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Probing Astrophysics and Fundamental Physics with Accurate Gravitational Waveforms for Eccentric Compact Binary Inspirals[1] NICOLAS YUNES, University of Illinois at Urbana-Champaign, BLAKE MOORE, Montana State University — The growing number of gravitational wave observations suggests the possibility of detecting signals from binaries with non-negligible orbital eccentricity in the near future. Models that incorporate the effects of small eccentricities ($e < 0.2$) exit, but they may not be sufficient to analyze waves from systems with moderate eccentricity. We recently developed a model that faithfully accounts for eccentric corrections in the moderate eccentricity regime ($e < 0.8$ for certain source masses) at 3rd post-Newtonian order. In this talk, I will first review the waveform construction, and then focus on the astrophysical and fundamental physics that can be probed if we detect such eccentric signal, based on a Bayesian parameter estimation study. I will first discuss the accuracy to which eccentricity can be measured given a moderately eccentric signal, as well as the smallest eccentricity that can be measured given a slightly eccentric signal, and the systematic biases that can be incurred if a quasi-circular model is used to extract an eccentric signal. I will conclude with a discussion of how eccentricity enhances our ability to test General Relativity, focusing on tests of scalar-tensor theory and Einstein-dilaton-Gauss-Bonnet gravity.

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Nicolas Yunes
University of Illinois at Urbana-Champaign

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