Abstract Submitted
for the APR17 Meeting of
The American Physical Society

Gravitational waves from a plunge into a nearly extremal Kerr black hole LIOR M. BURKO, Georgia Gwinnett College, GAURAV KHANNA, University of Massachusetts Dartmouth — We study numerically in the time domain the linearized gravitational waves emitted from a plunge into a nearly extremal Kerr black hole by solving the inhomogeneous Teukolsky equation in the extreme mass-ratio domain. We consider spinning black holes for which the specific spin angular momentum $a/M = 1 - \epsilon$, and we consider values of $\epsilon \geq 10^{-6}$. We find an effective transient behavior for the quasi-normal ringdown: the early phase of the quasi-normal ringdown is governed by a decay according to inverse time, with frequency equaling twice the black hole's horizon frequency. Our results confirm that a similar phenomenon, first found by Yang, Zimmerman, and Lehner for source-free scalar fields, occurs also for sourced gravitational waves. We find that the smaller ϵ the later the transition from this transient inverse time decay to exponential decay. Such sources, if exist, may be interesting potential sources for terrestrial or space borne gravitational wave observatories. We briefly discuss some of the observational features of such sources for gravitational-wave astronomy, extending previous results by Gralla, Hughes, and Warburton for the "smoking gun" features of such sources from the pre-ISCO phase of the coalescence to the ringdown phase. .

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Date submitted: 24 Sep 2016 Electronic form version 1.4