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Inferring Core-Collapse Supernova Physics with Gravitational Waves PETER KALMUS, Caltech — Stellar collapse and the subsequent development of a core-collapse supernova explosion emit bursts of gravitational waves (GWs) that might be detected by the advanced generation of laser interferometer gravitational-wave observatories such as advanced LIGO, advanced Virgo, and LCGT. GW bursts from core-collapse supernovae encode information on the intricate multi-dimensional dynamics at work at the core of a dying massive star and may provide direct evidence for the yet uncertain mechanism driving supernovae in massive stars. Recent multi-dimensional simulations of core-collapse supernovae exploding via the neutrino, magnetorotational, and acoustic explosion mechanisms have predicted GW signals which have distinct structure in both the time and frequency domains. Motivated by this, we describe a method for determining the most likely explosion mechanism underlying a hypothetical GW signal, based on Principal Component Analysis and Bayesian model selection. Using simulated advanced LIGO noise and assuming a single detector and linear waveform polarization for simplicity, we demonstrate that our method can correctly identify magnetorotational explosions throughout the Milky Way and explosions driven by the neutrino and acoustic mechanisms to $\sim$2 kpc.

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