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Linear and non-linear flow coefficients from transport theory

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The observation of fluid-like behavior in nucleus-nucleus (AA), proton-nucleus (pA) and high-multiplicity proton-proton (pp) collisions motivates systematic studies of how different measurements approach their fluid-dynamic limit. We have developed numerical methods to solve the ultra-relativistic Boltzmann equation for systems of arbitrary size and transverse geometry. Here, we apply these techniques for the first time to the study of azimuthal flow coefficients v_n including non-linear mode-mode coupling and to an initial condition with realistic event-by-event fluctuations. We show how both linear and non-linear response coefficients extracted from v_n develop as a function of opacity
from free streaming to perfect fluidity. We note in particular that away from the fluid-dynamic limit, the signal strength of linear and non-linear response coefficients does not reduce uniformly, but that their hierarchy and relative size shows characteristic differences.

Authors: WU, Bin (CERN); KURKELA, Eero Aleksi (CERN); TAGHAVI, Seyed Farid (Technische Universitaet Muenchen (DE)); WIEDEMANN, Urs (CERN)

Presenter: WIEDEMANN, Urs (CERN)

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