Blue luminous stars in nearby galaxiesâ€“ UIT 005: a possible link to the Luminous Blue Variable stage

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A detailed study of the blue supergiant UIT 005 (B2-2.5Ia+) in M33 is presented. The results of our quantitative spectral analysis indicate that the star is a very luminous, log $(L/L_odot)sim5.9$ dex, and massive, Msim50,M$_odot$, object, showing a very high nitrogen-to-oxygen ratio in its surface (N/Osim8, by mass).
Based on the derived Mg and Si abundances, we argue that this high N/O ratio cannot be the result of an initial low O content due to its location on the disk of M33, a galaxy known to present a steep metallicity gradient. In combination with the He abundance, the most plausible interpretation is that UIT005 is in an advanced stage of evolution, showing in its surface N enrichment and O depletion resulting from mixing with CNO processed material from the stellar interior.
A comparison with the predictions of current stellar evolutionary models indicates that there are significant discrepancies, in particular with regard to the degree of chemical processing, with the models predicting a much lower degree of O depletion than observed. At the same time, the mass-loss rate derived in our analysis is an order of magnitude lower than the values considered in the evolutionary calculations.
Based on a study of the surrounding stellar population and the nearby cluster, NGC588, using HST/WFPC2 photometry, we suggest that UIT005 could be in fact a runaway star from this cluster. Regardless of its origin, the derived parameters place the star in a region of the Hertzsprung--Russell diagram where Luminous Blue Variables are usually found, but we find no evidence supporting photometric or spectroscopic variability, except for small H$alpha$ changes, otherwise observed in Galactic B-type supergiants.
Whether UIT005 is an LBV in a dormant state or a regular blue supergiant could not be discerned in this study. Subsequent monitoring would help us to improve our knowledge of the more massive stars, bridging the gap between regular and more exotic blue supergiants.

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