University of Glasgow

SUPA

Institute for Gravitational Research

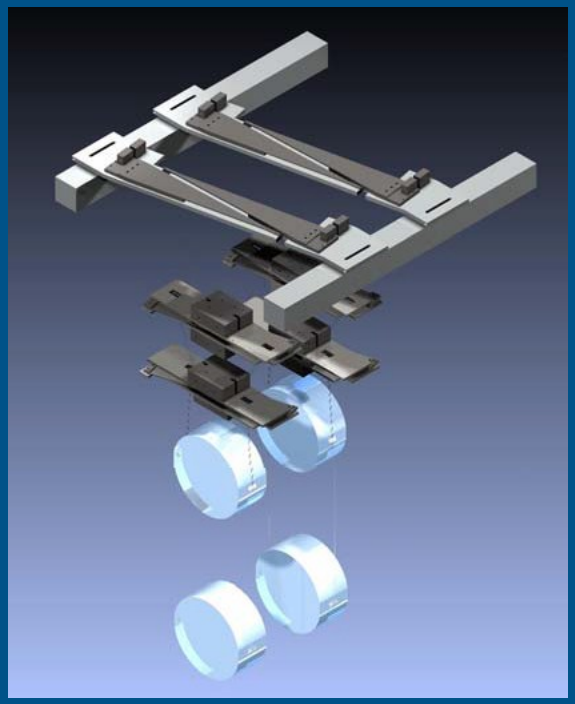
The IGR is supported by STFC and the University of Glasgow

LSC

GEO 600

Glasgow's Institute for Gravitational Research (IGR) is the UK centre for experimental gravitational wave detection, and is a world-leader in the field.

It continues to innovate and invent, with the aim of creating a global detection network of kilometre-scale laser interferometers and space-based detectors. These instruments are central to the emergent field of gravitational astronomy, which is opening a new window on the cosmos.



Artist's impression of the Advanced LIGO suspension.

Areas of research:

Interferometry

A full-scale prototype interferometer is housed in the institute, enabling the development of novel optical techniques, study of radiation pressure and quantum noise, and the direct measurement of thermal noise effects. These studies will help influence the evolution of possible next generation detectors, such as upgrades to LIGO and GEO 600.

LIGO - Washington State, USA

LIGO - Louisiana, USA

Institute for Gravitational Research

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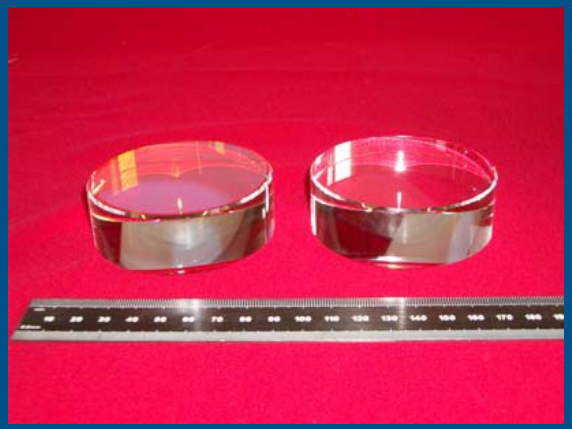
Materials

High purity silicon, sapphire and fused silica samples are currently used, or proposed, as substrates for the interferometer mirrors. Their material properties are investigated, at both room and cryogenic temperatures, enabling the characterisation and reduction of their sensitivity limiting noise contribution.



Fused silica test samples

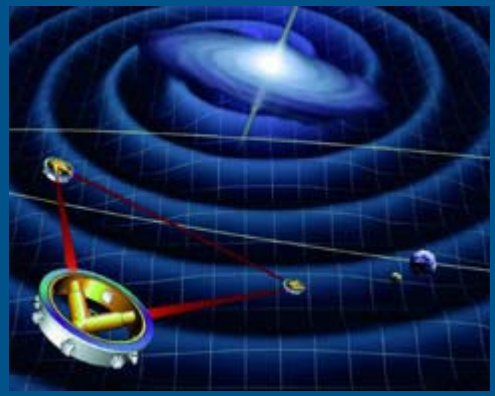
Astrophysical searches

Now that first-generation interferometers are operating at design sensitivity, meaningful astrophysical interpretation of the data is crucial. We perform searches for gravitational waves from well-parameterised sources, such as pulsars, as well as poorly modelled sources, such as core-collapse supernovae and neutron star mergers. Our work also extends to the use of Monte-Carlo methods to extract as much astrophysical information from any potential signals.

The Crab pulsar and wind nebula in X-ray (blue), and optical (red) (NASA/CXC/ASU/J. Hester et al.)

Space-based interferometry

The space-based eLISA detector, and its precursor mission, LISA Pathfinder, require high precision optics capable of withstanding the rigours of space. The IGR has developed specialised bonding techniques for LISA Pathfinder and used this to construct monolithic optical benches for the mission.



Artist's impression of the space-based gravitational wave detector LISA.