The Galaxy - Globular Cluster Connection in NGC 3115

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Abstract

We present Gemini Multi-Object Longslit spectroscopy of the isolated S0 galaxy NGC 3115. We have determined kinematical data and Lick/IDS absorption line-strength indices for the major and minor axes out to around 2Re. Using stellar population models which include the effects of variable [α/Fe] ratios, we derive metallicities, abundance ratios and ages for the stellar population of NGC 3115. We compare these results to those previously presented for the globular cluster system of NGC 3115.

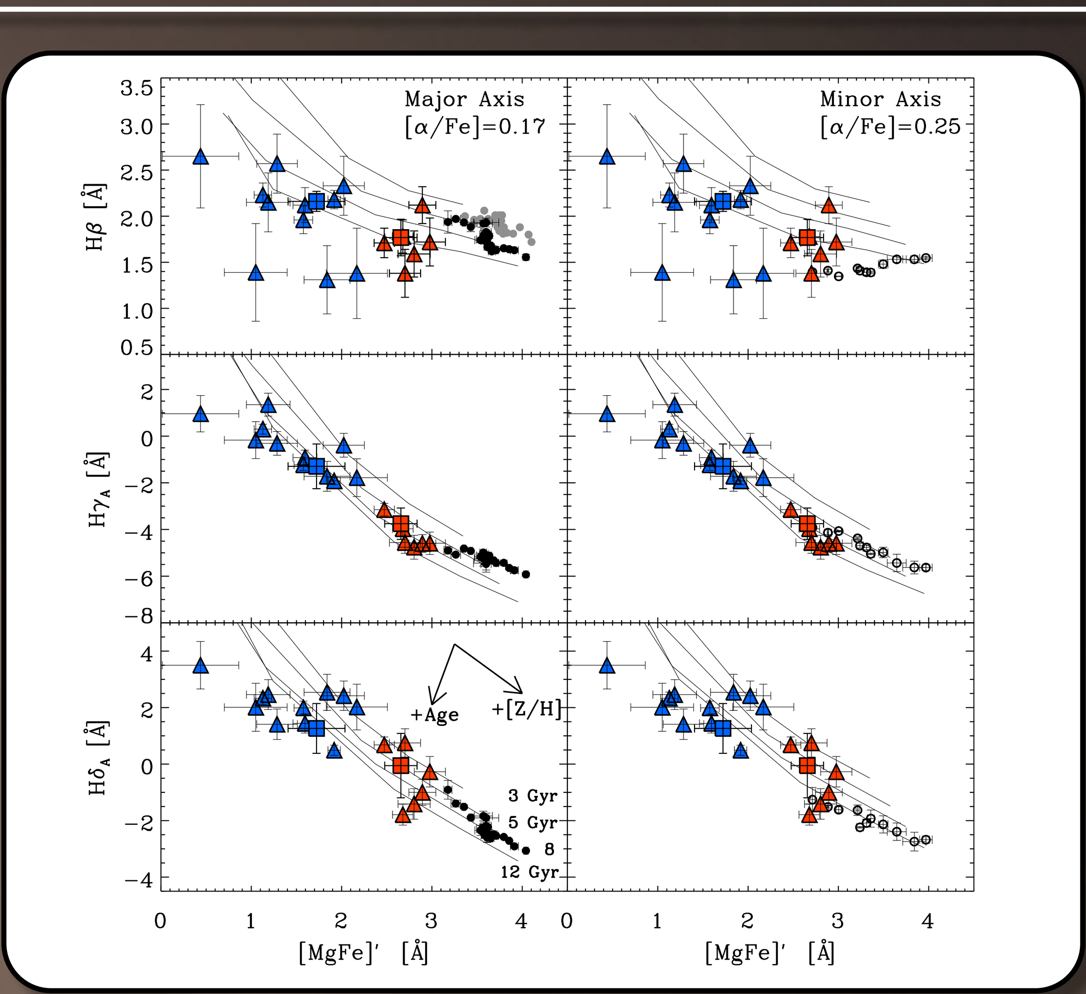
Introduction

Globular cluster systems of galaxies are useful probes of the formation histories of galaxy spheroids under the assumption that the stellar content of GCs traces the majority of stars that form at the same epoch as the cluster.

To investigate the validity of this assumption we have investigated the stellar content of the nearby S0 galaxy NGC 3115 using the GMOS instrument on the Gemini-North telescope.

Data reduction was carried out using the standard Gemini-IRAF routines.

We have measured kinematics and line-strength indices for the major and minor axes which allows us to probe both the structure of the galaxy and its stellar content.



Figs. 5. Age-metallicity diagnostic plots for the binned major and minor axes. Symbols are as in Fig. 2. Overplotted are models from Thomas et al. (2003,2004) with [α/Fe] indicated in top right corner.

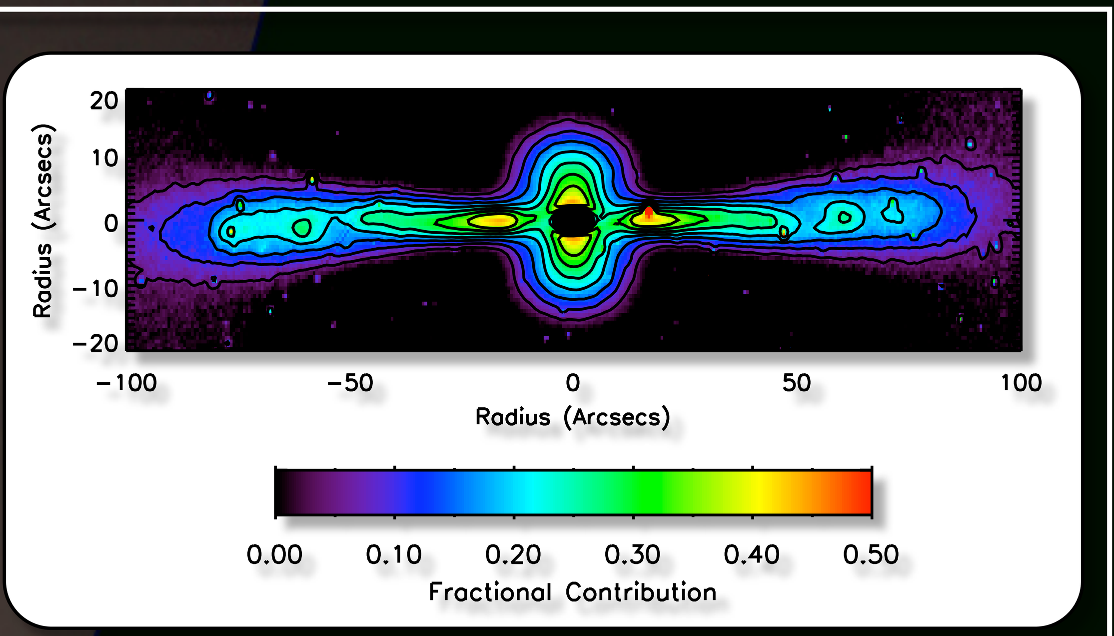


Fig. 6. The fraction of flux provided by the disc component in the *i* band.

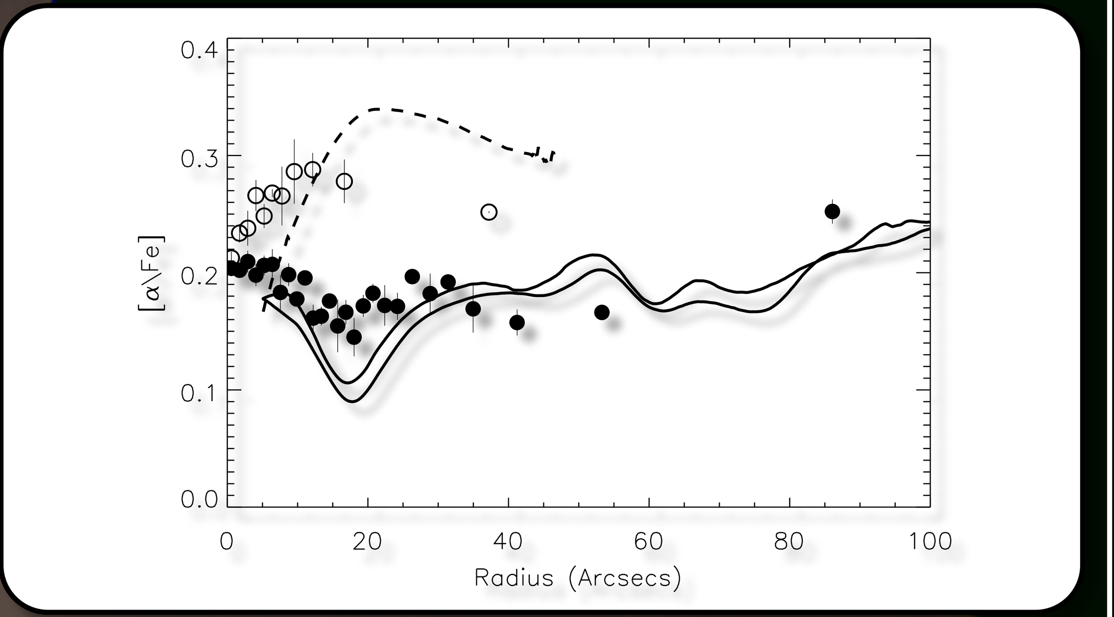


Fig. 7. Model predictions for variation in [α/Fe] for major (black lines) and minor (dashed line) axes. Model assumes [α/Fe] = 0.0 for disc and 0.3 for spheroid with their relative contributions of the disc and spheroid components obtained from Fig. 6. Circles are binned galaxy data.

Results

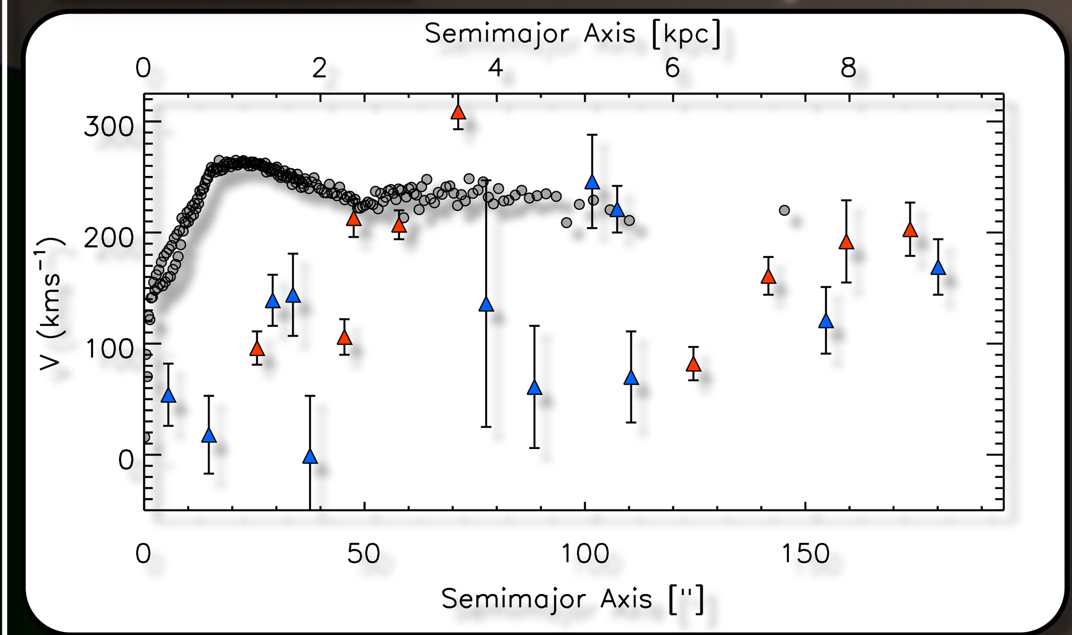


Fig. 1. Major axis rotation curve. GC velocities (triangles) from Kuntschner et al. (2002) projected onto the major axis. 21 of 26 GCs rotate in a prograde manner.

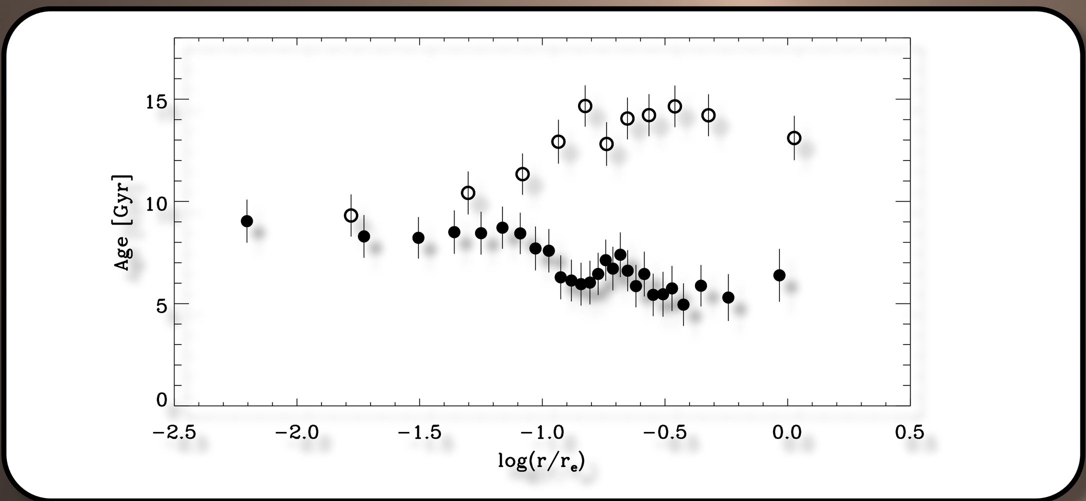


Fig 4. Ages determined by fitting the Hβ,Fe5015,Mgb,Fe5270 and Fe5335 indices to the models of Thomas et al. (2003,2004). Black circles major axis, white circles minor axis. The GCs have ages consistent with 12Gyr ± 2Gyr.

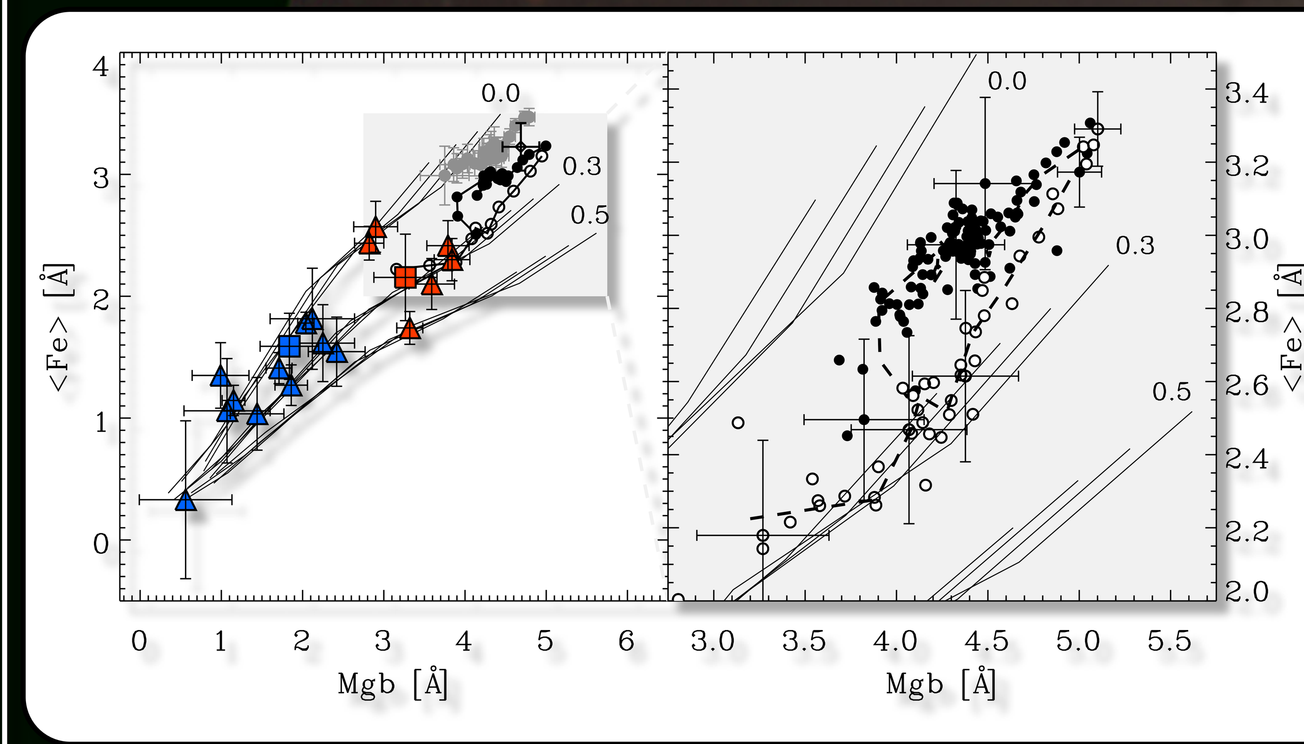


Fig. 2. [α/Fe] ratios of the galaxy data and GCs. In left hand panel filled and open black circles are binned major and minor axis galaxy data respectively. Filled grey circles major axis data from Fisher et al. (1996). Triangles are GC values, and squares are error weighted means of the GC populations. Over-plotted are models by Thomas et al. (2003,2004) labeled by [α/Fe]. Right hand panel shows the unbinned galaxy data.

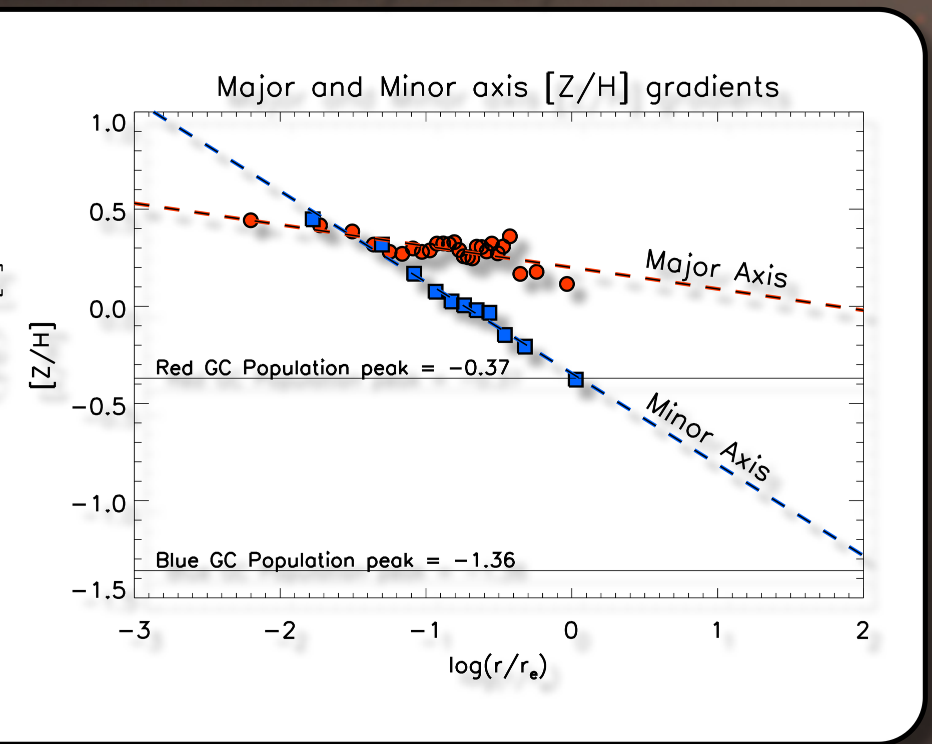


Fig. 3. [Z/H] gradients for the major and minor axes as measured by fitting the Hβ,Fe5015,Mgb,Fe5270 and Fe5335 indices to the models of Thomas et al. (2003,2004). Also plotted are the [Z/H] values of the peaks of the bimodal GC population (Kundu & Whitmore (1998)). The major axis clearly shows evidence for the presence of a higher metallicity population.

Conclusions

- NGC 3115 has a significant stellar disc, which is kinematically and chemically distinct from the surrounding spheroid.
- The spheroid of NGC 3115 appears uniformly old ~10 − 12 Gyr age with [α/Fe] of 0.2 − 0.3. It is consistent in age, [α/Fe] and [Z/H] with the red GC subpopulation, hinting at a common origin for the two.
- The major axis displays clear evidence for contamination by a younger (5-8 Gyr), more chemically enriched stellar disc.
- Previously observed discrepancies in age determination between the Hβ and higher order Balmer lines for the GC population can largely be explained by changes in the higher order Balmer lines due to varying [α/Fe].
- The GC system displays clear evidence for prograde rotation in the same sense as the disc and spheroid components.

References

Kuntschner H., Ziegler B. L., Sharples R. M., Worthey G., Fricke K. J., 2002, A&A, 395, 761

Kundu A., Whitmore B. C., 1998, AJ, 116, 2841

Silva D. R., Boroson T. A., Thompson I. B., Jedrzejewski R. I., 1989, AJ, 98, 131

Thomas D., Maraston C., Bender., 2003, MNRAS, 339,897

Thomas D., Maraston C., Korn A., 2004, MNRAS, 351, L19

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