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**Séminaire de Physique Nucléaire Théorique**

# Coupling nuclear structure and relativistic hydrodynamic calculations : collectivity in small systems

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Whether or not femto-scale droplets of quark-gluon plasma (QGP) are formed in so-called small systems at high-energy colliders is a pressing question in the phenomenology of the strong interaction. For proton-proton or proton-nucleus collisions the answer is inconclusive due to the large theoretical uncertainties plaguing the description of these processes. While upcoming data on collisions of $^{16}$O nuclei may mitigate these uncertainties in the near future, here we demonstrate the unique possibilities offered by complementing $^{16}$O+$^{16}$O data with collisions of $^{20}$Ne ions. We couple both NLEFT and PGCM ab initio descriptions of the structure of $^{20}$Ne and $^{16}$O to hydrodynamic simulations of $^{16}$O+$^{16}$O and $^{20}$Ne+$^{20}$Ne collisions at high energy. We isolate the imprints of the bowling-pin shape of $^{20}$Ne on the collective flow of hadrons, which can be used to perform quantitative tests of the hydrodynamic QGP paradigm. In particular, we predict that the elliptic flow of $^{20}$Ne+$^{20}$Ne collisions is enhanced by as much as 1.170(8)(30) for NLEFT and 1.139(6)(39)for PGCM relative to $^{16}$O+$^{16}$O collisions for the 1% most central events. At the same time, theoretical uncertainties largely cancel when studying relative variations of observables between two systems. This demonstrates a method based on experiments with two light-ion species for precision characterizations of the collective dynamics and its emergence in a small system.

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