

# Yellow Supergiants in the Andromeda Galaxy (M31)

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The yellow supergiant content of nearby galaxies can provide a critical test of stellar evolution theory, bridging the gap between the hot, massive stars and the cool red supergiants. But, this region of the color-magnitude diagram is dominated by foreground contamination, requiring membership to somehow be determined. Fortunately, the large negative systemic velocity of M31, coupled to its high rotation rate, provides the means for separating the contaminating foreground dwarfs from the (it bona fide) yellow supergiants within M31. We obtained radial velocities of about 2900 individual targets within the correct color magnitude range corresponding to masses of 12 $M_{\odot}$  and higher. A comparison of these velocities to those expected from M31's rotation curve reveals 54 rank 1 (near certain) and 66 rank 2 (probable) yellow supergiant members, indicating a foreground contamination  $\geq 96\%$ . We expect some modest contamination from Milky Way halo giants among the remainder, particularly for the rank 2 candidates, and indeed follow-up spectroscopy of a small sample eliminates 4 rank 2's while confirming 5 others. We find excellent agreement between the location of yellow supergiants in the H-R diagram and that predicted by the latest Geneva evolutionary tracks which include rotation. However, the relative number of yellow supergiants seen as a function of mass varies from that predicted by the models by a factor of  $>10$ , in the sense that more high mass yellow supergiants are predicted than are actually observed. Comparing the total number (16) of  $>20M_{\odot}$  yellow supergiants with the estimated number (24,800) of unevolved O stars indicates that the duration of the yellow supergiant phase is about 3000 years. This is consistent with what the 12 $M_{\odot}$  and 15 $M_{\odot}$  evolutionary tracks predict, but disagrees with the 20,000-80,000 year time scales predicted by the models for higher masses.

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Comments:

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