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Porting plasma physics simulation codes to modern computing architectures using the LIBMRC **framework** KAI GERMASCHEWSKI, STEPHEN ABBOTT, University of New Hampshire — Available computing power has continued to grow exponentially even after single-core performance satured in the last decade. The increase has since been driven by more parallelism, both using more cores and having more parallelism in each core, e.g. in GPUs and Intel Xeon Phi. Adapting existing plasma physics codes is challenging, in particular as there is no single programming model that covers current and future architectures. We will introduce the open-source LIBMRC framework that has been used to modularize and port three plasma physics codes: The extended MHD code MRCv3 with implicit time integration and curvilinear grids; the OpenGGCM global magnetosphere model; and the particle-in-cell code PSC. LIBMRC consolidates basic functionality needed for simulations based on structured grids (I/O, load balancing, time integrators), and also introduces a parallel object model that makes it possible to maintain multiple implementations of computational kernels, on e.g. conventional processors and GPUs. It handles data layout conversions and enables us to port performance-critical parts of a code to a new architecture step-by-step, while the rest of the code can remain unchanged. We will show examples of the performance gains and some physics applications.

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