
Unexpected Detection of a Cool Gas Reservoir in the Hot Halos of LRGs

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Abstract

Luminous red galaxies (LRGs) are some of the most massive objects and have been quiescent since $z \sim 1$. According to the prevailing theory of galaxy evolution, any gas accreted into the circumgalactic medium (CGM) about these massive galaxies ($\log M_{\text{halo}} \sim 13.7 M_{\odot}$) should be shock-heated to very high temperatures. We put this theory to the test using a sample of 21 LRGs with QSO sightlines piercing their CGM out to a distance of 500 kpc. From these observations we detect 4 Lyman limit systems (LLSs, $16 \leq \log(N_{\text{HI}}) \leq 19 \text{ cm}^{-2}$); three of the absorbers are metal-rich, and one is metal-poor ($[X/H] = -1.8$). Using a limit of $\log(N_{\text{HI}}) \geq 16$, we find a covering factor of strong HI in the halos of LRGs to be 31% within R_{vir} . The presence of cool ($T \sim 10^4 \text{ K}$) gas in the LRG halos is unexpected, as is the presence of a low-metallicity LLS that may trace recent accretion onto the LRG. A large reservoir of cool gas is found around these red and dead galaxies, but they are not using it for star formation.

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