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A structure-preserving scheme for the Landau-Fokker-Planck equation with the relativistic kernel TAKASHI SHIROTO, National Institutes for Quantum and Radiological Science and Technology, YASUHIKO SENTOKU, Osaka University — Recently, we published a paper of mass-momentum-energy-conserving scheme for the relativistic Landau-Fokker-Planck equation. The mass conservation is easily derived for any collision kernel, but the conservation laws of momentum and energy depend on the mathematical symmetries of the Beliaev-Budker kernel. Unlike the potential formulation, the momentum conservation is also derived simply in the Landau form. However, the discussion of energy conservation is more difficult than the others because one of the mathematical symmetries is coupled with the integration-by-parts. In this work, we developed a new method to calculate the Beliaev-Budker kernel in discrete form ensuring the conservation laws of mass, momentum and energy. Some constraints for conservation laws were derived with careful discussion of the integration-by-parts in discrete form, and the discrete kernel was obtained uniquely which can preserve these constraints. In a numerical experiment, the proposed scheme strictly maintains the conservation laws of mass, momentum and energy, and the growth rate of the entropy agrees well with a linear theory assuming the initial distribution.

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