Abstract Submitted
for the APR21 Meeting of
The American Physical Society

Eccentric binary black hole surrogate models for the gravitational waveform: comparable mass, nonspinning case[1] TOUSIF ISLAM, University of Massachusetts Dartmouth, VIJAY VARMA, Cornell, JACKIE LODMAN, Caltech, SCOTT FIELD, GAURAV KHANNA, UMass, MARK SCHEEL, Caltech, HARALD PFEIFFER, AEI, DAVIDE GEROSA, U. Birmingham, LAWRENCE KIDDER, Cornell — We develop new strategies to build numerical relativity surrogate models for eccentric binary black hole systems, which are expected to play an increasingly important role in current and future gravitational-wave detectors. We introduce a new surrogate waveform model, `NRSur2dq1Ecc`, using 47 nonspinning, equal-mass waveforms with eccentricities up to 0.2 when measured at a reference time of $5500M$ before merger. This is the first waveform model that is directly trained on eccentric numerical relativity simulations and does not require that the binary circularizes before merger. The model includes the $(2,2)$, $(3,2)$, and $(4,4)$ spin-weighted spherical harmonic modes. We show that our waveform model can accurately predict numerical relativity waveforms with mismatches $\approx 10^{-3}$. We demonstrate that the waveform model can also recover subtle effects like mode-mixing in the ringdown signal without any special ad-hoc modeling steps. Finally, we show that despite being trained only on equal-mass binaries, `NRSur2dq1Ecc` can be reasonably extended up to mass ratio $q \approx 3$ with mismatches $\simeq 10^{-2}$ for eccentricities smaller than ~ 0.05 as measured at a reference time of $2000M$ before merger.

[1]National Science Foundation, Sherman Fairchild Foundation, European Union H2020, Leverhulme Trust, and Royal Society

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Date submitted: 07 Jan 2021 Electronic form version 1.4