Abstract Submitted
for the APR18 Meeting of
The American Physical Society

Detection and characterization of eccentric compact binary coalescence at the interface of numerical relativity, analytical relativity and machine learning[1] ELIU HUERTA, DANIEL GEORGE, ROLAND HAAS, DANIEL JOHNSON, DEREK GLENNON, ADAM REBEI, A. MIGUEL HOLGADO, NCSA/University of Illinois at Urbana-Champaign, C. J. MOORE, IST-CENTRA, PRAYUSH KUMAR, Cornell University, ALVIN CHUA, JPL/Caltech, ERIK WESSEL, University of Arizona, JONATHAN GAIR, University of Edinburgh, HARALD PFEIFFER, CITA/AEI — We present ENIGMA, a time domain, inspiral-merger-ringdown waveform model that describes non-spinning binary black holes systems that evolve on moderately eccentric orbits (https://arxiv.org/abs/1711.06276). The inspiral evolution is described using a consistent combination of post-Newtonian theory, self-force and black hole perturbation theory. Assuming moderately eccentric binaries that circularize prior to coalescence, we smoothly match the eccentric inspiral with a stand-alone, quasi-circular merger, which is constructed using machine learning algorithms that are trained with quasi-circular numerical relativity waveforms. We show that ENIGMA reproduces with excellent accuracy the dynamics of quasi-circular compact binaries, and numerical relativity waveforms that describe eccentric binary black hole mergers with mass-ratios $1 < q < 5.5$, and eccentricities $e < 0.2$ ten orbits before merger. We use ENIGMA to show that if the gravitational wave events GW150914, GW151226, GW170104 and GW170814 have eccentricities $e \sim 0.1$ at 10 Hz, they can be misclassified as quasi-circular binaries due to parameter space degeneracies between eccentricity and spin corrections.

[1]This research is part of the Blue Waters sustained-petascale computing project, which is supported by the National Science Foundation (awards OCI-0725070 and ACI-1238993) and the State of Illinois.

Eliu Huerta
NCSA/University of Illinois at Urbana-Champaign

Date submitted: 10 Apr 2018 Electronic form version 1.4