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**Nonparametric Equation of State Inference with Chiral Effective Field Theory** REED ESSICK, Kavli Institute for Cosmological Physics, University of Chicago, PHILIPPE LANDRY, California State University, Fullerton, INGO TEWS, Theoretical Division, Los Alamos National Lab, SANJAY REDDY, Institute for Nuclear Theory, University of Washington, DANIEL HOLZ, University of Chicago — Recent observations of neutron stars in a variety of astrophysical systems provides a new handle on the equation of state of extremely dense matter. Building on recent nonparametric studies of with GW170817, we investigate how to self-consistently incorporate theoretical uncertainties from chiral effective field theory at low densities with nonparametric extensions to high densities. Nonparametric equation of state inference offers the best chance to avoid modeling systematics and other less-than-obvious prior beliefs and has already enabled novel studies of, e.g., whether the cores of neutron stars undergo strong phase transitions without the need to specify the precise form of the phase transition a priori. Coupling this extreme model freedom at high densities with carefully quantified theoretical uncertainty at low densities, we investigate astrophysical observations' impact on our belief that strong phase transitions exist as well as the maximum density up to which chiral effective field theory agrees with the data. In this way, neutron star observations can directly determine when effective field theory may begin to break down, rather than assuming a particular theoretical model from the start.?

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