A Rare Encounter with Very Massive Stars in NGC 3125-A1

Aida Wofford (1), Claus Leitherer (2), Rupali Chandar (3), and Jean-Claude Bouret (4)

1 -UPMC-CNRS, UMR7095, Institut dâ€™Astrophysique de Paris, F-75014, Paris, France
2- Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA
3- University of Toledo, Department of Physics and Astronomy, Toledo, OH 43606, USA
4- Aix Marseille Universite, CNRS, LAM (Laboratoire dâ€™Astrophysique de Marseille) UMR 7326, 13388, Marseille, France

Super star cluster A1 in the nearby starburst galaxy NGC 3125 is characterized by broad He II 1640 emission (full width at half maximum, FWHMâˆ¼1200 km sâˆ'1) of unprecedented strength (equivalent width, EW=7.1Â±0.4 AA). Previous attempts to characterize the massive star content in NGC 3125-A1 were hampered by the low resolution of the UV spectrum and the lack of co-spatial panchromatic data. We obtained far-UV to near-IR spectroscopy of the two principal emitting regions in the galaxy with the Space Telescope Imaging Spectrograph (STIS) and the Cosmic Origins Spectrograph (COS) onboard the Hubble Space Telescope (HST). We use these data to study three clusters in the galaxy, A1, B1, and B2. We derive cluster ages of 3-4 Myr, intrinsic reddenings of E(Bâˆ'V)=0.13, 0.15, and 0.13, and cluster masses of 1.7Ã—10^5, 1.4Ã—10^5, and 1.1Ã—10^5 MâŠ™, respectively. A1 and B2 show O V 1371 a massive stars, which is rarely seen in star-forming galaxies, and have Wolf-Rayet (WR) to O star ratios of N(WN5âˆ'6)/N(O)=0.23 and 0.10, respectively. The high N(WN5âˆ'6)/N(O) ratio of A1 cannot be reproduced by models that use a normal IMF and generic WR star line luminosities. We rule out that the extraordinary He II 1640 emission and O V 1371 absorption of A1 are due to an extremely flat upper IMF exponent, and suggest that they originate in the winds of very massive (>120MâŠ™) stars. In order to reproduce the properties of peculiar clusters such as A1, the present grid of stellar evolution tracks implemented in Starburst99 needs to be extended to masses >120MâŠ™.

Reference: Tentatively scheduled for the ApJ, February 10, 2014, V782 -
1 issue
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1312.5982

Comments:

Email: wofford@iap.fr