Production of K(892)*0 mesons in Cu+Au collisions and U+U collisions

Vladislav Borisov

Peter the Great Saint-Petersburg Polytechnic University

11-17 October 2020
Motivation

Signatures of QGP formation: Jet quenching

p+p collisions

A+B collisions
Signatures of QGP formation: Strangeness enhancement

\[ K^{*0} \rightarrow (K\pi)^\pm \text{-meson} \]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quark content</td>
<td>( d\bar{s}(\bar{d}s) )</td>
</tr>
<tr>
<td>Mass, (MeV/c^2)</td>
<td>891.66±0.26</td>
</tr>
<tr>
<td>Lifetime, fm/c</td>
<td>4.16</td>
</tr>
</tbody>
</table>
Motivation

CuAu

Most central

Most peripheral

$\pi^0$

$\sqrt{2}$

$uu-dd$
Motivation

CuAu

Most central

Jet quenching

Most peripheral

\( \pi^0 \)

\( uu - dd \) \( \sqrt{2} \)
Motivation

CuAu

Most central

Most peripheral

$\phi$

$\pi^0$

$\sqrt{2}$
Motivation

CuAu

In most central collisions $\phi$ $R_{AB}$ are less suppressed than $\pi^0$ $R_{AB}$ in intermediate $p_T$ range.
Motivation

$K^*0$

Most central

Most peripheral

$d\bar{s}$

$\varphi$

$s\bar{s}$

$\pi^0$

$u\bar{u} - d\bar{d}$
$K^{*0}$ meson production was previously measured by PHENIX in symmetric Cu+Cu collisions at $\sqrt{s_{NN}} = 200$ GeV.
Experiment PHENIX
Raw yield extraction

0-20% centrality bin
1.80 < p_T < 2.0 GeV/c

The invariant mass distribution of pairs $K^\pm\pi^\mp$
Transverse momentum spectra of $K^{*0}$-meson

\[ \frac{1}{2\pi p_T} \frac{d^2N}{dp_T dy} = \frac{1}{2\pi p_T} \frac{1}{2 N_{evt} \cdot Br \cdot \epsilon_{eff}(p_T)} \frac{1}{\Delta p_T \Delta y} \]

\( \frac{1}{2} \) points to the average of $K^{*0}$ and $\bar{K}^{*0}$
Nuclear modification factors

\[ R_{AB}(p_T) = \frac{d^2N_{AB}(p_T)/dydp_T}{N_{coll}/\sigma_{pp}^{inel} \cdot d^2\sigma_{pp}/dydp_T} \]

2 set parametrizations are used for U+U collisions

Parameters of the deformed Woods-Saxon distribution

<table>
<thead>
<tr>
<th>Parameter ( R ) (fm)</th>
<th>SET1</th>
<th>SET2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( a ) (fm)</td>
<td>6.81</td>
<td>6.86</td>
</tr>
<tr>
<td>( \beta_2 )</td>
<td>0.28</td>
<td>0.265</td>
</tr>
<tr>
<td>( \beta_4 )</td>
<td>0.093</td>
<td>0</td>
</tr>
</tbody>
</table>

\( N_{coll} \) for different centralities

<table>
<thead>
<tr>
<th>Centrality, %</th>
<th>SET1</th>
<th>SET2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>935±98</td>
<td>999±114</td>
</tr>
<tr>
<td>20-40</td>
<td>335±33</td>
<td>375±41</td>
</tr>
<tr>
<td>40-80</td>
<td>48±6</td>
<td>55±8</td>
</tr>
<tr>
<td>0-80</td>
<td>340±10</td>
<td>376±15</td>
</tr>
</tbody>
</table>
$R_{AB}$ of $K^*0$ in Cu+Cu, Cu+Au and U+U collisions

$R_{AB}$ of $K^*0$ in Cu+Cu and Cu+Au collisions are in a good agreement at similar number of participants
$R_{AB}$ of $K^{*0}$ in Cu+Cu, Cu+Au and U+U collisions

$R_{AB}$ of $K^{*0}$ in Cu+Au and U+U collisions are in a good agreement at similar number of participants.
Production and suppression of the $K^{*0}$ -meson seem to depend on nuclear overlap size, but not on its geometry.
$R_{AB}$ of hadrons in Cu+Au and U+U collisions

CuAu

UU
$R_{AB}$ of hadrons in Cu+Au and U+U collisions
Talk by D. Larionova
"barion puzzle"
**R_{AB} of hadrons in Cu+Au and U+U collisions**

Jet quenching

$K^0$ and $\varphi$ are less suppressed the $\pi^0$ and $\eta$.
The $K^*$ and $\phi$ mesons $R_{AB}$ exhibit similar shape in all centralities in whole $p_T$ range.

In most central collisions the $K^*$-meson is less suppressed than $\pi^0$ and $\eta$ in the intermediate $p_T$ ($2 < p_T < 5$ GeV/c) range whereas at higher $p_T$ ($p_T > 5$ GeV/c), $K^*$, $\pi^0$ and $\eta$ show similar suppression values.

In peripheral collision light hadron $R_{AB}$ shows similar suppression values.

The $K^*$ -meson nuclear modification factors in Cu+Cu, Cu+Au, and U+U collisions for similar $N_{part}$ values exhibit similar shape.

- Production and suppression of the $K^*$ -meson seem to depend on nuclear overlap size, but not on its geometry.
Thank you for attention!