Deja vu all over again: Fluids, black holes, and the Center for Relativity

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RAMfest: Austin, June 2007

Guiding themes

Relativistic Fluids
Adaptive Mesh Refinement
Black holes & Excision

Relativistic Fluids

Critical phenomena
Resolution
Dynamics (P=rho)
MHD
B^2 >> rho



Critical phenomena & AMR



(With Choptuik)



Berger-Oliger AMR (space & time)
Distributed parallelism Vertex/Cell CenteredShadow hierarchy



HAD Strong Scaling Tests



80

HAD and Computed Tomography



(Anderson & Butler)

Black Holes & Excision

ADM equations

 Excision with causal differencing

Analytic KS gauge

Superposed Texas ID

Blended Dirichlet BCs

Crank-Nicholson





(Brandt, Correll, Gomez, Huq, Laguna, Lehner, Marronetti, Matzner, DN, Pullin, Schnetter, Shoemaker, and Winicour)



Excision with Overlapping Grids



Scalar field & boosted BH



Schwarzshild BH, boost 0.5c

Robust for high boosts (v=0.99c) and spins (a=0.99) (With Calabrese)



MHD on Overlapping Grids





(With Hirschmann and Millward)

Black hole accretion with excision

Initial data similar to Koide et al. (1999)
Bondi flow + Disk
Disk density 100x Bondi
Disk rotates with Keplerian velocity

(With Megevand, Anderson, Hirschmann, Lehner, and Liebling)

t=0.00 (5.171159e-01,2.672581e+02)

zscale=8.000e-03 59 x 59 x 27 (X slice) [-15.00,15.00], [-15.00,15.

2.67e+02

5.17e-01



