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Distinguishing Signatures of Prompt Convection in Core-Collapse Supernovae Using Coherent WaveBurst Gravitational Wave Searches

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Core collapse supernovae (CCSNe) are the explosive deaths of massive stars, followed by the formation of a proto-neutron star. Gravitational wave signals from these extremely compact objects can simultaneously inform macroscopic and microscopic physics, ranging from modeling what powers supernovae to constraining the nuclear equation of state. As the inner core of the collapsing star becomes denser, degeneracy pressure causes the core to stiffen, which halts collapse and triggers a rebound of the inner core. A dynamical shock wave propagates outward, causing prompt convection. This convection emits a high-frequency gravitational wave. In this project, we develop a method to distinguish the prompt convection region from other CCSN explosion stages. We use the model-independent coherent WaveBurst search algorithm and perform the analysis in the time-frequency space.

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