

APR13-2013-000346

Abstract for an Invited Paper
for the APR13 Meeting of
the American Physical Society

Gravitational waves from binaries and dense stellar clusters

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It is an exciting time for gravitational wave astrophysics! The LIGO and Virgo gravitational wave detectors are currently undergoing an upgrade that will improve their sensitivity by a factor of about 10. At this “advanced” sensitivity, it is likely that they will detect at least one gravitational wave signal from a coalescing compact binary per year; it is possible that detection rates may be several hundred times that. Many of these sources are possibly formed in dense stellar environments—though the exact rates of field and cluster formation are uncertain. I will discuss the state-of-the-art in extracting information about the binary system’s properties from these signals and what this information can tell us about the formation environment of the coalescing objects. I will review our current knowledge—and uncertainty—about the formation mechanisms of these objects, highlighting the ways that gravitational wave observations can inform our understanding. Finally, I will discuss some recent modeling results that run contrary to decades old assumptions about the formation of binary black hole gravitational wave sources in globular clusters and the implications for gravitational wave astronomy.