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Evidence Against Dark Matter Halos Surrounding the Globular Clusters MGC1 and NGC 2419

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The conjecture that the ancient globular clusters (GCs) formed at the center of their own dark matter halos was first proposed by Peebles (1984), and has recently been revived to explain the puzzling abundance patterns observed within many GCs. In this Letter we demonstrate that the outer stellar density profile of isolated GCs is very sensitive to the presence of an extended dark halo. The GCs NGC 2419, located at 90 kpc from the center of our Galaxy, and MGC1, located at ~200 kpc from the center of M31, are ideal laboratories for testing the scenario that GCs formed at the centers of massive dark halos. Comparing analytic models to observations of these GCs, we conclude that these GCs cannot be embedded within dark halos with a virial mass greater than $10^6 M_{\text{sun}}$, or, equivalently, the dark matter halo mass-to-stellar mass ratio must be $M_{\text{dm}}/M_* < 1$. If these GCs have indeed orbited within weak tidal fields throughout their lifetimes, then these limits imply that these GCs did not form within their own dark halos. Recent observations of an extended stellar halo in the GC NGC 1851 are also interpreted in the context of our analytic models. Implications of these results for the formation of GCs are briefly discussed.

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