**K* meson production in \( p + p \) and \( d + Au \) collisions at \( \sqrt{s_{NN}} = 200 \) GeV with PHENIX experiment at RHIC**

D. K. Mishra, P. Shukla, and R. K. Choudhury
(for PHENIX Collaboration)

*Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai - 400085, INDIA*

**Introduction**

Resonances having very short lifetime (\( \sim \) few fm/c) provide unique capabilities to probe the hadron production mechanisms and the collision dynamics in heavy ion collisions. To isolate phenomena related to the dense and hot medium created in such collisions and to understand cold nuclear matter effects, it is important to measure particle production in smaller collision systems like \( p + p \) and \( d + A \). Comparison of the mass, width for \( K^* \) in \( p + p \), \( d + Au \) and heavy ion collisions will give information on the interaction taking place in quark gluon plasma or hadronic matter. Measuring the \( K^* \) yields from intermediate transverse momentum (\( p_T \)) (2 < \( p_T \) GeV/c < 5) to high \( p_T \) (\( p_T > 5 \) GeV/c), one can study multiple re-scattering of partons in the initial state, parton energy loss and quark recombination processes, which will help in understanding different suppression patterns for meson and baryons [1–3].

We report the measurement of the \( K^* \) in \( p + p \) and \( d + Au \) collisions at \( \sqrt{s_{NN}} = 200 \) GeV via its hadronic decay (\( K^*(892) \rightarrow \pi K \)) with the PHENIX detector, which is one of the major detectors at Relativistic Heavy Ion Collider (RHIC), BNL to search for Quark Gluon Plasma (QGP). The techniques used for the measurement of the \( K^* \) spectrum in \( p + p \) collisions are established and used to get the \( K^* \) signal in \( d + Au \) collisions. The \( K^* \) is studied at intermediate to high \( p_T \) regions from 0.9 to 8 GeV/c.

**Analysis**

The data presented here were taken during 2005 for \( p + p \) and during 2008 for \( d + Au \) RHIC run. The \( K^{*0} \) and \( \overline{K}^{*0} \) are obtained by invariant mass reconstruction from their daughter track (\( K, \pi \)) combinations and subtracting the combinatorial backgrounds obtained from mixed-event technique. Figure 1 shows the \( K^* \) invariant mass spectra for \( p + p \) collisions at \( \sqrt{s} = 200 \) GeV for a particular \( p_T \) (2.3 - 2.6) bin. The \( K^* \) invariant mass spectra for \( d + Au \) collisions for a particular \( p_T \) bin (2.1 < \( p_T \) GeV/c < 2.3) is shown in Fig. 2. In both \( p + p \) and \( d + Au \) the signal is fitted with the relativistic Breit-Wigner function plus a second order polynomial function that represents the residual background. The uncorrected yields obtained in each \( p_T \) bins were corrected for the detector acceptance and efficiency. The corrected (\( K^{*0} + \overline{K}^{*0} \))/2 yields as a function of \( p_T \) for \( p + p \) collisions is shown in Fig. 3. A Tsallis function was used to extract the \( K^{*0} \) yields per unit of rapidity. The

*Available online at www.sympnp.org/proceedings*
The STAR experiment measured the $K^{*0}$ production up to $p_T \sim 3.5$ GeV/c, whereas the present results extend the measurement range up to 8 GeV/c. These results are used to study hadronic matter effects at intermediate and high $p_T$ and set a baseline for studying QGP signals in heavy ion collisions.

Tsallis function is defined as:

$$\frac{1}{2\pi p_T} \frac{d^2 N}{dp_T dy} = \frac{1}{2\pi} \frac{dN}{dy} \times \frac{1}{nT + m_0(n-1)(nT + m_0)} \left( \frac{nT + m_T}{nT + m_0} \right)^{-n},$$

where, $dN/dy$ is the multiplicity of $K^*$ production at mid-rapidity, $T$ is the inverse slope parameter, $n$ is a measure of the amount of fluctuations and $m_T$ is the transverse mass $\sqrt{p_T^2 + m_{K^*0}^2}$, $m_{K^*0}$ is $K^{*0}$ mass taken to be 0.896 GeV/c$^2$.

The STAR experiment measured the $K^*$ production up to $p_T \sim 3.5$ GeV/c, whereas the present results extend the measurement range up to 8 GeV/c. These results are used to study hadronic matter effects at intermediate and high $p_T$ and set a baseline for studying QGP signals in heavy ion collisions.

Conclusion

We have measured the $K^{*0}$ signal in both $p+p$ and $d+Au$ collisions with PHENIX detector at $\sqrt{s_{NN}} = 200$ GeV from intermediate to high $p_T$ up to 8 GeV/c range. The PHENIX preliminary invariant $p_T$-spectra for $p+p$ collisions has been reported. The PHENIX preliminary invariant $p_T$-spectra and the nuclear modification factor ($R_{dAu}$) will be obtained in $d+Au$ collisions up to high $p_T$ to study the cold matter effects. The results and status of $d+Au$ analysis will also be presented.

References