

# Measurement of $v_2$ and $v_3$ in p+Au, d+Au and $^3\text{He}$ +Au collisions at $\sqrt{s_{NN}} = 200$ GeV from STAR

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We present a comprehensive measurement of the transversal momentum ( $p_T$ ) and multiplicity ( $N_{ch}$ ) dependence of azimuthal harmonics  $v_2$  and  $v_3$  in RHIC small system scan at  $\sqrt{s_{NN}} = 200$  GeV. This measurement contains several new results and important improvements: 1) previous results on  $v_2$  in p+Au and d+Au collisions are now expanded to include  $^3\text{He}$ +Au collisions, as well as new  $v_3$  results in all three systems; 2) the non-flow systematics are reduced using the actual p+p data at 200 GeV as reference in the peripheral subtraction procedure. This is demonstrated by the reduced sensitivity on the choice of non-flow subtraction methods as well as a closure test of these methods with the HIJING and AMPT models; 3) the  $v_2$  signal is also extracted using four-particle subevent cumulant method in d+Au and  $^3\text{He}$ +Au, and compared with that from two-particle correlations to gain insight on the flow fluctuations in small systems. We also compare our results with existing measurements from the RHIC and LHC. The implications of these new results on our understanding of the initial geometry including nucleon substructure and the origin of collectivity in small systems are discussed.