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Self-consistent construction of virialized wave dark matter halos[1]
SHAN-CHANG LIN, National Taiwan University, HSI-YU SCHIVE, National Center for Supercomputing Applications, SHING-KWONG WONG, TZIHONG CHIUEH, National Taiwan University — Wave dark matter (ψDM), which satisfies the Schrödinger-Poisson equation, has recently attracted substantial attention as a possible dark matter candidate. The present work adopts a different approach in assessing massive halos by constructing wave-halo solutions directly from the wave distribution function. This approach bears certain similarity with the analytical construction of particle-halo (cold dark matter model). Instead of many collisionless particles, one deals with one single wave that has many non-interacting eigenstates. The key ingredient in the wave-halo construction is the distribution function of the wave power, and we use several halos produced by structure formation simulations as templates to determine the wave distribution function. Among different models, we find the fermionic King model presents the best fits and we use it for our wave-halo construction. We have devised an iteration method for constructing the nonlinear halo and demonstrate its stability by three-dimensional simulations. A Milky-Way-sized halo has also been constructed, and the inner halo is found flatter than the NFW profile.

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