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## Probing the structure of $f_0(980)$ from the elliptic flow in p-Pb collisions at the LHC

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The study of exotic hadrons has long been a topic of great interest for the understanding of Quantum Chromodynamics (QCD). As one of the light exotic hadrons, the structure and constituent quark content of  $f_0(980)$  have been debated for decades, with theories suggesting it could be a tetraquark state ( $s\bar{s}q\bar{q}$ ) or a hadronic molecule ( $K\bar{K}$ ). Assuming that the  $f_0(980)$  is a  $K\bar{K}$  molecule that can only survive at the kinetic freeze-out of the evolving bulk matter, we implement the coalescence model to study its transverse momentum ( $p_T$ ) spectra and elliptic flow  $v_2(p_T)$  in high-multiplicity p-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV. Using the well-tuned kaon phase-space distributions from the Hydro-Coal-Frag model, our  $K\bar{K}$  coalescence calculations for the  $f_0(980)$  successfully reproduce the elliptic flow measured by CMS over the range  $0 < p_T < 12$  GeV and are also agree with the  $p_T$ -spectra from ALICE with a reasonable range of values for the  $f_0(980)$  radius. These results in heavy ion collisions are consistent with the  $K\bar{K}$  molecular picture of the  $f_0(980)$ . We also find that the number-of-constituent scaling of  $v_2$  for the  $f_0(980)$  is violated in p-Pb collisions at the LHC, due to a large proportion of the coalescing kaons having different momenta. This demonstrates the necessity of realistic coalescence model calculations and also explains why the CMS interpretation of the  $f_0(980)$  as an ordinary  $q\bar{q}$  meson is no longer reliable, since the measured  $v_2$  was analyzed by applying a simple scaling formula based on the assumption of equal momentum coalescence. Our investigation provides a novel way to explore the internal structure of light exotic hadrons that are abundantly produced in relativistic heavy and/or light ion collisions.

### References

[1] Y. Wang, W. Zhao, C. M. Ko, F. Guo, J. Xie, H. Song, in preparation.

**Author:** WANG, Yili (Peking University)

**Co-authors:** Prof. KO, Che-Ming; Prof. GUO, Feng-Kun (Institute of Theoretical Physics, Chinese Academy of Sciences); SONG, Huichao; Dr XIE, Ju-Jun (Institute of Modern Physics, Chinese Academy of Sciences); ZHAO, Wenbin (Wayne State University)

**Presenter:** WANG, Yili (Peking University)

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