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New parameteric model for entropy deposition in ultrarelativistic nuclear collisions

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Hybrid models based on hydrodynamics and Boltzmann transport provide a powerful tool to extract properties of the strongly coupled quark-gluon plasma produced in the first fm/c of ultrarelativistic nuclear collisions. The largest source of uncertainty in these model-to-data extractions is the choice of theoretical initial conditions used to model the distribution of entropy (energy) at the hydrodynamic thermalization time.

In this work we adopt a data driven approach and introduce a new parametric initial condition model that is constrained by systematic model-to-data comparison [1412.4708]. Starting from a participant nucleon model, we eschew binary collision scaling and parameterize the mapping from participant nucleon density to entropy deposition using a family of functions known as generalized means. These functions —described by a single continuous parameter —interpolate between the minimum and maximum of the local participant thickness functions and reduce to well known harmonic, geometric and arithmetic means for certain special cases.

We demonstrate that this new ansatz is flexible and can be used to emulate a broad class of initial condition models which are not described by a two-component wounded nucleon and binary collision parameterization. The model is then embedded in a state of the art hybrid simulation, and Bayesian model-to-data comparison is used to constrain initial state and medium properties simultaneously [1502.00339]. We compare results to measured flows, spectra and charged particle multiplicities and discuss implications for first principle initial condition calculations.

On behalf of collaboration:

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