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On the Galaxy Size–Halo Connection

Andrew Hearin[1], Peter Behroozi[2], Andrey Kravtsov[3], Benjamin Moster[4]
[1] *Argonne National Laboratory, Argonne, IL, USA 60439, USA*
[2] *Department of Physics, University of Arizona, 1118 E 4th St, Tucson, AZ 85721 USA*
[3] *Department of Astronomy & Astrophysics, The University of Chicago, Chicago, IL 60637 USA*
[4] *Universitäts-Sternwarte, Ludwig-Maximilians-Universität München, Scheinerstr. 1, 81679 München, Germany*

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ABSTRACT

We derive empirical modeling constraints on the connection between dark matter halos and the half-mass radius $R_{1/2}$ of galaxy bulges and disks. We show that both $R_{1/2}^{\rm disk}$ and $R_{1/2}^{\rm bulge}$ are well-described by power law scaling relations with halo virial radius, $R_{1/2} = AR_{\rm vir}^{\alpha}$. Novel to this work, we use new SDSS measurements of the $R_{1/2}-$dependence of galaxy clustering to constrain the model parameters, $A_{\rm bulge}, A_{\rm disk}, \alpha_{\rm bulge}, \alpha_{\rm disk}$, and log-normal scatter $\sigma_{R_{1/2}}$. Even when only coarsely tuning these parameters to the observed one-point functions $\langle R_{1/2}^{\rm disk}|M_*^{\rm disk}\rangle$ and $\langle R_{1/2}^{\rm bulge}|M_*^{\rm bulge}\rangle$, our model accurately predicts the observed two-point clustering on small- and large-scales. This success non-trivial, as we show that galaxy clustering is highly sensitive to the physics that shapes satellite galaxy profiles. We find no evidence for the commonly assumed relation between halo spin $\lambda_{\rm halo}$ and $R_{1/2}^{\rm disk}$, and show that this assumption cannot be meaningfully constrained with either the clustering or lensing of L_* galaxies. Our results provide simple boundary conditions for more complex and fine-grained models of galaxy size. We make our python code publicly available to support cosmological surveys that require realistic synthetic galaxy populations.

1 INTRODUCTION

Some introduction goes here.

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