Gravitational Waves from Core-Collapse Supernovae

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In the last few years, we have seen the emergence of fully three-dimensional simulations of core-collapse supernovae. Recently, several successful explosions have been obtained in the so neutrino-driven paradigm. Simulations from different groups around the world appear to converge and agree on general properties of the collapse of stellar cores. From such simulations, we can make theoretical predictions of the gravitational waves we expect to observe from core-collapse supernovae. In my talk, I will present gravitational wave signals from two sets of three-dimensional models. First I will discuss what we expect if the progenitor star is non-rotating and then I will present results for progenitors with realistic rotation rates. The gravitational wave strain as a function of time seems stochastic at first. However, in the time-frequency domain clear signals components can be seen. I will discuss the underlying hydrodynamical processes that generate these signal components and what a hypothetical observation of such a signal would tell us about the still not fully understood core-collapse scenario. Reconstructing the time-frequency structure of a detected signal will be crucial, a good understanding of the theoretical predictions can be useful when developing pipelines to detect and reconstruct signals from core-collapse supernovae. At the end of my talk, I will touch upon recent progress in the area of signal reconstruction.