Patras Conference 2021

Data analysis pipeline for optomechanical dark matter detectors

Doris Todorović (doris.todorovic@student.uniri.hr)
Adrian Udovičić (adrian.udovicic@student.uniri.hr)
Marin Karuza

Department of Physics, University of Rijeka

16 June 2021

DEPARTMENT OF PHYSICS
UNIVERSITY OF RIJEKA

Contents

Motivation

T. Cheng; R. Primulando, M. Spinrath,
Dark matter induced Brownian motion,
Eur. Phys. J. C 80, 519 (2020)

See talk on Thursday, 15:50

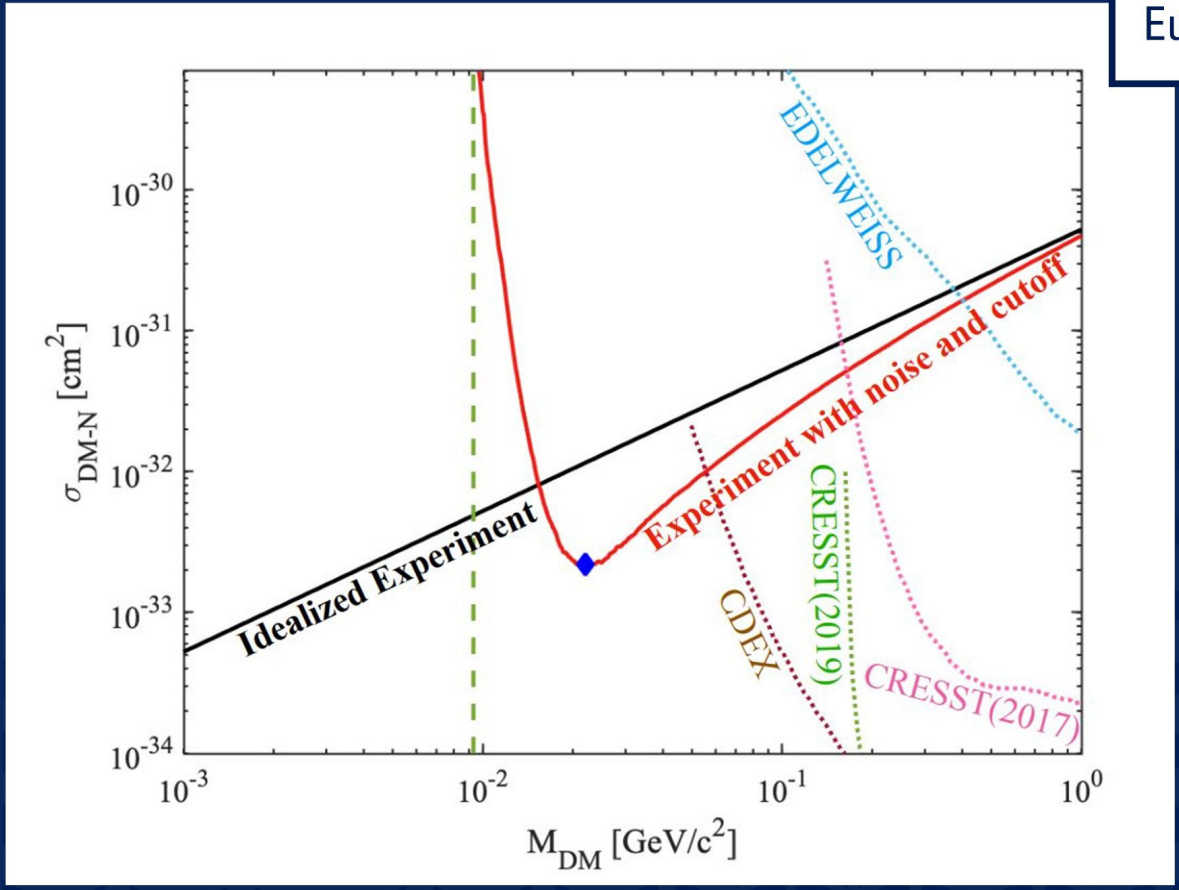


Figure 1.
The DM parameter space of the proposed experimental setup for a total target mass of 10-3 g.

Experimental setup

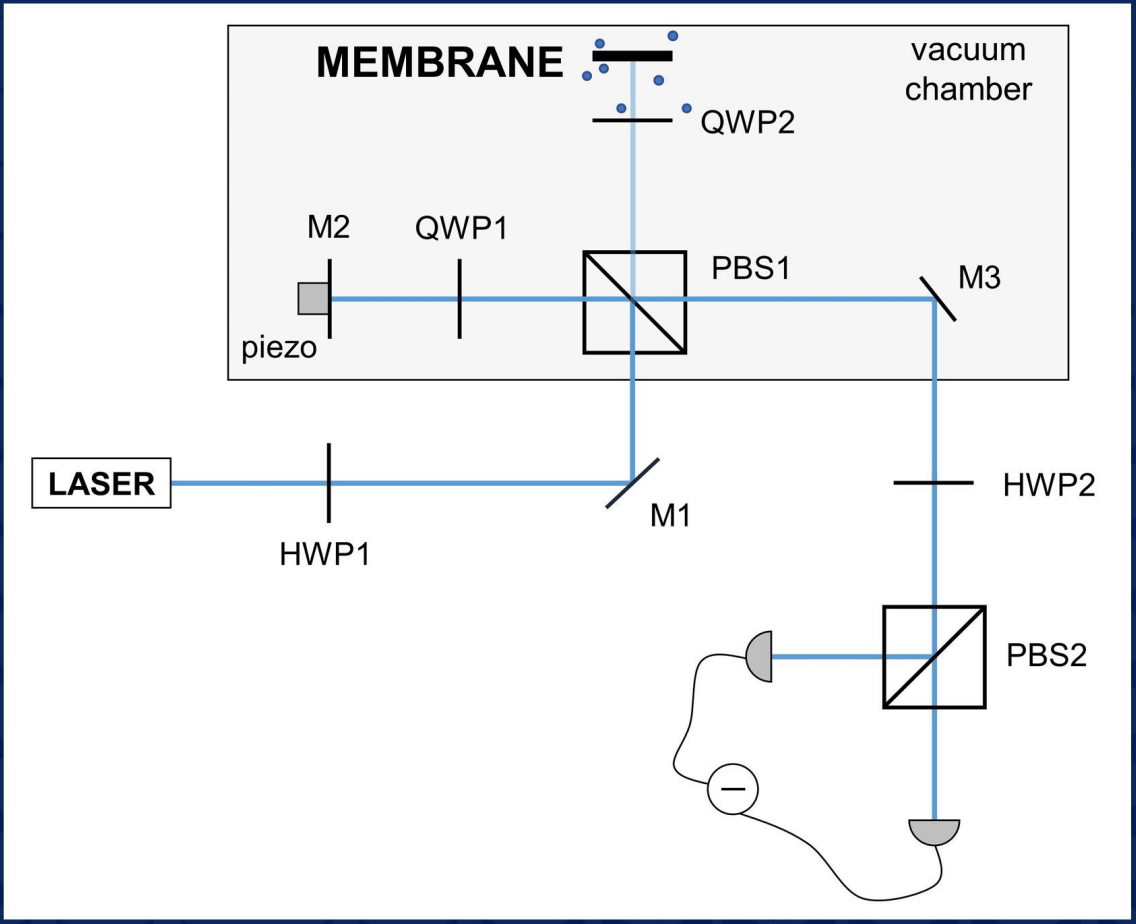


Figure 2.
The schematic diagram of the experimental setup.

- target: membrane
- light DM
- Michelson inteferometer

Automation & analysis

- Automation

DATA STRUCTURE

- data taking period:
  October 2020 – March 2021
- sampling rate:
  448 281,25 Hz
- file size: 307 MB
- total file size: 25 TB

SUPERCOMPUTER BURA

- storing large amounts of raw data

PYTHON CODE

- parallelization (concurrent.futures)
- FFT
- Lorenzian fit

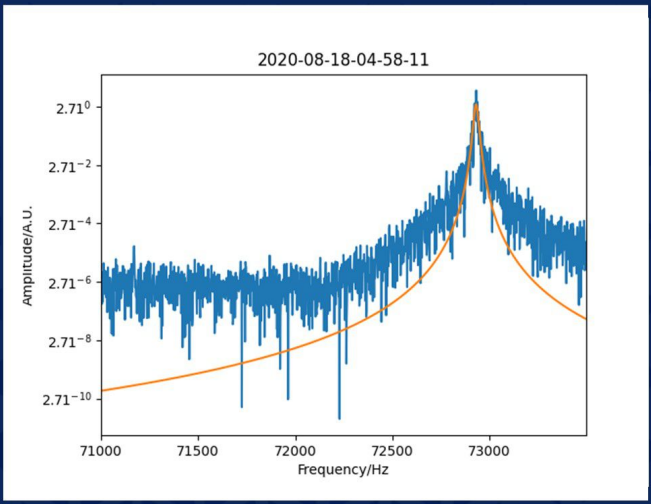


Figure 3.
Frequency - amplitude graph fitted with a Lorentzian type peak.

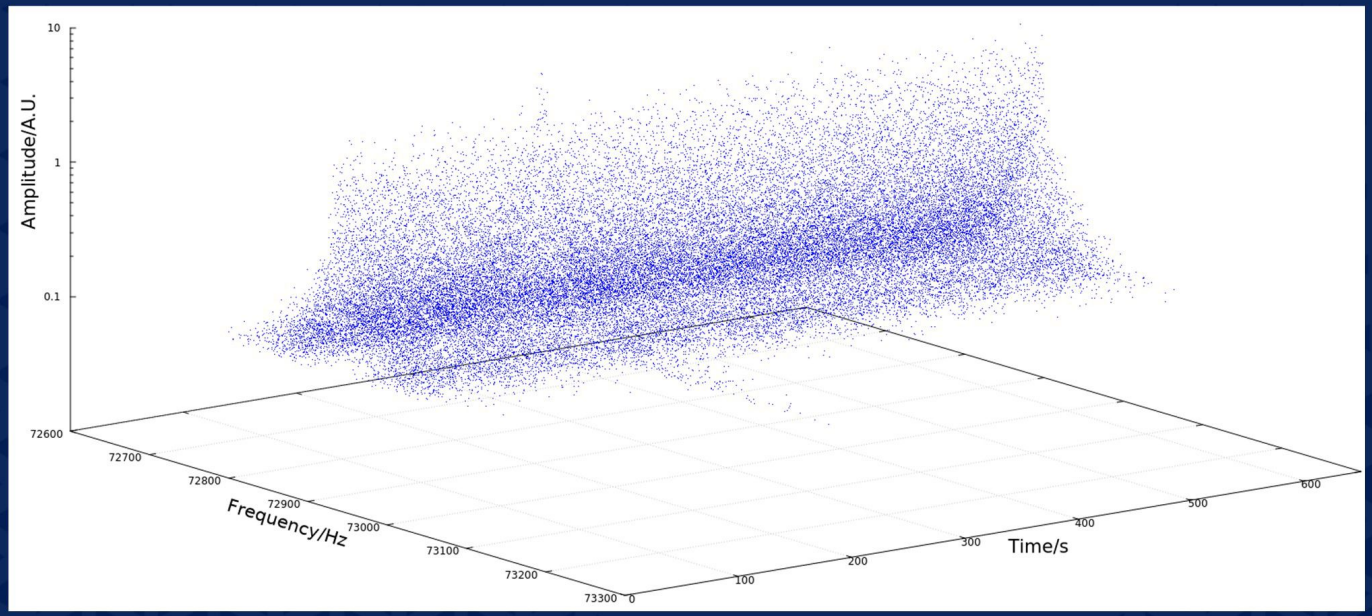
Automation & analysis

- Data analysis - transient signals

Figure 4.
Frequency - amplitude graph fitted with a Lorentz peak.

DATA VISUALIZATION →

PEAK FINDING METHOD (ANOMALY ANALYSIS) →

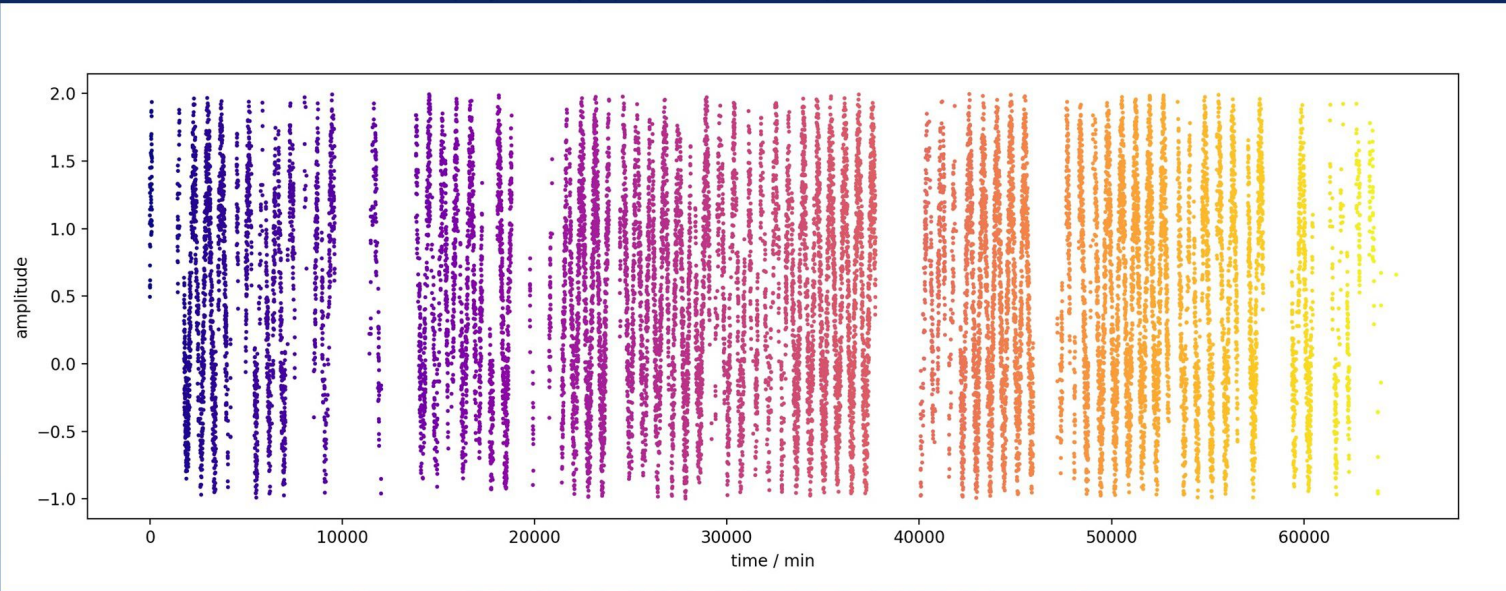


Automation & analysis

- Data analysis - steady-state signals

1 ST FOLDING METHOD

Figure 5.
The simulated signal.



Automation & analysis

- Data analysis - steady-state signals

1 ST FOLDING METHOD

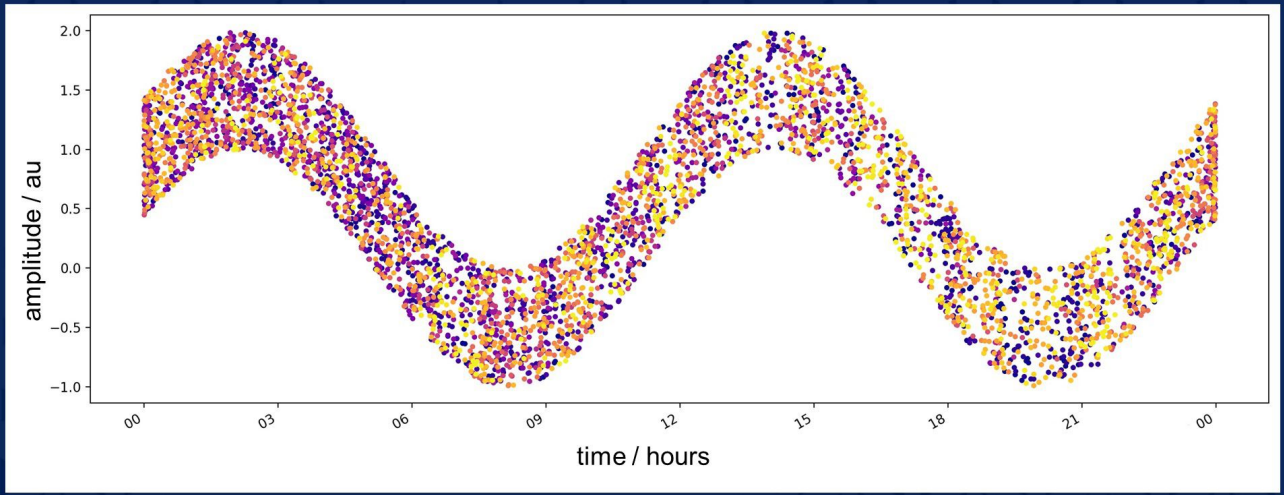
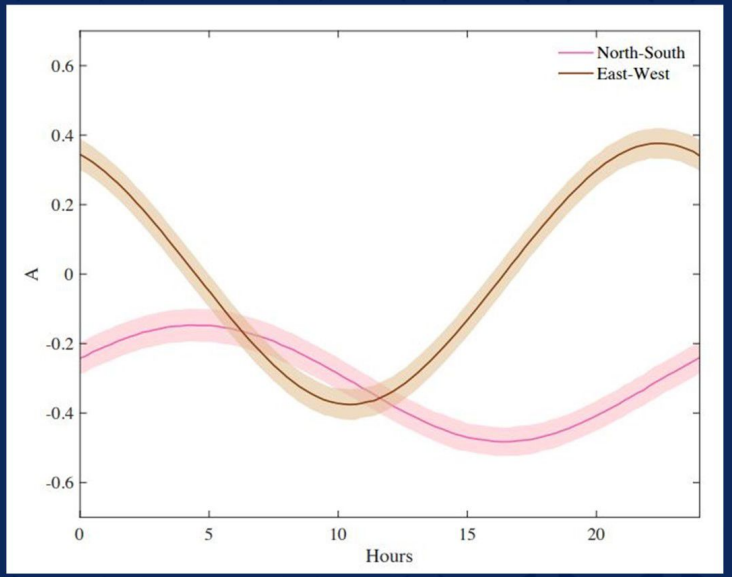


Figure 6.
Folded simulated signal.

Figure 7.
The expected time dependence of the signal within 24 hours.



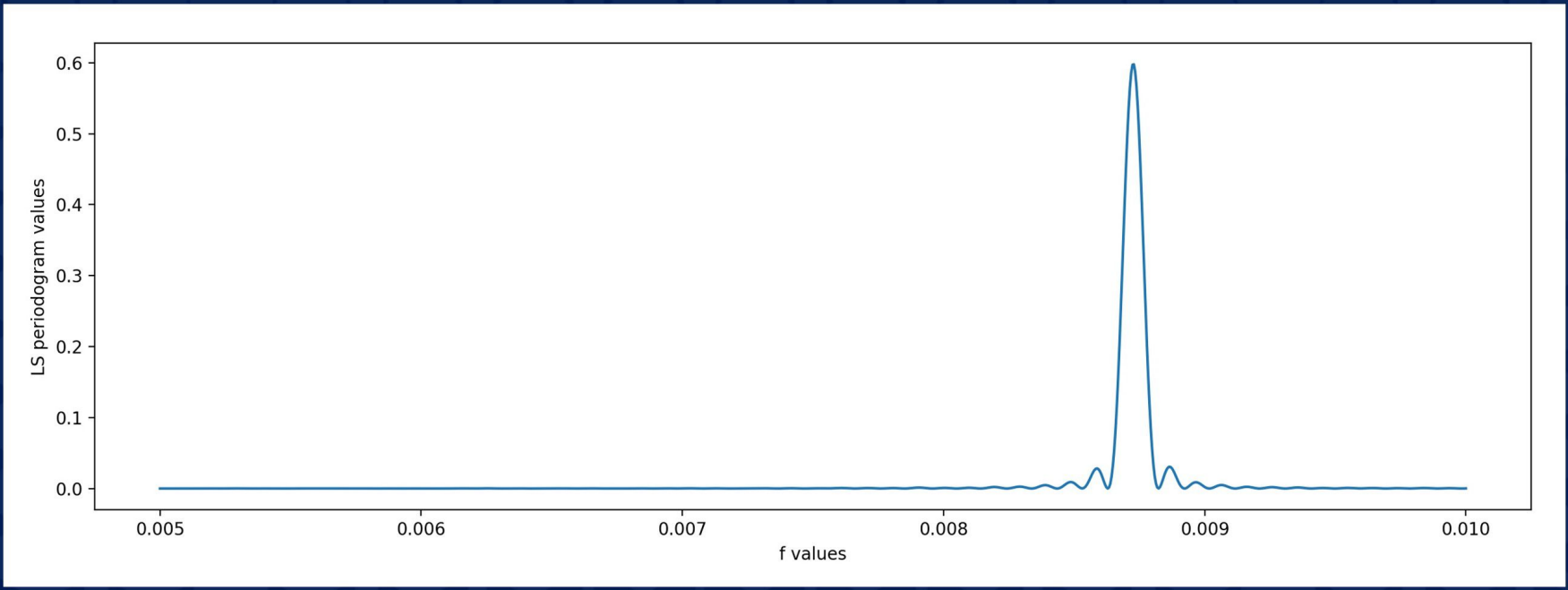
T. Cheng; R. Primulando, M. Spinrath, *Dark matter induced Brownian motion*, Eur. Phys. J. C 80, 519 (2020)

Automation & analysis

- Data analysis - steady-state signals

2 ND LOMB – SCARGLE PERIODOGRAM

Figure 8.
The Lomb-Scargle periodogram of the simulated signal.



Conclusion

- Preliminary results

Figure 9.
The amplitude folding for a period from October to January.