Abstract Submitted
for the DNP20 Meeting of
The American Physical Society

Bounds on the Equation of State of Neutron Stars from the QCD Energy Momentum Tensor[1] SIMONETTA LIUTI, Univ of Virginia, ABHA RAJAN, Brookhaven National Lab, TYLER GORDA, KENT YAGI, Univ of Virginia
— The recent detection of gravitational waves from merging neutron star events has opened a new window on the many unknown aspects of their internal dynamics. A key role in this context is played by the transition from baryon to quark matter traced by the neutron star equation of state. The quark matter phase of neutron stars is thought to be governed by short range interactions among quark and gluons within Quantum Chromodynamics (QCD), the theory which describes the inner structure of the nucleon. Pressure, energy, as well as other mechanical properties of the nucleon are encoded in the QCD Energy Momentum Tensor. The QCD energy momentum tensor matrix elements are connected to the Mellin moments of the generalized parton distributions which can be measured in deeply virtual exclusive scattering experiments. As a consequence, we establish a connection between observables from high energy experiments and from the analysis of gravitational wave events. Both can be used to mutually constrain the respective sets of data. In particular, the emerging QCD-based picture is consistent with the GW170817 neutron star merger event once we allow a first-order phase transition from a low-density nuclear matter EoS to the newly-constructed high-density quark-gluon one.

[1]DE-SC0016286 (S.L.); DE-SC0012704 (A.R.), DE-SC0007984 (T.G.), NSF Award PHY-1806776 (K.Y.).

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Date submitted: 26 Jun 2020 Electronic form version 1.4