

# The distance to the young open cluster Westerlund 2

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A new X-ray,  $UBVR_c$ , and  $JHK_s$  study of the young cluster Westerlund 2 was undertaken to resolve discrepancies tied to the cluster's distance. Existing spectroscopic observations for bright cluster members and new multi-band photometry imply a reddening relation towards Westerlund-2 described by  $E_{(U-B)}/E_{(B-V)} = 0.63 + 0.02 E_{(B-V)}$ . Variable-extinction analyses for Westerlund-2 and nearby IC 2581 based upon spectroscopic distance moduli and ZAMS fitting yield values of  $R_V = A_V/E_{(B-V)} = 3.88 \pm 0.18$  and  $3.77 \pm 0.19$ , respectively, and confirm prior assertions that anomalous interstellar extinction is widespread throughout Carina (e.g., Turner 2012). The results were confirmed by applying the color difference method to  $UBVR_c JHK_s$  data for 19 spectroscopically-observed cluster members, yielding  $R_V = 3.85 \pm 0.07$ . The derived distance to Westerlund-2 of  $d = 2.85 \pm 0.43$  kpc places the cluster on the far side of the Carina spiral arm. The cluster's age is no more than  $\tau \sim 2 \times 10^6$  yr as inferred from the cluster's brightest stars and an X-ray (Chandra) cleaned analysis of its pre-main-sequence demographic. Four Wolf-Rayet stars in the cluster core and surrounding corona (WR20a, WR20b, WR20c, and WR20aa) are likely cluster members, and their inferred luminosities are consistent with those of other late-WN stars in open clusters. The color-magnitude diagram for Westerlund-2 also displays a gap at spectral type B0.5 V with associated color spread at higher and lower absolute magnitudes that might be linked to close binary mergers. Such features, in conjunction with the evidence for mass loss from the WR stars, may help to explain the high flux of  $\gamma$  rays, cosmic rays, and X-rays from the direction towards Westerlund-2.

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