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Measurement of D-meson production and flow in Pb-Pb collisions with ALICE at the LHC

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Open-charmed mesons are unique tools to study the properties of the Quark-Gluon Plasma (QGP) formed in ultra-relativistic nucleus-nucleus collisions. Charm quarks, due to their large mass, are produced in hard partonic scattering processes in the initial stages of the collision. Therefore, they experience all the phases of the QGP evolution propagating through the medium and interacting with its constituents.

The measurement of D-meson nuclear modification factor $R_{\rm AA}$, defined as the ratio of the measured yield in nucleus-nucleus collisions to the one in proton-proton interactions scaled by the average number of binary nucleon-nucleon collisions, provides information on the interactions of charm quarks with the medium, in particular on their energy loss. The study of D-meson elliptic flow, the second-harmonic coefficient of the Fourier decomposition of the particle momentum-azimuthal distribution with respect to the reaction plane, at low transverse momentum $p_{\rm T}$ can give insight into the participation of charm quarks in the collective expansion of the system and their possible thermalization in the medium. At high $p_{\rm T}$ it allows us to assess the path-length dependence of parton energy loss. These two observables can also shed light on possible modifications of charm-quark hadronization in the medium. In fact, the comparison of the yields of D-meson species with and without strange-quark content permits us to study the role of the recombination mechanism for charm quarks.

In this talk, the latest results on the $p_{\rm T}$-differential $R_{\rm AA}$ and flow of $\rm D^0$, $\rm D^+$, $\rm D^{*+}$ and $\rm D_s^+$ mesons measured at mid-rapidity in Pb-Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV obtained by the ALICE Collaboration will be presented for different centrality classes. The measurements exploit the large data sample collected with ALICE at the end of 2018 and also improved analysis methods based on machine learning techniques. The comparison of the results with model predictions will be discussed as well.

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