U28a Connecting luminous red galaxies to central and satellite subhalos

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We develop a novel abundance matching method to construct a mock catalog of luminous red galaxies (LRGs) in the Sloan Digital Sky Survey (SDSS), using catalogs of halos and subhalos in N-body simulations for a Λ-dominated, cold dark matter model. Motivated by observations suggesting that LRGs are passively-evolving, massive early-type galaxies with a typical age ≥ 5 Gyr, we assume that simulated halos at $z = 2$ (z2-halo) are progenitors for LRG-host subhalos observed today. We then identify the descendant subhalos at $z = 0.3$ (SDSS redshift) in descending order of the masses of z2-halos until the comoving number density of the matched subhalos becomes comparable to the measured number density of SDSS LRGs, $\bar{n}_{\mathrm{LRG}} = 10^{-4} \ h^3$ Mpc^{-3}. While the SDSS LRGs are galaxies selected by the magnitude and color cuts from the SDSS images and are not necessarily a stellar-mass-selected sample, our mock catalog reproduces a host of SDSS measurements. The mock catalog generated based on our method can be used for removing or calibrating systematic errors due to the Finger-of-God effect in the cosmological interpretation of LRG clustering measurements as well as for understanding the nature of LRGs such as their formation and assembly histories.