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Dark matter halo response to the disc growth

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Comments
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Abstract
We consider the sensitivity of the circular-orbit adiabatic contraction approximation to the baryon condensation rate and the orbital structure of dark matter haloes in the Λ cold dark matter (ΛCDM) paradigm. Using one-dimensional hydrodynamic simulations including the dark matter halo mass accretion history and gas cooling, we demonstrate that the adiabatic approximation is approximately valid even though haloes and discs may assemble simultaneously. We further demonstrate the validity of the simple approximation for ΛCDM haloes with isotropic velocity distributions using three-dimensional N-body simulations. This result is

easily understood: an isotropic velocity distribution in a cuspy halo requires more circular orbits than radial orbits. Conversely, the approximation is poor in the extreme case of a radial orbit halo. It overestimates the response of a core dark matter halo, where radial orbit fraction is larger. Because no astronomically relevant models are dominated by low angular momentum orbits in the vicinity of the disc and the growth time-scale is never shorter than a dynamical time, we conclude that the adiabatic contraction approximation is useful in modelling the response of dark matter haloes to the growth of a disc.

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