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A self-similar approach to Dark Matter halo dynamics in 2D Vlasov simulations

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Understanding dark matter halo dynamics can be pivotal to unravelling the nature of dark matter particles. Analytical treatment of the multistream flows inside the turn-around region of a collapsed CDM (cold dark matter) halo using various self-similar approaches already exist. In this work, we adapt the Fillmore and Goldreich self-similar solutions assuming cylindrical symmetry to data from 2D Vlasov-Poisson (ColdICE package) simulations of isolated halos seeded with sin-wave initial conditions. We measure trajectories in position and phase-space, mass and density profiles and compare these to predictions from the self-similar model, with an aim to establish the limits of self-similar behaviour and the factors leading to deviations from it.

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