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The role of strangeness in heavy-quark hadronisation from small to large collision systems with ALICE

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Production measurements of strange hadrons originating from the hadronisation of charm quarks (prompt) and from beauty-hadron decays (non-prompt) offer a unique tool to study the heavy-quark hadronisation across different collision systems. In proton-proton (pp) and p–Pb collisions, they enable quantifying the fragmentation of heavy quarks to strange heavy-flavour hadrons relative to that of heavy-flavour hadrons without strange valence quark. These measurements also provide important tests for perturbative QCD-based calculations and the possible presence of cold nuclear-matter effects. In Pb–Pb collisions, the production of heavy-flavour hadrons with strange-quark content is sensitive to the hadronisation mechanisms of charm and beauty quarks in the quark–gluon plasma (QGP) and to final-state effects. If a fraction of heavy quarks hadronises via recombination with light-flavoured quarks in the medium, the production of heavy hadrons with strange-quark content is expected to be enhanced compared to that of non-strange hadrons, due to the abundant production of (anti)strange quarks in heavy-ion collisions compared to pp and p–Pb collisions.

This contribution discusses the final results of the ALICE Collaboration obtained by measuring strange D mesons in pp, p–Pb, and Pb–Pb collisions collected during the LHC Run 2. It reports the charm-quark fragmentation fraction to strange D mesons in pp and p–Pb collisions. The first measurement of the production of orbitally excited charm-strange mesons in pp collisions is also reported. Additionally, the production measurements of prompt $\mathrm{D_s}^+$ mesons are compared to those of non-strange mesons across the different collision systems, along with the measurement of non-prompt $\mathrm{D_s}^+$ mesons in heavy-ion collisions. Lastly, the first studies of strange and non-strange D mesons using the large data sample of pp collisions at $\sqrt{s} = 13.6$ TeV harvested from the start of LHC Run 3 are presented.

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