High-Performance Radiative Transport Equation Solver.

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Abstract : Energy transport via radiative transfer is significant for many fields of science and technology, especially when high temperatures are considered. The modeling of such radiative transfer phenomena has been gaining attention these last decades within diverse scientific fields, such as heat transfer, neutron transport, optical imaging, biomedical optics, astrophysics, radiative transport, etc. In this talk, I will present two different strategies for discretizing the steady-state monochromatic radiative transfer equation. These strategies yield similar linear systems, but with very different sparsity patterns. I will show how this may affect the performance of the underlying linear algebra backend (in our case, PETSc), and how to design efficient preconditioners for these systems. Indeed, most of the solvers available in the literature (direct methods, domain decomposition, multigrid) fail to solve such systems.