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Gravitational waves from compact objects inspiralling into massive black holes

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A key source for LISA is the inspiral of compact objects into massive black holes. We review the useful information the gravitational waves will carry, and discuss recent progress in theoretical modeling of the gravitational waveforms. For these sources the radiation reaction timescale is longer than the orbital timescale by the ratio of the masses, so the inspiral is adiabatic. The leading order, adiabatic waveforms are those waveforms for which instantaneous errors are of order the mass ratio, and cumulative phase errors over the entire inspiral scale as the zeroth power of the mass ratio (i.e. are of order unity). Recently Yasushi Mino has shown that generic adiabatic waveforms can be computed using for the radiation reaction force the gradient of one half the difference between the retarded and advanced metric perturbations. We describe an explicit computational procedure for obtaining waveforms based on Mino's result, and argue that the computed waveforms will be sufficiently accurate for signal detection with LISA. Data-analysis templates will require higher accuracy, going beyond adiabaticity; this remains a significant challenge.