EVIDENCE FOR AN OLD GALACTIC BULGE FROM RR LYRAE STARS IN BAADE'S WINDOW: THE INSIDE-OUT PICTURE OF GALAXY FORMATION

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In their recent, high-quality spectroscopic observations of 59 RR Lyrae stars in Baade's window field of the Galactic nuclear bulge, Walker and Terndrup (1991) found that the metallicity distribution for their whole sample is sharply peaked at [Fe/H] = -1.0. Comparison of their data with the sample of halo RR Lyraes (Suntzeff et al. 1991) suggests that the metallicity at which the stellar population is most likely to form RR Lyraes increases with decreasing galactocentric distance.

The horizontal-branch (HB) model calculations indicate that this is what one would expect if the radial variation in HB morphology observed in the halo continues to the very center of the Galaxy. In particular, the observed peak of the bulge RR Lyrae abundance distribution at [Fe/H] = -1.0 can only be reproduced by the unique relationship between the HB type and [Fe/H] that is shifted to the right of the mean relationship for inner halo globular clusters (see Fig. 7a of Lee 1991).

If age is indeed the second parameter, as supported by recent work, this provides evidence, for the first time, that the oldest stellar population in the Galactic nuclear bulge is indeed older than that in the halo, perhaps by 1-1.5 Gyr. Other possibilities, such as high helium abundance (Y) or high core rotation rate for RR Lyrae stars in the bulge can be ruled out from the analyses of the periods of RR Lyraes. Also, the variations in CNO abundances affect the main-sequence turnoff and HB in the opposite way of what is needed to explain the observations of globular clusters in the halo (see Lee et al. 1988, 1991; Lee 1991).

This implies that the bulge may have been the first part of our Galaxy to form, and then have served as a nucleus around which the rest of the Galaxy was built up from the inside out (see Larson 1990).

REFERENCES

Larson, R. B. 1990, *Publ. A. S. P.*, **102**, 709.
Lee, Y.-W. 1991, in ASP Symp., *The Formation and Evolution of Star Clusters*, ed. K. Janes (San Francisco: ASP), p. 205.
Lee, Y.-W., Demarque, P., and Zinn, R. 1988, in *Calibration of Stellar Ages*, ed. A. G. D. Philip (Schenectady: Davis), p. 141.
Lee, Y.-W., Demarque, P., and Zinn, R. 1991, *Ap. J.*, submitted.
Suntzeff, N. B., Kinman, T. D., and Kraft, R. P. 1991, *Ap. J.*, **367**, 528.
Walker, A. R., and Terndrup, D. M. 1991, *Ap. J.*, **378**, 119.