Contribution to the LISA data analysis applying true data taking condition for a realistic analysis.

Since 2015, the first gravitational waves (GW) detection has opened a new window on the Universe. LISA, spatial interferometer project, (Laser Interferometer Space Antenna) will be able to measure GW in a new frequency range (from 0.02 mHz to 1 Hz). Many signals from different sources will be reachable : Black Holes (Super Massive, Stellar Mass, Extrem Mass ratio), Galactic binaries and stochastic background from primordial Universe.

Laser beams is exchanged from a spacecraft to another one in the triangular LISA constellation. Inter-spacecraft distance are measured by interferometry techniques to reach a relative variation about 10^{-21}. In the LISA data, waveform signatures are specific to the gravitational sources. The waveform data analysis will allow to determine source parameters (coalescence time, position, masses, spins, ...). The objective will be to provide a gravitational sky catalog.

LPCCaen team started to contribute to the LISA Data Challenge working group (LDC). One of the first contribution has been to detect a Super-Massive Black Holes merger by a low latency pipeline in order to let the electro-magnetic detectors to join to the observation. This work consists into specific signals from coalescence (so called « *chirps* ») identification in the time/frequency spectrograms. The next step will be to localize and estimate the intrinsic parameters of the gravitational system.

The goal of this thesis will be to develop some data analysis algorithm in order to estimate binary system parameters. The student will have to study the analysis sensitivity to the source parameters in function of the duration of the data processing. One of the expected products will be apply the real data taking condition to underline the effect into the electro-magnetic counter part alerts. The candidate will have to :

- add features to the instrument simulator to apply data taking in real conditions,
- publish simulated data in the same way than expected real data publication,
- provide performance evaluator for the developed algorithm.

The Phd student will have the opportunity to present his work to the international LDC working group.

The expected skills of the student are: solid background in physics and programmation (Python, C/C++) for simulation and data analysis. Knowledge in astrophysics and signal waveform data analysis will be appreciated.

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