The Relativistic Hydrodynamics Adaptive Nested Mesh Code for IBM Power 9

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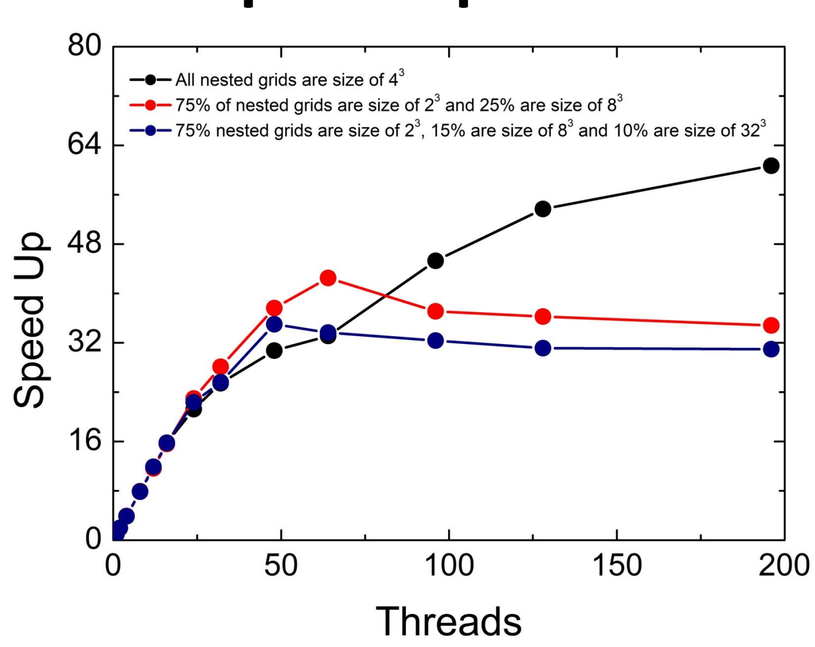
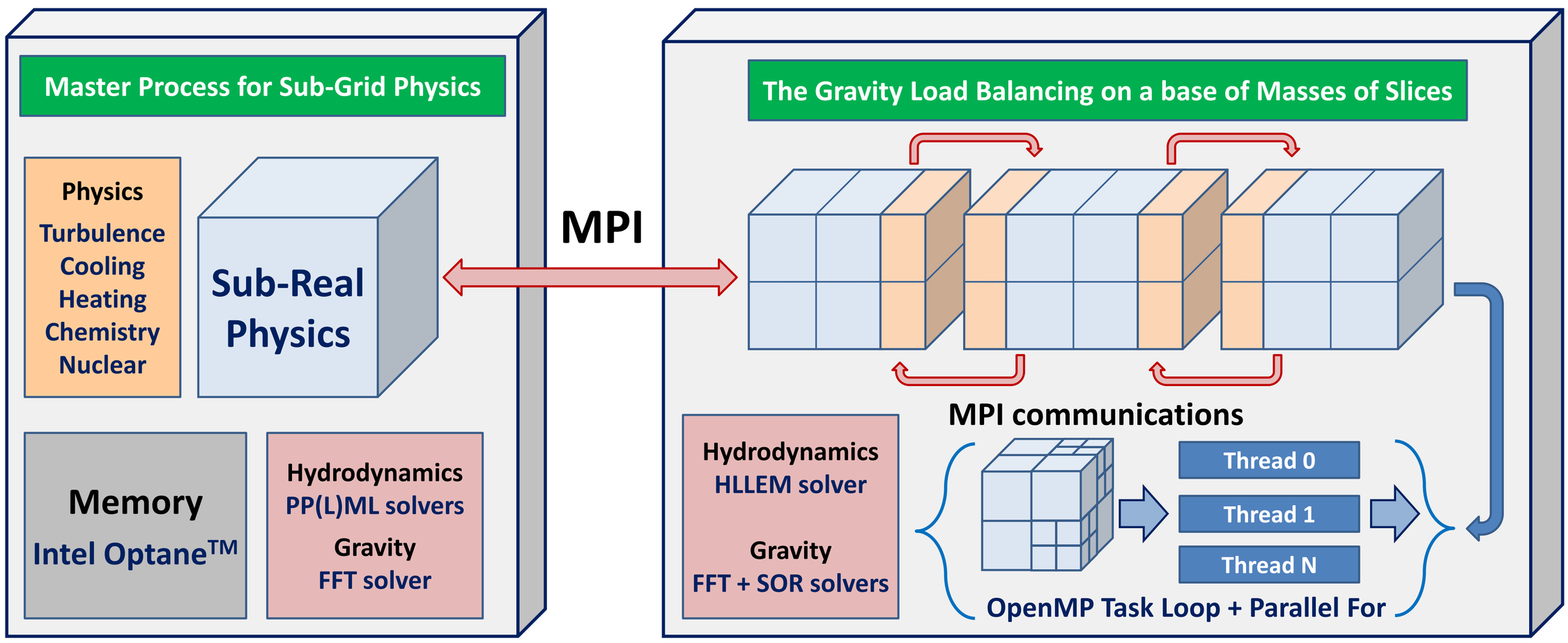
Abstract

Many astrophysical phenomena are associated with gas motion at relativistic velocities. The source of such currents are active galactic nuclei, micro quasars, pulsars, gamma bursts, black holes, neutron stars and gravitational waves. To study such phenomena, it is necessary to perform simulation within the scope of special relativistic hydrodynamics. One of the difficulties of modeling relativistic flows is the different scale of processes, which requires the use of both parallel computing and adaptive meshes.

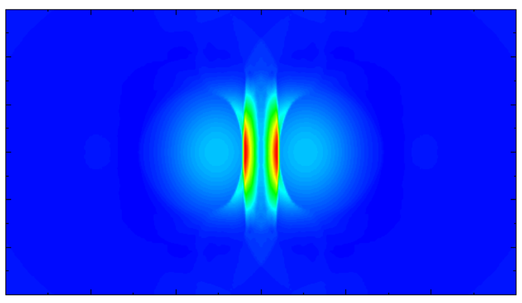
The Speed Up of Code



The Architecture of HydroBox3D Code

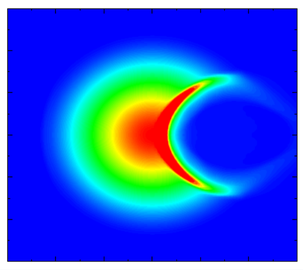


The Numerical Simulation of SMBH and SNIa



The central collision of super massive black holes in special relativity. (equatorial density)

The SNIa no central explosion of the white dwarf with $^{12}C+^{12}C \rightarrow ^{23}Na + p$ carbon burning (density)



Conclusion

The results of numerical simulations of (non) relativistic hydrodynamics flows using the latest IBM Power 9 processors are presented. The numerical method implemented in the code is based on a combination of the Godunov method and Piecewise-Parabolic on Local Stencil method and extended for using nested adaptive mesh technologies. A relativistic hydrodynamic evolution of astronomical objects is performed on the node with IBM Power 9 on shared memory architecture.