Abstract Submitted
for the APR17 Meeting of
The American Physical Society

SENR: A Next-Generation, Super-Efficient Numerical Relativity Code for the Age of Gravitational Wave Astrophysics ZACHARIAH ETIENNE, IAN RUCHLIN, West Virginia University, THOMAS BAUMGARTE, Bowdoin College — Short-inspiral black hole binary (BHB) mergers are perhaps the most extensively studied LIGO source candidate by numerical relativity (NR), so it was extremely fortuitous that LIGOs first detections of gravitational waves (GWs) were from precisely these systems. In a sense, these discoveries represent coming-of-age for our field, but NRs current position is a precarious one. LIGO data analysis depends on NR-based GW catalogs built upon only one NR code and remain largely unvalidated by independent NR codes. More worryingly, LIGO may soon detect GWs from a double neutron star (DNS) binary, and there currently exist no NR codes capable of generating DNS GWs with small, convergent phase errors over large numbers of orbits in-band. We introduce SENR, a Super-Efficient, open-development NR code aimed at addressing these critical shortcomings. Building upon recent breakthroughs in reference metric-based simulations, SENR employs dynamical coordinate systems to increase the efficiency of moving-puncture BHB and DNS GW modeling by 100x. Excitingly, SENR has the potential to afford high-end gamers the opportunity to join us in source modeling, potentially increasing throughput of GW generation by an enormous factor. We present an overview of the SENR code and its development.

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Date submitted: 30 Sep 2016 Electronic form version 1.4