LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

Séminaire LAL

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Mardi 28 août 2018 à 11h00

Mitigation of the effects of seismic noise in gravitational-wave detectors

Seismic noise is an important noise source at low frequency for second-generation, gravitational-wave detectors. This talk will discuss two particular aspects of the broader seismic efforts. First of all, Newtonian gravitational noise from seismic fields will become a limiting noise source at low frequency for second-generation, gravitational-wave detectors. It is planned to use seismic sensors surrounding the detectors' test masses to coherently subtract Newtonian noise using Wiener filters derived from the correlations between the sensors and detector data. We will use data from a seismometer array deployed at the corner station of the LIGO Hanford detector combined with a tiltmeter for a detailed characterization of the seismic field and to predict achievable Newtonian-noise subtraction levels. We will also use data from an underground array at the Homestake mine in Lead, SD to explore this effect for third generation detectors. We measurements of wavefield coherence between stations, though this is explored in several ways: coherences are examined in frequency-wavenumber domain, in time domain, as a function of station-station distance and by the construction of Wiener filters. The second aspect is in the prediction of the ground velocity and arrivals of earthquakes at detector sites. We leverage the power of machine learning algorithms and historic seismic data to predict the ground velocity and the state of the gravitational wave interferometer during the event of an earthquake. The level of accuracy achieved with this scheme makes it possible to switch control configuration during periods of excessive ground motion thus preventing the interferometer from losing lock.

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