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A robust and conservative dynamical low-rank algorithm

In this talk, we propose a numerical strategy to solve the Vlasov-Poisson equation, based on the dynamical low rank approximation, which is extremely efficient to reduce the complexity of such model.
Previous approaches based on dynamical low rank approximation destroyed the physical structure of the problem, as physical invariants were lost.
Starting from the conservative continuous setting proposed in [1], we introduce a suited modification of the algorithm [2], able to conserve mass and momentum (up to machine precision) and significantly improves energy conservation. The main ingredients are the adding suited basis functions to the approximation space and conservative rank truncation. Finally, rank adaptation techniques are introduced. This is a joint work with L. Einkemmer and A. Ostermann.

[1] L. Einkemmer and I. Joseph, A mass, momentum, and energy conservative dynamical low-rank scheme for the Vlasov equation, J. Comput. Phys., 2021.
[2] G. Ceruti and C. Lubich, An unconventional robust integrator for dynamical low-rank approximation, BIT Numer. Math., 2022.

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