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Gravitational Waves and Protoneutron Star Oscillations in Rotating Core-Collapse Supernovae[1] HANNAH KLION, CHRISTIAN OTT, Caltech, ERNAZAR ABDIKAMALOV, Nazarbayev University, JIM FULLER, Caltech
— In the milliseconds following the core bounce of a rapidly rotating core-collapse supernova, there are correlated oscillations at 700-800 Hz in the central density of the protoneutron star and in the emitted neutrino and gravitational wave signals. It has been hypothesized that these oscillations arise from an excited non-linear quadrupolar mode of the protoneutron star. Using a 3D general-relativistic hydrodynamic code, we further study these oscillations by simulating the iron core collapse of a $12\,M_\odot$ progenitor in an octant of the 3D cube with periodic boundaries in the azimuthal direction. We study the initial rotational configurations that lead to correlated oscillations and the relationship between the oscillation frequency and properties of the progenitor and protoneutron star. We find that the oscillation frequency increases monotonically with the post-bounce rotation rate. To better understand the effect of rotation on the oscillation modes, we also study the modes of protoneutron star models in rotational equilibrium.

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