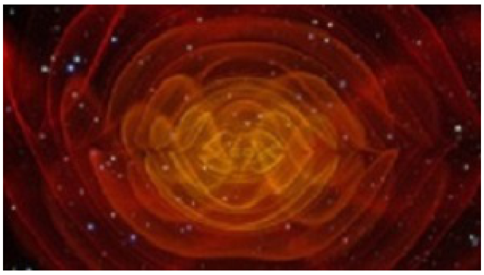

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Discussion on EMRI/IMRI using numerical relativity

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When mass ratios are not very extreme, perturbation theory becomes difficult. Standard numerical relativity codes, however, are inefficient unless the objects are of comparable mass, because the time-step and grid size are fixed by the smaller object. However, the smaller the mass ratio, the less important is the dynamics of the smaller object.

I propose therefore a discussion on how to do numerical relativity by excising the smaller object and replacing it with a parametrized analytic solution. The boundary of the excised region becomes a (timelike) boundary of the numerically integrated domain. The boundary condition can be a matching condition of the external geometry to an internal solution in the excised region that has no inherent dynamics. It can be tidally distorted but this would be treated as an adiabatic perturbation on the external timescale. The matching boundary is, from the point of view of the inner solution, in the far-field of the compact body.

This method has heritage as far back as EIH but is most closely associated with the way Futamase approached the point-particle limit of the PN problem for two compact objects, where the orbit solution was obtained by boundary matching to "inner" solutions for the compact objects: Physical Review D, vol. 32, (1985) pp. 2566-2574. Unlike for the PN problem, however, in the EMRI/IMRI problem there is no scaling on velocity; the only small parameter is the mass ratio.

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