastidar, G.C.Goswami and N.Chaudhuri; Proc.16th Int.Cosmic ray Conf., Kyoto, Japan, Vol.10, MM 4-16, (1979) p.261.
4. Nuclear shadowing in leptonproduction and photoproduction of hadrons; Ghosh B, Ghoshdastidar M.R., Basak D.K., Goswami G.C. and Chaudhuri N.; Proc. 17th Int.Cosmic ray Conf. Paris, France, Vol.7, MM4-11, p.92(1981).
5. A critical evaluation of the single particle inclusive cross-sections used for describing particles 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, France, Vol.5 (1981)ME-1.1, p.1.
6. Low energy muon spectra near sea level; B.Ghosh, M.R.Ghoshdastidar and N.Chaudhuri; Proc. 16th Int.Conf. on cosmic rays, Kyoto, Japan, Vol.10 MM 2.2-3(1979) p.67.
7. A simple ADC unit for cosmic ray air shower experiments; G.C.Goswami, B.Ghosh, M.R.

- Ghoshdastidar, S.K.Sengupta and N.Chaudhuri;
Nucl.Inst. and Methods, 192(1982)375.
8. A Sample-Hold and analog multiplexer for multidetector systems; G.C.Goswami, M.R. Ghoshdastidar, B.Ghosh and N.Chaudhuri; Nucl.Inst. and Methods, 199(1982)506.
 9. 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, France, Vol.8, T4-20(1981) p.165.
 10. A new air shower project for studies of muons and hadrons; N.Chaudhuri, B.Ghosh, M.R.Ghoshdastidar and G.C.Goswami; Proc. 16th Int.Conf. on Cosmic rays, Kyoto, Japan, Vol.8, BA 2.2-52(1979) p.362.
 11. A new multidetector system with magnetic spectrograph for the study of cosmic ray extensive air shower components; D.K.Basak, N.Chakravarty, B.Ghosh, G.C.Goswami and N.Chaudhuri; Nucl.Inst. and Methods, (1984), 227, 167.
 12. Random access memory with programmer for data acquisition and printing in a

- multidetector system; N.Chaudhuri, G.C. Goswami, D.K.Basak and B.Ghosh; Instrumentation Bulletin, WRIC, University of Bombay, India, Second quarter, Vol.4, No.2(1985) p.15.
13. Observations on air showers in the size range $10^4 - 10^5$ particles; D.K.Basak, N.Chakravorty, B.Ghosh, G.C.Goswami and N.Chaudhuri; Proc. 18th Int.Conf.on cosmic rays, Bangalore, Vol.6 EA 1.1(1983)p.1.
14. Elastic scattering of gamma-rays in the energy range 1 - 3 MeV; S.K.Sengupta, N.Bhattacharyya, B.Ghosh and N.Chaudhuri; Indian J.Phys., 53A, (1984) p.310-315.
15. Cosmic rays at North Bengal University Part 1 : 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), 5, 21.

The available reprints of the papers are submitted with the thesis.