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CDM Halos as Bose-Einstein Condensates: from Axions to Repulsive Dark Matter TANJA RINDLER-DALLER, PAUL R. SHAPIRO, Dept of Astronomy and Texas Cosmology Center, The University of Texas at Austin — In the past two decades, suggestions have appeared in the literature that dark matter (DM) may be in the form of a Bose-Einstein condensate (BEC). The respective particle candidates, which have been shown to form a BEC, can be found at the low end of the DM mass spectrum, ranging from the QCD axion down to extremely-light bosons. In the context of the Gross-Pitaevskii theory of gaseous BECs under self-gravity with varying particle interaction strengths, we derive the respective halo structures and density profiles. BEC halos have flat cores for all particle coupling strengths, in contrast to the cuspy centers of standard CDM halos. We also study the influence of angular momentum, as acquired by tidal-torquing in the early phases of halo formation, and show that vortices can be formed in halo centers in the regime of strong particle interactions, making an initially irrotational fluid having vorticity. Vortices deplete the DM in their cores, which in turn influences the gravitational coupling to the baryons. As a consequence, baryon cooling and condensation, a prerequisite of star formation, may be delayed or suppressed for small-mass halos.

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