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MHD-driven Supernovae in Three Dimensions

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Core-collapse in rapidly rotating, strongly magnetized progenitors may power some of the most luminous supernovae we observe and possibly set the stage for a subsequent long gamma-ray burst. I will present results of two sets of new three-dimensional (3D) general-relativistic magnetohydrodynamic simulations of core collapse in these progenitors: First, I will discuss how an m=1 kink instability of the ultra-strong toroidal magnetic field affects jet stability and the dynamics, geometry and signature of MHD-driven explosions. In the second part, I will discuss MHD turbulence and its impact on the global field structure in the post-bounce evolution of rapidly rotating proto-neutron stars.