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Initial Data for Binary Neutron Stars with Arbitrary Spin and Orbital Eccentricity PETR TSATSIN, Department of Physics, Florida Atlantic University, PEDRO MARRONETTI, Physics Division, National Science Foundation — The starting point of any general relativistic numerical simulation is a solution of the Hamiltonian and momentum constraint. One characteristic of the Binary Neutron Star (BNS) initial data problem is that, unlike the case of binary black holes, there are no formalisms that permit the construction of initial data for stars with arbitrary spins. For many years, the only options available have been systems either with irrotational or corotating fluid. Ten years ago, Marronetti & Shapiro (2003) introduced an approximation that would produce such arbitrarily spinning systems. More recently, Tichy (2012) presented a new formulation to do the same. However, all these data sets are bound to have a non-zero eccentricity that results from the fact the stars' velocity have initial null radial components. We present here a new approximation for BNS initial data for systems that possess arbitrary spins and arbitrary radial and tangential velocity components. The latter allows for the construction of data sets with arbitrary orbital eccentricity. Through the fine-tuning of the radial component, we were able to reduce the eccentricity by a factor of several compared to that of standard helical symmetry data sets such as those currently used in the scientific community.

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