

BLACK HOLES IN DENSE STAR CLUSTERS
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TITLE: Gravitational-Wave Detection of Massive Stellar Black Hole Binaries

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If binaries consisting of two ~ 100 solar mass black holes exist, they will serve as extraordinarily powerful gravitational-wave sources detectable to redshifts of $z \sim 2$ with the advanced LIGO/Virgo ground-based detectors. Large uncertainties about the evolution of massive stars preclude definitive rate predictions for mergers of these massive black holes. We show that rates as high as hundreds of detections per year, or as low as no detections whatsoever, are both possible. Although we find that direct formation of such binaries may be rare, the high multiplicity of massive stars, and their common formation in relatively dense stellar associations, open up dynamical channels for massive black hole mergers (e.g., via Kozai cycles or repeated binary-single interactions). We identify key physical factors that shape the population of very massive black hole-black hole binaries. Advanced gravitational-wave detectors will provide important constraints on the formation and evolution of very massive stars.