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Precision Measurement of Complete Black Hole Binary Inspiral-Merger-Ringdown Signals with LISA SEAN MCWILLIAMS, JAMES IRA THORPE, JOHN G. BAKER, BERNARD J. KELLY, NASA Goddard Space Flight Center, 8800 Greenbelt Rd., Greenbelt, MD 20771 — Until recently, only the inspiral and ringdown phases of black hole binary (BHB) coalescences had been modeled. The merger signals, which were expected to be the most luminous portion of the total signal, were unavailable due to the technical difficulty of calculating the behavior of a BHB in this highly dynamical and non-linear regime. Advancements in the field of numerical relativity make it possible to include the merger segment of BHB coalescence in the search for and characterization of gravitational wave signals. The implications for LISA include an increase in the event rate due to the increase in achievable signal-to-noise ratio, as well as potentially improved accuracy regarding the extraction of the source parameters. We investigate the degree to which mergers improve parameter estimation, by studying the impact of including mergers on achievable parameter accuracy over a significant range of masses and mass ratios for nonspinning systems, and its impact on LISA science. We find that nonspinning waveforms that include mergers provide competitive constraints on extrinsic parameters such as the sky position, as compared to results from rapidly spinning and precessing systems where the merger was not included.

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