

Group Institute for Gravitational Research

Project name Ultra-thin fused silica fibres

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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)

This is intended as an M level project although a scaled down version can be offered for BSc students. The Institute for Gravitational Research has a fused silica laser pulling machine capable of producing fibres down to a minimum diameter of 20um and with lengths from a few cm to 100cm. These fibres have applications as suspension elements in future gravitational wave detectors such as the 10m prototype interferometer at the Albert Einstein Institute, Hannover, Germany and a new interferometer currently under construction in Glasgow. Thin fused silica fibres are surprisingly strong and can support loads up to 2.5N before fracturing.

This project will focus on the development of techniques to pull and test thin fused silica fibres for future detector suspensions. The fibres will be pulled and optically profiled in order to measure their dimensional tolerance. A selection of fibres will be strength tested to determine their ultimate tensile strength, while a selection will be installed into a vacuum tank where their intrinsic mechanical loss can be accurately measured. We propose to pull fibres in the diameter range 20um - 100um to look for the effect of surface loss which scales as the inverse of the fibre diameter. This project combines experimental hardware development in addition to some modeling work to predict the expected mechanical loss of the fibres. Full training for a Class IV laser will be provided and necessary prior to any work being carried out on the fibre pulling machine.