The impact of astrophysical population model choices on post-Newtonian deviation tests of general relativity

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The Laser Interferometer Gravitational-wave Observatory detects gravitational waves and uses them to test the theory that predicts their existence: Einstein's theory of general relativity. Testing general relativity using gravitational waves can be done at the individual event level and the population level. Most current tests of general relativity are not inferred jointly with a population model to describe the astrophysical distribution of the sources. The omission of a population model describing the astrophysical population of binary black hole mergers inscribes an implied population model that may be inaccurate. This inaccurate population model could lead to biases in supposed deviations from general relativity. This investigation used injected signals of simulated binary black hole systems to infer the probability distributions for population model parameters. These probability distributions are constructed using Markov Chain Monte Carlo analysis. A family of mass population models was injected and recovered using each of the different models as the population distribution to determine whether biases in deviations from general relativity and population misspecification can be observed. Further research is needed as more gravitational wave events are detected and our understanding of the mass population distribution evolves.