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Monte-Carlo simulations of multi-specie relativistic thermalization for Big bang nucleosynthesis.[1] ATUL KEDIA, GRANT MATHEWS, NISHANTH SASANKAN, University of Notre Dame, MOTOHIKO KUSAKABE, Beihang University — Multi-component relativistic fluids have been studied for decades. However, simulating the dynamics of the particles and fluids in such a mixture has been a challenge due to the fact that such simulations are computationally expensive in three spatial dimensions. Here we report on the development and application of a multi-dimensional relativistic Monte-Carlo code of explore the thermalization process in a relativistic multi-component environment in a computationally inexpensive way. As an illustration we simulate the fully relativistic three-dimensional Brownian-motion-like solution to the thermalization of a high mass particle (proton) in a bath of relativistic low-mass particles (electrons). We follow the thermalization and ultimate equilibrium distribution of the Brownian-like particle as can happen in the cosmic plasma during big bang nucleosynthesis. We also simulate the thermalization of energetic particles injected into the plasma as can occur, for example, by the decay of massive unstable particles during the big bang.

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