

# Recent results on correlations and fluctuations in pp, p+Pb, and Pb+Pb collisions from the ATLAS Experiment at the LHC

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The azimuthal anisotropies of particle yields observed in relativistic heavy-ion collisions have been traditionally considered as a strong evidence of the formation of a deconfined quark-gluon plasma produced in these collisions. However multiple recent measurements from the ATLAS Collaboration in pp and p+Pb systems show similar features as those observed in Pb+Pb collisions, indicating the possibility of the production of such a deconfined medium in smaller collision systems. This talk presents a comprehensive summary of ATLAS measurements in pp collisions at 2.76, 5.02 and 13 TeV and in p+Pb collisions at 5.02 and 8.16 TeV. It includes measurements of two-particle hadron-hadron and muon-hadron correlations in  $\Delta\phi$  and  $\Delta\eta$ , with a template fitting procedure used to subtract the dijet contributions. Measurements of multi-particle cumulants  $c_n\{2-8\}$  are also presented. The standard cumulant measurements confirm presence of collective phenomena in p+Pb collisions, but are biased by non-flow correlations and are not able to provide evidence for collectivity in pp collisions. To address this, measurements from a new sub-event cumulant method that suppresses the contribution of non-flow effects are presented. More detailed studies of longitudinal flow decorrelations, and higher-order cumulants in ultra-central Pb+Pb collisions are also presented to provide deeper insight into the details of the geometry of the initial state.

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