PREFACE

One of the possible approaches for examining the dynamics of multiparticle production in relativistic heavy-ion collisions is to investigate the occurrence of fluctuations in particle density distribution of the particles produced in these collisions. These fluctuations may arise due to: (i) statistical reasons or (ii) occurrence of an uneven phenomenon during the collisions. An attempt is made to investigate some features relating to non-statistical fluctuations and multifractal specific heat in multiparticle production in 14.5A GeV/c $^{28}$Si-nucleus interactions. Experimental results are compared with those generated using Lund model, FRITIOF. The main objective of studying these aspects is the fact that non-statistical fluctuations are regarded as an important probe of the formation of quark-gluon plasma; multifractal specific heat is directly related to the signal of phase transition. Therefore, some useful information about QGP formation may be disentangled from such a study.

The thesis is organized into six chapters. Chapter I is of introductory nature. It gives a brief description of major facilities available around the World for carrying out study of relativistic heavy-ion collisions. The philosophy as to why there is much optimism for the possibility of creating regions of very high energy density using high-energy heavy-ion collisions. Explanation based on theoretical considerations of the various signatures of the formation of QGP in relativistic nuclear collisions is presented in the same chapter. Some of the important models of high energy nucleus-nucleus interactions used extensively for explaining experimental data on heavy-ion interaction at relativistic energies are also described in this chapter.

Chapter II gives the details of the stack used, criteria for selecting the events, scanning procedure, methods of measurements, etc. It is followed by the analysis
of some fascinating features of relativistic nuclear collisions such as mean multiplicity, multiplicity distribution, pseudorapidity distribution and two-particle correlation among the produced particles using short gap and long gap procedures.

The occurrence of self-similarity among the produced particles in high energy nuclear collisions is believed to be due to the fractal nature of the particle emitting source. The analysis of multifractal moments is carried out in Chapter III which indicates the existence of self-similar nature in multiparticle production following linear rise of multifractal moments in the entire rapidity space. The contribution of the dynamical component of the multifractal moments is gleaned using Monte Carlo simulated data.

Chapter IV contains results on intermittency using the method of $F_q$ moments. The results on Levy stability and Renyi dimensions are also presented in this chapter.

In order to provide thermodynamical interpretation to the observed behaviour of intermittency and multifractality in multiplicity distributions of relativistic charged particles produced, multifractal specific heat, $c$, has been computed using $F_q$ moments, modified $G_q$ moments and Takagi moments and the results are presented in Chapter V. It is envisaged that a sudden change in the value of multifractal specific heat may be considered as a signal of phase transition.

Finally, Chapter VI sums up major findings of the present work.