PHYS:5905 Final Project

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1. MPI/OpenMP hybrid code: add OpenMP support for the the MPI-enabled HYDRO code.

2. Setup: We run the simulation on a 1024×1024 grid on $[0, 1] \times [0, 1]$, with number of timesteps being 4000 and final time $T = 1.0$. Since the next time step requires information of the current and the previous steps, we only add openmp in each timesteps, but not between timesteps.

3. Validation: Compared the new outputs with the original ones using `diff` (with grid size 128×128). All outputs are exactly the same. We also compared the output of different settings of parallelization with grid size 1024×1024, and the outputs are also the same.

4. Time: We test the program on two 32-core nodes on Argon, with OMP_NUM_THREADS ranging from 32 to 1 while keeping the product of threads and MPI tasks at 64. Figure 1 shows the computational time of the options. Using OpenMP on each MPI task increases the total time cost when the grid size is not very large.
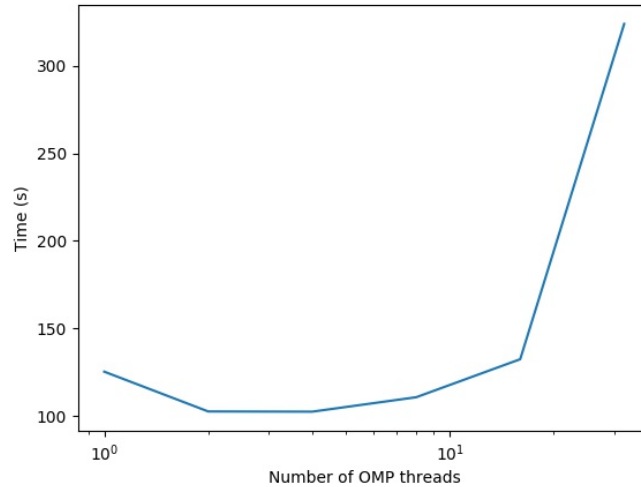

Figure 1: Running time vs. OMP threads