R Coronae Borealis Stars, Products of White-Dwarf Mergers

R Coronae Borealis (RCB) stars form a small class of cool, carbon-rich supergiants that have almost no hydrogen. They undergo extreme, irregular declines in brightness of up to 8 magnitudes due to the formation of thick clouds of carbon dust. It is thought that RCB stars result from the mergers of CO/He white-dwarf binaries. A concerted effort is being made to discover all the RCB stars in the Galaxy, using a series of IR color-color cuts, including the recent release of the WISE All-Sky Catalog. With this technique, we have discovered 40 new RCB stars bring the total known to almost 150. We are using a combination of 3D-hydrodynamics codes and the 1D MESA (Modules for Experiments in Stellar Astrophysics) stellar evolution code including nucleosynthesis to construct post-merger spherical models based on realistic merger progenitors and on our hydrodynamical simulations, and then following the evolution into the region of the HR diagram where RCB stars are located. We are investigating nucleosynthesis in the dynamically accreting material of CO/He WD mergers which may provide a suitable environment for significant production of 18O and the very low 16O/18O values observed. Solving the mystery of how the RCB stars evolve will lead to a better understanding of other important types of stellar merger events such as Type Ia SNe.