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The merger of binary white dwarf–neutron stars: Simulations in full general relativity VASILEIOS PASCHALIDIS, YUK TUNG LIU, ZACHARIAH ETIENNE, STUART SHAPIRO, University of Illinois at Urbana-Champaign — Using the pseudo-white dwarf (pWD) approximation we perform hydrodynamic simulations of binary white dwarf–neutron star (WDNS) late inspiral and merger in full GR. The initial binary is in circular orbit at the Roche limit. The goal is to determine the ultimate fate of such systems. We focus on binaries whose total mass exceeds the maximum mass ($M_{\rm max}$) a cold, degenerate equation of state can support against gravitational collapse. Our simulations of a pWDNS system with a $0.98M_\odot$ WD and a $1.4M_\odot$ NS show that the merger remnant is a spinning Thorne-Zytkow-like Object (TZlO) surrounded by a massive disk. The final total rest mass exceeds $M_{\rm max}$, but the remnant does not collapse promptly. To assess whether the object will ultimately collapse after cooling, we introduce radiative thermal cooling. When we cool the spinning TZlO, the remnant does not collapse, demonstrating that differential rotational support is sufficient to prevent collapse. Given that the final total mass exceeds $M_{\rm max}$, magnetic fields and/or viscosity may redistribute angular momentum and ultimately lead to delayed collapse to a BH. We infer that the merger of realistic massive WDNS binaries likely will lead to the formation of spinning TZlOs that undergo delayed collapse.

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