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One-arm Spiral Instability in Hypermassive Neutron Stars Formed by Dynamical-Capture Binary Neutron Star Mergers[1] VASILEIOS PASCHALIDIS, Princeton University, WILLIAM E. EAST, KIPAC, Stanford University, SLAC, FRANS PRETORIUS, Princeton University, STUART L. SHAPIRO, University of Illinois at Urbana-Champaign — Using general-relativistic hydrodynamical simulations, we show that merging binary neutron stars can form hypermassive neutrons stars that undergo the one-arm spiral instability. We study the particular case of a dynamical capture merger where the stars have a small spin, as may arise in globular clusters, and focus on an equal-mass scenario where the spins are aligned with the orbital angular momentum. We find that this instability develops when post-merger fluid vortices lead to the generation of a toroidal remnant – a configuration whose maximum density occurs in a ring around the center-of-mass – with high vorticity along its rotation axis. The instability quickly saturates on a timescale of ~ 10 ms, with the $m = 1$ azimuthal density multipole mode dominating over higher modes. The instability also leaves a characteristic imprint on the post-merger gravitational wave signal that could be detectable if the instability persists in long-lived remnants.

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