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Lattice Boltzmann approach to radiative transport in numerical astrophysics DANIELE SIMEONI, Universit di Ferrara - Bergische Universitaet Wuppertal - University of Cyprus , ALESSANDRO GABBANA, Universit di Ferrara - INFN-Ferrara, LUCIANO REZZOLLA, Institut fur Theoretische Physik Frankfurt - School of Mathematics, Trinity College, SAURO SUCCI, La Sapienza, Italian Institute of Technology - Istituto Applicazioni del Calcolo, National Research Council of Italy, RAFFAELE TRIPICCIONE , Universit di Ferrara - INFN-Ferrara, LUKAS WEIH , Institut fur Theoretische Physik Frankfurt — Radiative Transfer expresses how energy is carried by electromagnetic waves through media while being affected by absorption, emission and scattering. It is described by the Radiative Transfer Equation (RTE), which can be obtained building on the kinetic equations describing the evolution of gasses composed of massless particles like photons or neutrinos. Analytical solutions for this equation are available only for a small number of cases, and therefore numerical methods are needed for the study of physically interesting processes. In this talk, we present a novel approach for the simulation of the RTE which builds on the Boltzmann-like nature of the governing equations and is inspired by Lattice Boltzmann methods (LBM), commonly used in many different areas of fluid-dynamics. Our approach retains several advantages of LBM, including outstanding efficiency in parallel computations. We test our numerical methods against several benchmark cases and present results of the coupling of this LBM approach to a hydrodynamic solver for the simulation of a relativistic jet, which is an astrophysical phenomenon that plays a role in the evolution of neutron stars.

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