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Hydrodynamical instabilities in core collapse supernovae and differentially rotating proto-neutron stars SHANGLI OU, Louisiana State University, JOEL TOHLINE — We present results from three-dimensional hydrodynamic simulations of the development of nonaxisymmetric structure in two related scenarios: the post-bounce core of a massive star based on the work of Ott et al. (2005); and differentially rotating, proto-neutron stars (NS). A one-armed, m=1 spiral instability, which was found by Centrella et al. (2001) in n=3.33 polytropes, arises in both cases. Further investigations strongly suggest that this instability is directly triggered by corotation points residing inside cores with strong differential rotation. This instability is also capable of transporting angular momentum from the inner regions to the outer regions of the core, which may help to explain why proto-NSs have smaller spin rates compared to earlier predicted values. The instability is not limited to the m=1 mode, but may also arise in higher order (e.g., m=2 and 3) modes, as long as their corotation points exist inside the newly formed core. This superposition/mixture of multiple unstable modes within a single core or proto-NS is consistent with the linear analysis presented by Watts et al.(2004). Gravitational waves from such scenarios are in general not monochromatic. The possible influence of magnetorotational instability (MRI) on the development of these modes is discussed. This work has been supported, in part, by NSF grants AST-0407070 and PHY-0326311, and by the Center for Computation and Technology at LSU.

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