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Production and polarization of the ϕ meson in pp collisions at $\sqrt{s} = 13.6$˜TeV with ALICE

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In non-central heavy-ion collisions, due to a non-zero impact parameter, a substantial angular momentum is produced. Through spin–orbit coupling, this angular momentum can induce quark polarization, which may subsequently manifest as a net polarization of the produced hyperons and vector mesons. In contrast, the hyperon and vector meson polarization in pp collisions provides an essential baseline for disentangling medium effects from those arising purely from initial partonic interactions. In this work, we present the first measurement of ϕ meson polarization in the dimuon decay channel ($\phi \rightarrow \mu^+\mu^-$) in the forward rapidity region˜($-4.0 < y < -2.5$) in pp collisions at $\sqrt{s} = 13.6$˜TeV. The data have been collected during the LHC Run 3 period with the upgraded ALICE detector. We use the helicity frame for this polarization analysis, where the quantization axis is along the direction of momentum of the ϕ meson. This study presents, for the first time, the polarization measurement of a light vector meson at forward rapidity, providing a unique opportunity to explore possible rapidity dependence of the ϕ meson polarization.

Author: GOSWAMI, Kangkan (Indian Institute of Technology Indore)

Presenter: GOSWAMI, Kangkan (Indian Institute of Technology Indore)

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