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Resolved Stellar Halos of M87 and NGC 5128: Metallicities from the Red-Giant Branch

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Abstract. We have searched halo fields of two giant elliptical galaxies: M87, using *HST* images at 10 kpc from the galactic center, and NGC 5128 (Cen A), using VIMOS VLT images at 65 kpc from the center and archival *HST* data from 8 to 38 kpc from the center. We have resolved thousands of red-giant-branch (RGB) stars in these stellar halo fields using V and I filters, and, in addition, measured the metallicity using stellar isochrones. The metallicity distribution function (MDF) of the inner stellar halo of M87 is similar to that of NGC 5128's stellar halo.

Keywords. galaxies: halo, galaxies: elliptical, galaxies: stellar content, galaxies: individual: M87, galaxies: individual: NGC 5128

1. Introduction

The stellar halos of galaxies trace the earliest star-forming histories of galaxies and resolved stellar photometry of the red-giant population allow the measurement of the MDF. Currently, only galaxies within 20 Mpc can be studied by direct stellar photometry. Within this distance are only a few giant ellipticals, making them especially noteworthy to study. We compare in Table 1 the basic properties of two of such galaxies, M87 and NGC 5128, and the two halo fields which we have studied using space and ground-based images, respectively (Bird *et al.* 2010, 2015).

We have used the observed V and I magnitudes to derive the bolometric magnitude $M_{\rm bol}$ and to make cuts in magnitude and color, $-3.22 < M_{\rm bol} < -3.00$ and $1.5 < V-I < 2.3$, for the purpose of isolating a pure sample of RGB stars from the challenging ground-based observations of NGC 5128. We have applied the same selection window to the space-based observations of M87 and NGC 5128 and show the MDFs in Fig. 1.

Table 1. Comparison of M87 and NGC 5128 and our stellar halo observations.

Description	M87	NGC 5128
$I_{\rm TRGB}$ [mag]	27	24
Distance [Mpc]	16.7	3.8
Hubble Type	cD-gE	cD-gE/S0pec
Environment	Virgo Cluster	Centaurus Group
RA [$^{\rm h}$ $^{\rm m}$ $^{\rm s}$]	12 30 49.4	13 27 59
Dec [$^\circ$ $'$ $''$]	+12 23 28	−42 14 50
$R_{\rm gc}$ [kpc]	12	65
$R_{\rm eff}$ [kpc]	6.3	5.8
Telescope	*HST*	VLT
Instrument	ACS WFC	VIMOS
Area [arcmin^2]	2	224
RGB	33890	1581

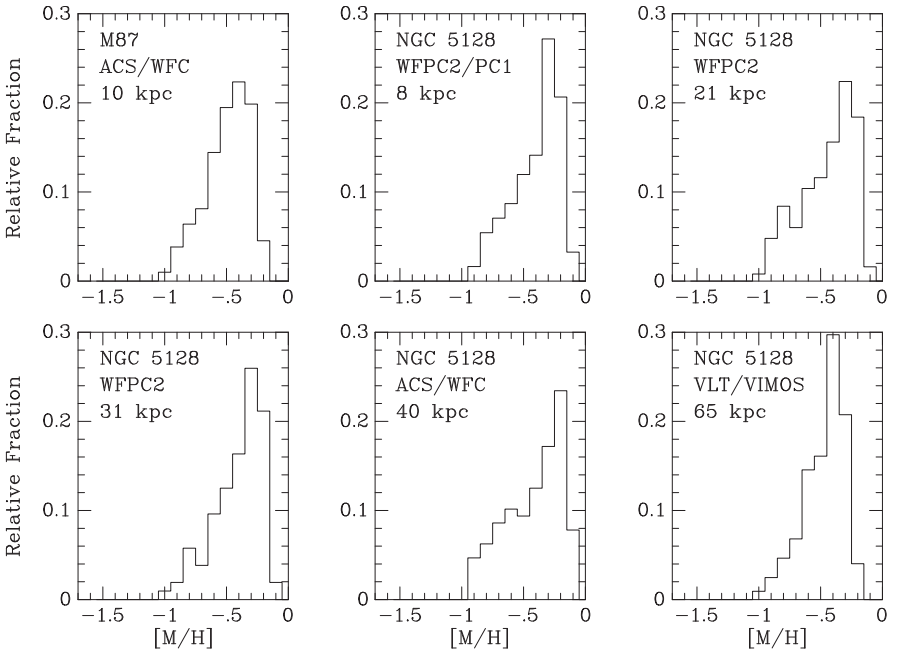

Figure 1. Normalized MDFs in [M/H] for the stellar halo fields of two elliptical galaxies: one 10 kpc field from M87 (Bird *et al.* 2010), and five fields from NGC 5128 including four *HST* fields at 8 kpc (Harris & Harris 2002), 21 kpc (Harris *et al.* 1999), 31 kpc (Harris & Harris 2000), and 40 kpc (Rejkuba *et al.* 2005), and one 65 kpc VLT/VIMOS field (Bird *et al.* 2015).

2. Results and Discussion

M87's inner halo MDF is similar to NGC 5128's halo MDFs, sharing peaks near [M/H] ~ -0.5. Super-solar metallicity stars are dimmer and substantially missed in the color magnitude diagrams and MDFs.

We have measured the metallicities from the RGB stars located in the halos of two elliptical galaxies, M87 and NGC 5128. The similarity of their MDFs reinforce the view that the oldest stellar populations in giant elliptical galaxies are fundamentally similar, regardless of whatever more recent accretion events may have happened to them. Further details of the studies presented here can be found in Bird *et al.* (2010) and Bird *et al.* (2015).

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