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Solving the Teukolsky Equation with Spectral Methods

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There is a necessity for efficient and accurate algorithms to simulate events that are expected to appear in LISA's frequency range in the next few decades. With this work, we are exploring an implicit and time-symmetric integrator in the context of the Teukolsky equation. In theory, this time-domain solver shows some advantages to ordinary integrators such as Runge-Kutta 4 for long-time evolutions of this equation. Even though there are already several articles exploring these time-symmetric schemes, there are still several aspects that need to be studied in detail in order to prove their usefulness. So far, we have provided convergence tests which were not shown previously in the context of the Teukolsky equation, and also several ideas to improve this scheme. In future work, we will be working on implementing these ideas into our code and on implementing an already existing version of the integrator that considers particle sources in the spatial domain. This latter point will enable us to study geodesic orbits of test-particles.

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