CLOSE BINARY NEUTRON-STAR SYSTEMS

Abstract

by

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We present a method to calculate solutions to the initial value problem in (3+1) general relativity corresponding to binary neutron-star systems (BNS) in irrotational quasi-equilibrium orbits. The initial value equations are solved using a conformally flat spatial metric tensor. The stellar fluid dynamics corresponds to that of systems with zero vorticity in the inertial reference frame. Irrotational systems like the ones analyzed in the present work are likely to resemble the final stages of the evolution of neutron-star binaries, thus providing insights on the inspiral process. The fluid velocity is derived from the gradient of a scalar potential. A numerical program was developed to solve the elliptic equations for the metric fields and the fluid velocity potential. We discuss the different numerical techniques employed to achieve high resolution across the stellar volume, as well as the methods used to find solutions to the Poisson-like equations with their corresponding boundary conditions. We present sequences of quasi-stable circular orbits which conserve baryonic mass. These sequences mimic the time evolution of the inspiral and are obtained without solving the complex evolution equations. They also provide sets of initial value data for future time evolution codes, which should be valid very close to the final merger. We evaluate the emission of gravitational radiation during the evolution through multipole expansions methods.