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The lowest-mass stellar black holes: catastrophic death of neutron stars in gamma-ray bursts RICHARD O'SAUGHNESSY, Penn State University, KRISTOF BELCZYNSKI, Los Alamos National Lab, VASSILIKI KALOGERA, Northwestern University, FRED RASIO, RON TAAM, THOMAS BULIK — Mergers of double neutron stars are considered the most likely progenitors for short gamma-ray bursts. Indeed such a merger can produce a black hole with a transient accreting torus of nuclear matter and the conversion of the torus mass-energy to radiation can power a gamma-ray burst. Using available binary pulsar observations supported by our extensive evolutionary calculations of double neutron star formation, we demonstrate that the fraction of mergers that can form a black hole – torus system depends very sensitively on the (largely unknown) maximum neutron star mass. We show that the available observations and models put a very stringent constraint on this maximum mass under the assumption that a majority of short gamma-ray bursts originate in double neutron star mergers. Specifically, we find that the maximum neutron star mass must be within 2–2.5 Msun. Moreover, a single unambiguous measurement of a neutron star mass above 2.5 Msun would exclude double neutron star mergers as short gamma-ray burst progenitors.

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