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Title: The Gas in Virgo's "Red and Dead" Dwarf Elliptical Galaxies
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Abstract

As star-forming dwarf irregulars and faint spirals fall onto a cluster, their gas content is easily and quickly removed by ram-pressure stripping or other cluster forces. Residual signs of star formation cease within 100 Myr, and only after approximately 1 Gyr do their optical features transition to elliptical. Despite this, ALFALFA has uncovered a population of three "red and dead" dwarf ellipticals in the Virgo Cluster which still have detectable reservoirs of HI. These dwarf ellipticals are extremely gas-rich—as gas-rich as the cluster's star-forming dwarf irregulars (Hallenbeck et al. 2012). Where does this gas come from? We consider two possibilities. First, that the gas is recently acquired, and has not yet had time to form stars. Second, that the gas is primordial, and has been disrupted from being able to form stars during the current epoch. We present deep optical (using CFHT and KPNO) and HI (Arecibo and VLA) observations of this sample to demonstrate that this gas is primordial. These observations show that all three galaxies have exponentially decreasing profiles characteristic of dwarf ellipticals and that their rotation velocities are extremely low. However, like more massive elliptical galaxies with HI, these dwarf galaxies show irregular optical morphology. For one target, VCC 190, we additionally observe an HI tail consistent with a recent interaction with the massive spiral galaxy NGC 4224.

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