Open charm hadron production and elliptic flow with event-shape-engineering from STAR

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Because of their early production, charm quarks are sensitive to the entire evolution of the system created in ultra-relativistic collisions of heavy ions. In particular, charm quark elliptic flow (v_2) is a valuable tool for study of charm transport in the quark-gluon plasma (QGP). Recent results from the STAR experiment show that in 10-40% central Au+Au collisions at the top RHIC energy the D^0-meson v_2 follows the Number-of-Constituent-Quark(NCQ) scaling similarly as light-flavor hadrons. To gain more insight into the charm quark dynamics it is of interest to study their flow in events with different initial conditions as well as to study the subsequent process of the charm hadronization.

In this talk, we will present the first D^0-meson v_2 measurement with the event-shape-engineering technique applied in Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. The D^0-meson v_2 will be shown as a function of the reduced flow vector q_2 and compared to those of light-flavor and strange hadrons. Moreover, we will report the most recent STAR measurements of various charm hadron (D^0, $D^{\pm}$, $D_s^{\pm}$, $\Lambda_c^{\pm}$) yields in Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV, including the $D_s^{\pm}/D_0$ yield ratio with improved precision, which helps constrain charm hadronization models. In addition, we will present results on D^0 production in d+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV making a baseline for cold nuclear matter effects on charm production. All these measurements utilize the STAR Heavy Flavor Tracker and data recorded during RHIC 2014 and 2016 runs by the STAR experiment.