The optimal filter for testing general relativity with gravitational waves

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Many proposed tests of general relativity using gravitational waves involve matching model waveforms to a limited time slice of a signal. For example, no-hair theorem tests involve using quasi-normal modes as a template waveform, which only model the post-merger part of a binary black hole signal. In such tests the time slice to analyze is itself an unknown parameter that must be estimated. The standard likelihood function used in gravitational-wave astronomy yields biased results in these situations, since the function assumes that the template waveform models the entire observable signal. Many methods have been proposed to try to control for this bias. In this talk I present a new likelihood function which naturally excludes times that are not well modelled by a template waveform. This can be used for tests of general relativity, as well as any situation in which some segment of a signal is not well modelled.