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Executive Summary

High Energy Collisions with No Extensive Statistics

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The detection of the *q*-exponential distributions of the energy and momentum of the produced particles is one of the most glaring aspects of high-energy collision (HEC) experimental data. Numerous investigations on the application of Tsallis statistics in the multiparticle production process were driven by experimental findings. The formula for the distribution is presented in one of the Cleymans' most well-known contributions to the study of non-extensive distributions. It is obtained from the non-additive entropy utilizing thermodynamical relations.

With the aid of various partners, Cleymans conducted several research using this formula, creating systematic evaluations of the experimental data and identifying significant patterns in the behaviour of the formula's parameters. Cleymans also participated in forecasting the results of upcoming studies; they were mainly supported by experimental data.

In the manner of Cleymans' later work, a systematic study of the HEC data is carried out in this publication. For different energies and particle species, the experimental data are fitted using Cleymans' formula for the transverse momentum (p_T) distribution. The outcomes are evaluated against the fits produced by other formulae. Because other phenomena, such as the collective flow, can interact in bigger systems, the analysis described here is limited to proton-proton (*pp*) collisions.

The distributions from the high-energy (*pp*) collision data were fitted to produce the free parameters in Equations for the current analysis. To do a systematic examination of the parameters, the behaviour of the parameters q and T, which are taken from the fit.

One can see that the fitting process is not as straightforward despite the straightforward curves that were created using the methods used in the present investigation. A study of the covariances reveals that the fitting parameters exhibit high correlations. The issue gets worse when the chemical potential is added as a free parameter. The study of the covariances between the parameters reveals distinct differences depending on the formula utilized, but the differences in the formulae used in this analysis are modest when evaluated through the best-fit parameters that were produced.

In this study, the non-extensive distribution techniques created by Jean Cleymans are used to analyze the high-energy proton-proton collision data. Using several transverse momentum distribution formulas, the results are compared. It is demonstrated that all formulas provide good data fitting while offering various best-fit parameters. Based on the findings, drawing firm conclusions is not what this study set out to do.

To get clearer findings, a more thorough analysis is required, and one is planned. The importance of this form of analysis, mostly created by Jean Cleymans, for comprehending the intricate events occurring during the multiparticle creation in high-energy collisions, however, is demonstrated in the current research.

Journal Reference

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KEYWORDS

Non extensive statistics, high energy collisions, multiparticle production, transversal momentum distribution