Spherical excision for moving black holes and
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abstract It is expected that the realization of a convergent and long-term stable numerical code for the simulation of a black hole inspiral collision will depend greatly upon the construction of stable algorithms capable of handling smooth and, most likely, time dependent boundaries. After deriving single grid, energy conserving discretizations for axisymmetric systems containing the axis of symmetry, we present a new excision method for moving black holes using multiple overlapping coordinate patches, such that each boundary is fixed with respect to at least one coordinate system. This multiple coordinate structure eliminates all need for extrapolation, a commonly used procedure for moving boundaries in numerical relativity.

We demonstrate this excision method by evolving a massless Klein-Gordon scalar field around a boosted Schwarzschild black hole in axisymmetry. The excision boundary is defined by a spherical coordinate system co-moving with the black hole. Our numerical experiments indicate that arbitrarily high boost velocities can be used without observing any sign of instability.