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Observing Gravitational Waves from the Next Nearby Core-Collapse Supernova

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The next galactic core-collapse supernova (CCSN) has already exploded, and its electromagnetic waves, neutrinos, and gravitational waves may arrive at any moment. We present a method for detecting GWs from CCSNe with a network of ground-based laser interferometers, triggered by electromagnetic or neutrino observations. Using such triggers, the uncertainty in the signal arrival time is greatly reduced and the source's sky position is constrained, limiting the relevance of the non-Gaussian detector noise background. Employing an excess-power search algorithm, we present sensitivity estimates for GW signals predicted by six different emission models, in the context of the first and second-generation of ground-based GW detectors. Furthermore, we discuss the prospects for constraining the CCSN explosion mechanism from GW signals, using Bayesian model selection, and introduce preliminary work on parameter estimation to uncover previously unattainable knowledge about the progenitor star of the CCSN.

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