**Scalable Space-time adaptivity for Simulations of Binary Black Hole Intermediate-Mass-Ratio-Inspirals**

Hari Sundar, University of Utah

We present a highly scalable framework that targets problems of interest to the numerical relativity and broader astrophysics communities. This framework combines a parallel octree-refined adaptive mesh with a wavelet adaptive multiresolution and a physics module to solve the Einstein equations of general relativity. The goal of this work is to perform advanced, massively parallel numerical simulations of intermediate-mass-ratio inspirals of binary black holes with mass ratios on the order of 100:1. These studies will be used to generate waveforms as used in the data analysis of the Laser Interferometer Gravitational-Wave Observatory and to calibrate semi-analytical approximate methods. Our framework consists of a distributed memory octree-based adaptive meshing framework in conjunction with a sophisticated code generator from symbolic expressions. By using octrees, we are able to support the extremely high-levels of adaptivity required to ensure scalability as the mass ratios become large. The computational requirements for simulations with large mass ratio also increase significantly if used with a spatially uniform timestepping scheme, with the time-step dictated by the finest refinement regions. We address this issue by developing a scalable local timestepping scheme on octree grids that provides a 70x speedup for simulations with a mass ratio of 100 compared to using a global timestepping scheme.