BOSTON UNIVERSITY

Boston University College of Arts & Sciences
Institute for Astrophysical Research

2022—2023 ASTROPHYSICS SEMINAR SERIES

The discovery and properties of binary-stripped helium stars

Massive stars stripped of their H-rich envelopes through mass transfer or common envelope ejection are thought to be the main progenitors of H-poor supernovae, to emit large amounts of hard ionizing radiation, and to constitute two necessary steps in the binary evolution pathways towards compact objects merging in gravitational wave events. Despite their importance, these stripped helium stars have remained elusive.

With new UV photometry combined with optical magnitudes, and follow-up optical spectroscopy, we identified a first sample of dozens of such stripped star systems in the Magellanic Clouds. We obtain estimates for their stellar parameters by fitting their optical spectra to a newly computed grid of helium star atmosphere models. Aligned with theoretical expectations, we find that stripped stars are hot (Teff~50-100 kK), compact (log g ~ 5), He-rich (Y_surf ~0.6-1), and H-poor (X_surf ~0-0.4). Furthermore, by matching the spectroscopic fits with the photometrical data, we find small radii (~1 Rsun), a range of luminosities (L ~ 1,000-100,000 Lsun), and masses that are sufficient to lead to core-collapse (~2-8 Msun). There are strong indications that the stellar winds are surprisingly weak, suggesting that binary-stripped helium stars are the main responsible for both IIb and Ib supernovae.

Apart from providing an observational anchor for both binary evolution models and simulations of common envelope ejection, this sample of stars prove that the full mass range of helium stars exists, forming a bridge between subdwarfs and Wolf-Rayet stars.

Monday, September 19th

3:30 - 4:30 p.m.

725 Commonwealth Ave | Room 502

Ylva Götberg

Carnegie Observatories