The Beginnings and Ends of Double White Dwarfs

Contribution ID: **5**

Type: **Talk**

Evolving R Coronae Borealis Stars with MESA

Friday, 5 July 2019 10:30 (20 minutes)

The R Coronae Borealis (RCB) stars are rare hydrogen-deficient, carbon-rich supergiants. They undergo extreme, irregular declines in brightness of many magnitudes due to the formation of thick clouds of carbon dust. Two scenarios have been proposed for the origin of an RCB star: the merger of a CO/He white dwarf (WD) binary and a final helium-shell flash. We constructed post-merger spherical models based on merger progenitor structures computed with the MESA code, and then followed the evolution into the region of the HR diagram where the RCB stars are located. We also investigated nucleosynthesis in the dynamically accreting material of CO/He WD mergers which may provide a suitable environment for significant production of ^{18}O and the very low ^{16}O/^{18}O values observed. Our MESA modeling consists of engineering the star by adding He-WD material to an initial CO-WD model, and then following the post-merger evolution using a nuclear-reaction network to match the observed RCB abundances as it expands and cools to become an RCB star. These new models are more physical because they include rotation, mixing, mass-loss, and nucleosynthesis within MESA. We follow the later evolution beyond the RCB phase to determine the stars' likely lifetimes. The relative numbers of known RCB and Extreme Helium (EHe) stars correspond well to the lifetimes predicted from the MESA models. In addition, most of computed abundances agree very well with the observed range of abundances for the RCB class.

Primary author: CHATZOPOULOS, Emmanouil (Louisiana State University)

Presenter: CHATZOPOULOS, Emmanouil (Louisiana State University)

Session Classification: Mergers