Hydrodynamic simulations of WD-WD mergers and the origin of RCB stars

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We study the properties of double white dwarfs (DWD) mergers by performing hydrodynamic simulations using the new and improved adaptive mesh refinement code Octo-Tiger. We follow the orbital evolution of DWD systems of mass ratio $q = 0.7$ for tens of orbits until and after the merger in order to investigate them as a possible origin for R Coronae Borealis (RCB) type stars. We reproduce previous results, finding that during the merger the Helium WD donor star is tidally disrupted onto the accretor Carbon-Oxygen WD, creating a shell of high temperature around the accretor. We investigate the possible Helium burning in this shell as well as the general structure of the merged object. Specifically, we are interested in the amount of Oxygen-16 dredged-up to the hot shell and the amount of Oxygen-18 produced. This is critical as the discovery of very high Oxygen-18 to Oxygen-16 ratios in RCB stars pointed out the merger scenario as a favourable explanation to their origin. In addition, we perform a resolution study in order to reconcile the difference found in the amount of oxygen-16 dredge-up between smooth particle hydrodynamic and grid-based simulations. Finally, we measure Octo-Tiger performance, showing superior scalability thanks to the usage of HPX (High Performance ParalleX) for its parallelisation, and a considerable speed-up due to an upgraded accelerator utilization.