Optimizing Astrophysical Simulation and Data Analysis codes on Intel Architectures

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Modern computing architectures allow for unprecedented levels of parallelization, bringing a much-needed speedup to key scientific applications, such as ever improving numerical simulations and their post-processing, likewise increasingly taxing. We report on optimization techniques used on popular codes for computational astrophysics (FLASH and ECHO) and the performance gained on second-generation Intel Xeon Phi and Xeon Scalable Processors (code-named Knights Landing and Skylake, respectively). We also show how simulation post-processing can largely benefit from HPC methods. We focus specifically on yt (an open source Python package for data analysis and visualization), in which speedups as high as to 4x or 8x with respect to the code baseline can be easily achieved just through the use of cython and the Intel Distribution for Python.

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