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Intergalactic Globular Clusters

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Abstract. We confirm and extend our previous detection of a population of intergalactic globular clusters in Abell 1185, and report the first discovery of an intergalactic globular cluster in the nearby Virgo cluster of galaxies. The numbers, colors and luminosities of these objects can place constraints on their origin, which in turn may yield new insights to the evolution of galaxies in dense environments.

1. Introduction

There are several reasons to believe that a population of intergalactic globular clusters (IGCs) should exist outside of galaxies:

(1) The Jeans mass at recombination was $\sim 10^5 - 10^6$ solar masses, and hence globular cluster sized objects could have formed wherever the local density of matter was high enough.

(2) Many galaxies may have met their demise over a Hubble time as a result of collisions and tidal disruption. Globular clusters are likely to survive the disruption of their parent galaxy, resulting in the gradual accumulation of a population of IGCs. Intergalactic stars, planetary nebulae, supernovae and HII regions have already been found; it would be surprising if there were no IGCs.

(3) The existence of IGCs might explain high specific frequencies, bimodal globular cluster metallicity distributions and other current puzzles in the study of globular cluster systems.

Jordán et al. (2003) reported a tentative detection of IGCs in the center of the rich galaxy cluster A1185 ($z = 0.032$) based on I-band images obtained with WFPC2 on the Hubble Space Telescope.

2. What's New?

We (Côté, Jordán, Marzke, West) recently obtained very deep, multicolored (V and I) images of the same A1185 field using HST with the new ACS. The goals of these new observations are to 1) detect the peak of the assumed universal Gaussian-like globular cluster luminosity function (which should occur at $I \sim 27.3$ at A1185's distance) and thereby confirm that these candidate IGCs are bona fide globular clusters and 2) use color information to infer their metallicities. Preliminary analysis indicates that we are reaching sufficiently faint magnitudes to reliably detect the luminosity function turnover. The number and colors (metallicities) of IGCs will provide constraints on the number and types of galaxies that have been destroyed or stripped over a Hubble time.

Using the Keck telescope, we (Ferguson, Gregg, Tanvir, von Hippel, West) recently measured the redshift of a candidate IGC in the nearby Virgo galaxy cluster that was found serendipitously on an HST image obtained for another project. Preliminary data reductions show that this object, which is slightly resolved in the HST image and appears to be a distant globular cluster, has a recessional velocity of ~ 470 km/s, and hence is most likely in the Virgo cluster. Its apparent magnitude, $m_V \sim 21.2$, is consistent with it being a bright globular cluster. Using telescopes on Mauna Kea we have since obtained optical and NIR colors of this object, as well as a medium-resolution spectrum that should yield its velocity dispersion. These data are presently being analyzed.

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References

Jordán, A., West, M.J., Côté, P. & Marzke, R.O. et al. 2003, AJ, 125, 1642