

GALEX Science: Super-Helium-Rich Populations in Globular Clusters

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Recent observations for the color magnitude diagrams (CMDs) of the massive globular cluster Omega Centauri have shown that it has a striking double main sequence (MS), with a minority population of bluer and fainter MS well separated from a majority population of MS stars. Here we confirm, with the most up-to-date Y^2 isochrones, that this special feature can only be reproduced by assuming a large variation ($dY = 0.15$) of primordial helium abundance among several distinct populations in this cluster. We further show that the same helium enhancement required for this special feature on the MS can by itself reproduce the extreme horizontal-branch (HB) stars observed in Omega Cen, which are hotter than normal HB stars. Similarly, the complex features on the HBs of other globular clusters, such as NGC 2808, are explained by large internal variations of helium abundance. Supporting evidence for the helium-rich population is also provided by the far-UV (FUV) observations of extreme HB stars in these clusters, where the enhancement of helium can naturally explain the observed fainter FUV luminosity for these stars. The on-going UV observations with GALEX will reveal whether the similar trend is observed in other globular clusters as well. The presence of super-helium-rich populations in some globular clusters suggests that the third parameter, other than metallicity and age, also influences CMD morphology of these clusters.