Dynamical low-rank approximation of kinetic Alfvén waves

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In this talk, we consider a complexity reduction technique for the drift kinetic equations based on the dynamical low-rank approximation. This approach allows us to resolve small-scale oscillations while still drastically reducing the number of degrees of freedom required to obtain an accurate simulation. In particular, we consider the solution of kinetic Alfvén waves by separating the dynamics parallel and particular to the magnetic field. This allows us to obtain a dynamical low-rank algorithm that exactly captures the commonly used 1+1 dimensional model of shear Alfvén waves. However, the algorithm is not limited to this situation and we present a comparison with an Eulerian solver that demonstrates that the dynamical low-rank approximation is extremely accurate even if a small rank is chosen. Thus, we succeed in drastically reducing the memory and computational cost required to run such simulations. We also discuss some details of the implementation, which is conducted on our dynamical low-rank framework Ensign (`https://github.com/leinkemmer/Ensign`).