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Inferring physical properties of stellar collapse by third-generation gravitational-wave detectors CHAITANYA AFLE, DUNCAN BROWN, Syracuse University — Galactic core-collapse supernovae are among the possible sources of gravitational waves. We investigate the ability of gravitational-wave detectors to extract the properties of the collapsing progenitor from the gravitational waves radiated. We use simulations of supernovae that explore a variety of progenitor core rotation rates and nuclear equations of state and use principal component analysis of the simulation catalog to determine the dominant features of the waveforms and create a map between the measured properties of the waveform and the physical properties of the progenitor, namely the ratio of the progenitors core rotational kinetic energy to potential energy (β) and the post bounce oscillation frequency (f-peak). We use Bayesian parameter inference and the map to calculate posteriors for the physical properties given a gravitational-wave observation. For a supernovae at the distance of the galactic center with $\beta = 0.02$ our method can estimate β with a 90% credible interval of 0.004 for Advanced LIGO, and 0.0008 for Cosmic Explorer. We demonstrate that if $\beta > 0.02$ for a source within the Milky Way observed by Cosmic Explorer, our method can also extract f-peak to a precision of within 5Hz allowing us to constrain the nuclear equation of state.

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