Strange Particles Production in Heavy Ion Collisions

Rakesh Mazumder*
Center of Excellence in Space Sciences, India, IISER KOLKATA,
Mohanpur- 741252, Nadia, West Bengal, INDIA

INTRODUCTION

In ultrarelativistic heavy ion collision the Quantum chromodynamics (QCD), the theory of the strong interaction predicts a phase transition from normal hadronic matter of confined state of quarks and gluons to a deconfined state of quarks and gluons, called Quark Gluon Plasma (QGP). Quark Gluon Plasma can be formed at high baryonic density or high temperature or at both.

In heavy ion collision at RHIC and LHC energy a phase transition from confined state to a deconfined state of Quark Gluon Plasma is expected. Strangeness is one of the earliest proposed signature of QGP. Strangeness is an important tool to get information about the reaction mechanism of Heavy Ion Collision because it is produced only after collision. In QGP state strangeness could be easily produced from pair production of strange-antistrange quark-pairs. There are two basic mechanisms through which this pair production is possible, one is through fusion of two gluons and another is a light quark and a light antiquark annihilates and goes to $s\overline{s}$-pairs.

$g + g \rightarrow s\overline{s}$ and $q + \overline{q} \rightarrow s\overline{s}$ (where q=u,d)

The main interest in strange particle production in Heavy ion collision is the expectation of production rate of strangeness per nucleon will be enhanced, in comparison to elementary nucleon-nucleon collision, if QGP is formed. The study of absolute yield and yield normalized with participant pair is also important. In this paper we will study the yield and normalized yield of strange particles, as a function of collision energy, in central nucleus-nucleus collision and we will compare the data [1] with result we have got from three model, HIJING, AMPT and UrQMD.

RESULTS AND DISCUSSION

For every strange particle discussed here we can conclude in general, from Figure 1, that the normalization of the yield with the number of nucleon participant pair does not change the trend of the data. It only scales the yield down. Inspired from [2] we have fitted a hybrid function which is a combination of logarithmic and power law as given below.

$$\frac{2}{N_p}\frac{dN}{dy} or \frac{dN}{dy} = A + B\, log(\sqrt{s}) + C(\sqrt{s})^n$$

The function describes well the increasing nature of the yield and normalized yield also. In case of singly-strange meson K the increasing nature of the yield (or normalized yield) with collision energy is same if we compare particle with corresponding antiparticle. But if we consider singly-strange baryon Λ or multistrange baryon Ξ , the increasing nature is very different if we compare particle with corresponding antiparticle. In case of antiparticle the rise in yield (or normalized yield) is much steeper than the case of particle. When we have compared the data with HIJING, AMPT and UrQMD, we have got same trend in almost all cases (only the change in magnitude is there).

References

[1] C. Blume, C. Markert, Progress in Particle and Nuclear Physics 66, 834-879 (2011).

[2] Aditya Nath Mishra, Rakesh Mazumder, and Raghunath Sahoo, AIP Conf. Proc. 1536, 1348 (2013).

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*Electronic address: `rm13rs027@iiserkol.ac.in`

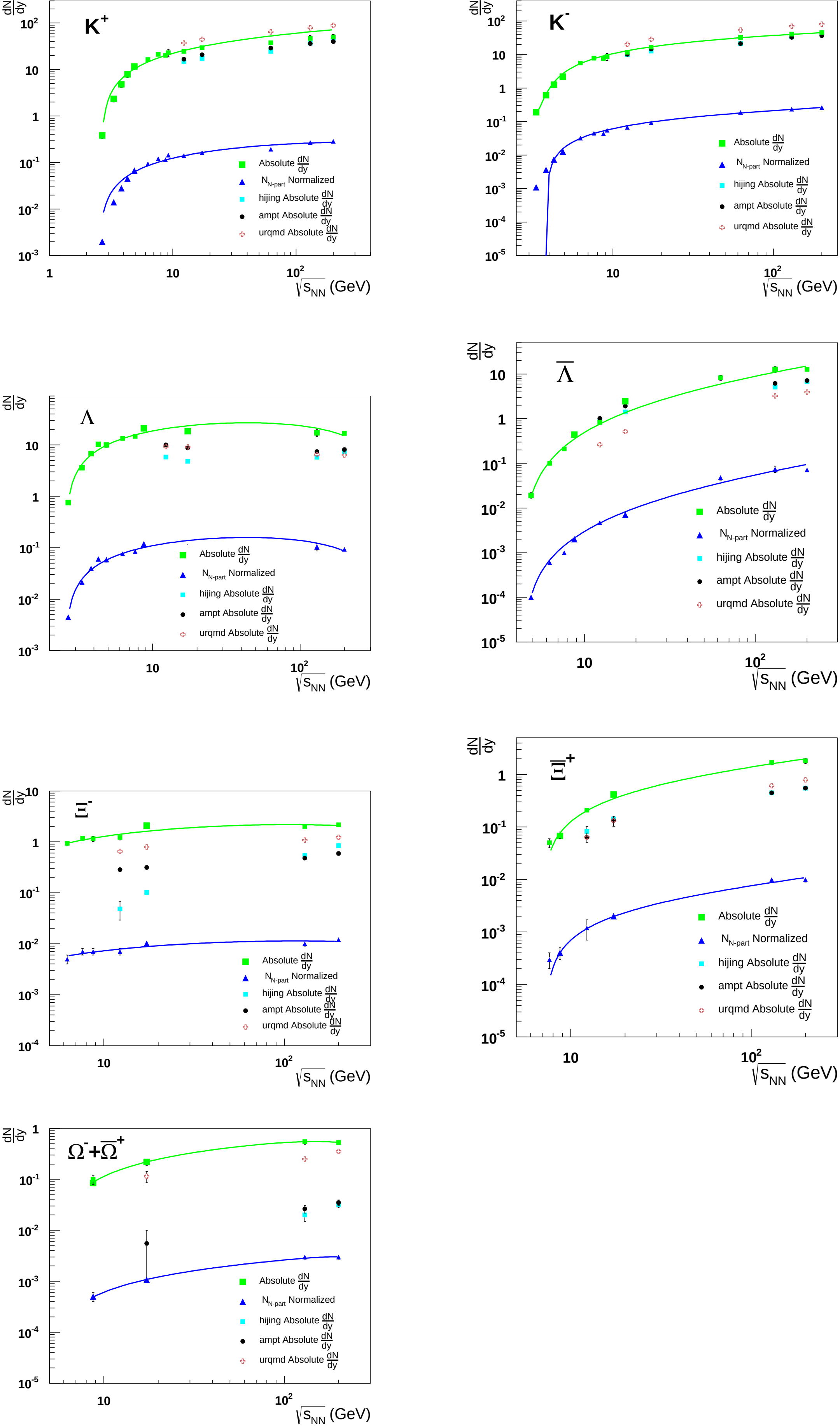

FIG. 1: Yield and normalized yield both from data [1] and model, around midrapidity are measured as a function of $\sqrt{s_{NN}}$ for K^+, K^-, Λ, $\overline{\Lambda}$, Ξ^-, $\overline{\Xi}^+$ and $\Omega^-+\overline{\Omega}^+$. A hybrid function is fitted to data [1].