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Measuring Nuclear Matter Parameters with X-ray and Gravitational-waveObservations[1] JOSEF ZIMMERMAN, ZACK CARSON, Department of Physics, University of Virginia, Charlottesville, Virginia 22904, USA, KRISTEN SCHUMACHER, Department of Physics, University of Illinois at Urbana-Champaign, Urbana, IL, 61801, USA, ANDREW W. STEINER, Department of Physics and Astronomy, University of Tennessee, Knoxville, TN 37996, USA; Physics Division, Oak Ridge National Laboratory, Oak Ridge, TN, KENT YAGI, Department of Physics, University of Virginia, Charlottesville, Virginia 22904, USA
— Recent results from the NICER collaboration provide direct measurements of the mass and radius R of a neutron star PSR J0030+0451. We combine this with the measurement of mass-weighted tidal deformability $\tilde{\Lambda}$ extracted from the binary neutron star merger event GW170817 through gravitational waves to place bounds on various nuclear matter parameters. The latter parameters are obtained by expanding binding energy per nucleon with nucleon number density and isospin symmetry. We first construct correlations between R, $\tilde{\Lambda}$, and linear combinations of nuclear parameters. Assuming that these distributions are 3-dimensional Gaussian, we extract bounds on each nuclear parameter (such as the curvature of symmetry energy) by marginalizing over the uncertainties in the measurement of R and $\tilde{\Lambda}$. We also comment on how these bounds change when we use radius measurements from other X-ray observations of neutron stars.

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Josef Zimmerman
Univ of Virginia

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