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Gravitational Waves Core-Collapse Supernova Science with Advance and Third Generation Interferometers

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Core-Collapse Supernovae(CCSNe) are the spectacular and violent deaths of massive stars. The study of Gravitational Waves (GW) from CCSNe give us information about the physical properties of the collapsed core and elucidate the explosion mechanism and can help elucidate the explosion mechanism as well unknown physics (silent supernovae or quark stars). I will review the state-of-art techniques used to search for GW from CCSNe and current work on detection perspectives with future GW Observatories. The reconstruction of the waveform and extraction of physical information is a difficult task. It requires a deep understanding of multi-dimensional CCSN simulations, data analysis caveats, detector response, as well as understanding how insights provided by neutrino and electromagnetic messengers help us extract GW signals from the detector noise. In the LIGO/Virgo Supernova Working Group we work on all aspects leading to direct detection of GW from CCSN and extracting physical information. I will talk about properties of the CCSN waveforms, their deterministic and non-deterministic components, algorithm development that uses the deterministic features (like g-modes) used to increase the visible distance for CCSN detection. I will also review the detection range, future algorithm developments and detection capabilities with the designs of future detector configurations.

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