

Group IGR

Project name Seismic noise characterisation, isolation and subtraction techniques

Supervisor Stefan Hild

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Suitability 20 credit no 30 credit yes 40 credit yes

Suitable for “theoretical physics” no

Project description (length should not exceed remainder of page)

High precision interferometers, such as gravitational wave detectors like GEO600 or LIGO, are able to measure the distance between 2 test masses a few kilometer apart up to a precision of a 1/1000 of a proton diameter. In order to achieve such an amazing sensitivity the test masses need to be suspended from seismic isolation systems providing a reduction of the seismic noise by about 10 orders of magnitude.

This project will involve the following activities: Setting up several seismic sensors inside the cleanroom lab of the Glasgow 10m interferometer and carry out long-duration measurements. In the next step the student will learn how to characterise the different temporal and spectral components of seismic noise. Based on these results seismic isolation requirements can be derived for the new speedmeter testbed currently under construction. The final step will be to investigate, design and test various seismic isolation strategies, which can include for instance passive isolation stacks, active suppression by means of feedback systems, or feedforward techniques based self-training multiple-input single-output (MISO) algorithms.

In this project the student will have a chance to acquire a wide range experimental and theoretical skills, including electronics, handling and analysis of large data sets, frequency domain techniques, numerical simulations, control techniques and advanced signal processing.