

## General Relativity and Quantum Cosmology

# Persistent junk solutions in time-domain modeling of extreme mass ratio binaries

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In the context of metric perturbation theory for non-spinning black holes, extreme mass ratio binary (EMRB) systems are described by distributionally forced master wave equations. Numerical solution of a master wave equation as an initial boundary value problem requires initial data. However, because the correct initial data for generic-orbit systems is unknown, specification of trivial initial data is a common choice, despite being inconsistent and resulting in a solution which is initially discontinuous in time. As is well known, this choice leads to a "burst" of junk radiation which eventually propagates off the computational domain. We observe another unintended consequence of trivial initial data: development of a persistent spurious solution, here referred to as the Jost junk solution, which contaminates the physical solution for long times. This work studies the influence of both types of junk on metric perturbations, waveforms, and self-force measurements, and it demonstrates that smooth modified source terms mollify the Jost solution and reduce junk radiation.

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