

Abstract for 8th Annual Gravitational Wave Data Analysis Workshop, Dec 17-20, 2003, Milwaukee, WI

Synthetic LISA: Simulating Time Delay Interferometry in a Model LISA

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Modeling efforts at the Goddard Space Flight Center and the Jet Propulsion Laboratory are aimed at producing a high-fidelity time-domain simulation of LISA. Here we describe the current version of Synthetic LISA, a software package that produces simulated time series intended to be useful in interfacing scientific and technical mission requirements, in developing and validating vetos, and in testing signal-processing procedures to be used on the actual data. Synthetic LISA simulates the gravitational-wave (GW) and noise responses of LISA, as filtered through the laser-noise-canceling time-delay-interferometry (TDI) transfer functions. It does this for all the TDI combinations: unequal arm Michelson (X, Y, Z), Sagnac (alpha, beta, gamma), beacon (P, Q, R), monitor (E, F, G), relay (U, V, W), and symmetrical Sagnac (zeta). The GW signal and noise responses include the amplitude and phase modulation of signals due to Doppler shifting and changing geometry as the array orbits the Sun.