Chemically Self Consistent Isochrones of the Globular Cluster NGC 2808

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A Multi-wavelength View On Globular Clusters Near and Far From JWST to the ELT

Abstract

The inferred helium mass fraction of multiple populations in globular clusters can vary signifigantly from older to younger populations. As the origin of these MPs remains an open question, and one which is sensitive to the population - population compositional differences, the extent of the composition variations is a key parameter when constraining formation channels. Many metal abundances may be directly measured spectroscopically; however, helium abundances are not directly observable in GCs. Instead, helium abundances are inferred from stellar models. It is therefore important to build stellar models which are chemically self-consistent between the structure, atmosphere, and opacities. In this work we present the first chemically self-consistent stellar models of the Milky Way Globular Cluster NGC 2808. We find that the helium abundance of the second generation of stars is higher than the first generation by SOME AMOUNT

Updating Atmosphers

For much of a stars radius ($\log(R) \approx -1.5$), OPAL and OPLIB opacities vary by up to approximately 2%. We calibrate a solar model (above) to confirm that variations of this order do not dramatically alter a solar model's evolutionary path.

These small variations may be more impactful for stars at or near the convective transition mass. The interior structure, which is believed to result in the Jao Gap, of such stars is very sensitive to temperature; therefore, small changes in opacity may be more impactful than in higher mass models.

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References

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Fiducial Measurment

In order to measure the subtle number density variations seperating populations along the Main Sequence we make use of a novel, convex-hull based, adaptive binning approach. This algorithm keeps the number of stars per bin uniform. An example of the density estiamte produced by this algorithm is showin in Figure 1. Note how the sequences stand out clearly in the density plot.

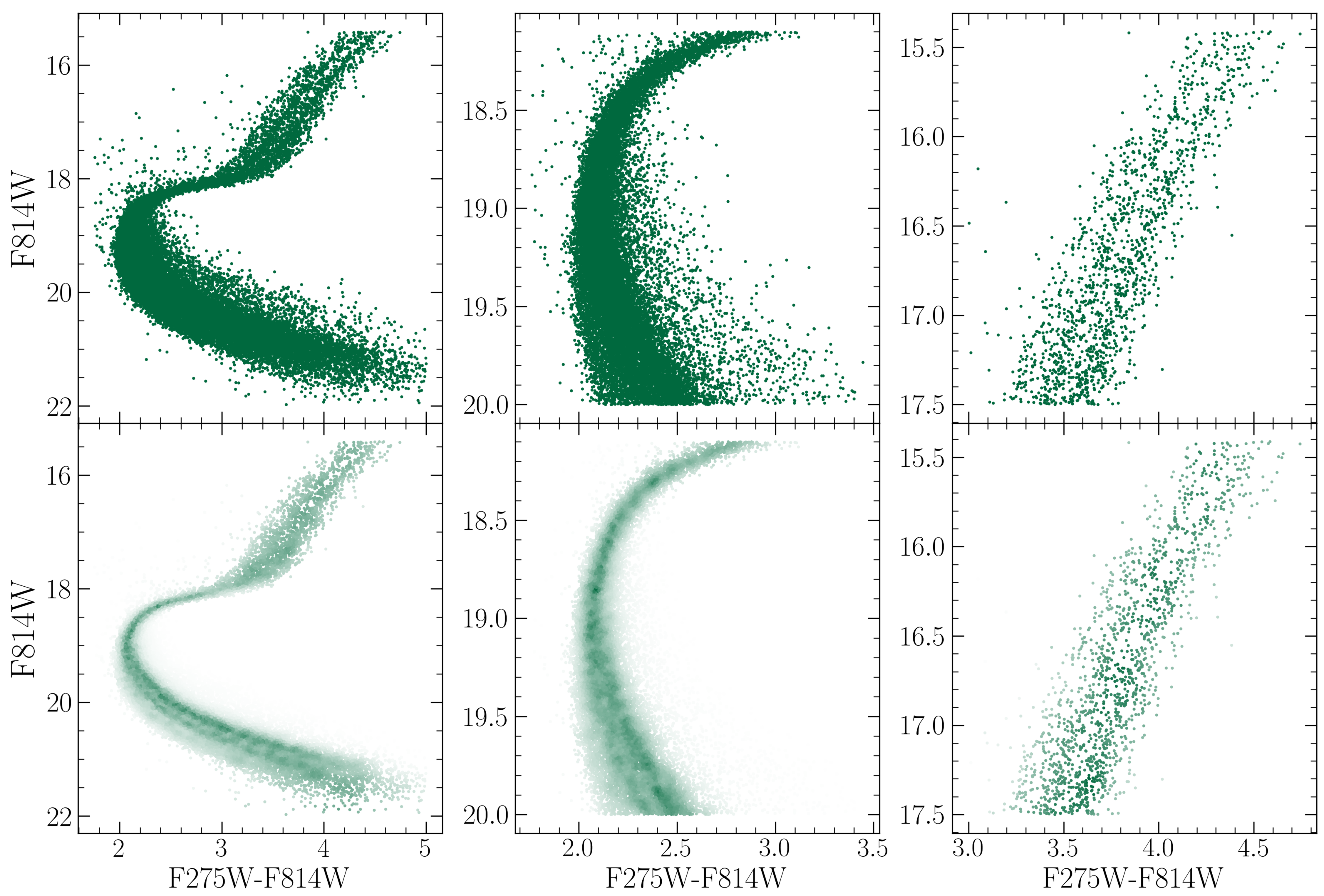

Fig. 1: NGC 2808 CMD from the HUGS survey after data quality cuts have been applied (top). Number density of stars in the CMD of NGC 2808 (bottom). Darker regions are more dense.

In order to trace the sequences we use Baysian Gaussian Mixture Modeling and the Diecrelt Process to fit the color-density profile over a series of magnitude bins. This eliminats the need for a prior on exact the number of populations, instead only requiring the max number of populations to be defined. Traced fiducial lines for NGC 2808 two most extreme populations (A&E in Milone et al. 2015) are showin in Figure 2.

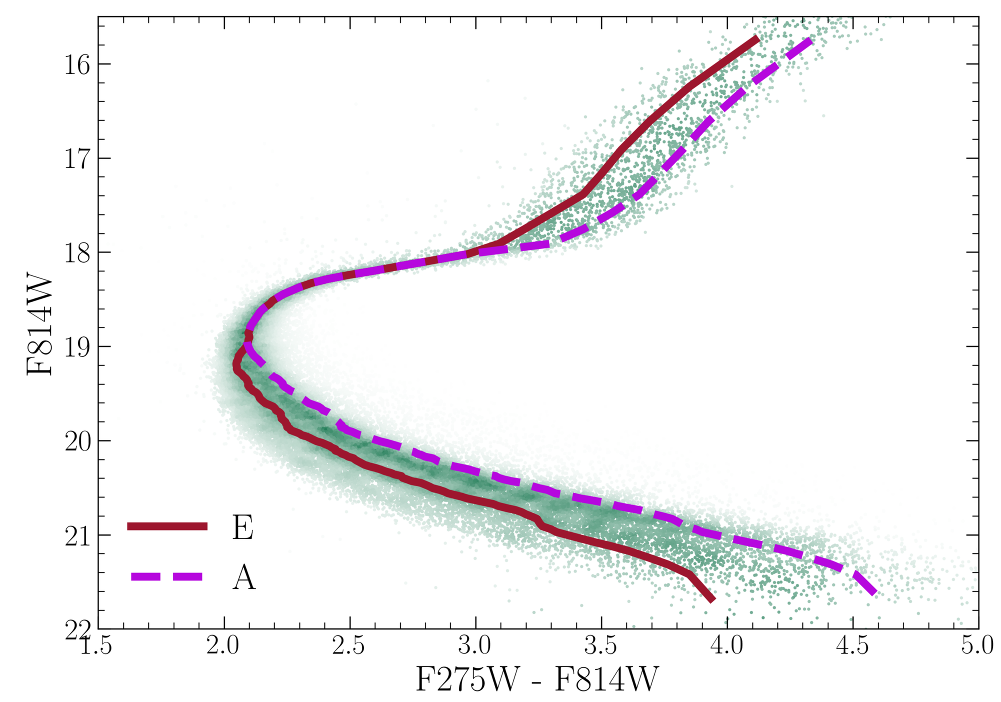

Fig. 2: NGC 2808 populations A & E median ridge lines measured using fidanka.