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Distinguishing between stellar and primordial black hole merger events

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Following the first Advanced LIGO detection, several studies investigated the possibility that GW150914 was of primordial origin and could provide evidence that stellar-mass black holes form part of dark matter. The support for the primordial hypothesis is extremely circumstantial. However, these studies raise an interesting question: how can one confirm or refute the primordial hypothesis for black hole binaries with stellar masses? In this study, we attempt to answer the questions: what would constitute smoking-gun evidence for (stellar-mass) primordial black holes, and what detector sensitivity is required to achieve this goal? We show that a population of primordial black holes can be reliably identified using measurements of redshift. We quantify what fraction of events would need to originate from a primordial population in order to differentiate between the progenitor populations using current and planned detectors.

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