Searching for Gravitational Waves

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VIRGO

French Italian collaboration

3 km arm length laser interferometer

Strain sensitivity - Sensitive to changes in arm lengths of 1 part in 1.e22

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Laser Interferometer Gravitational Wave Observatory

American project between MIT and Caltech

2x4 km detectors at Hanford and Livingston

1x2 km detector at Hanford

LIGO is taking part in the US GriPhyn project

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GEO600
A 600 m Interferometer

A partnership between Glasgow, Cardiff and 3 Max Planck Institutes

Funded by PPARC and BMBF

Cardiff is the UK data storage and analysis centre

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GEO600
Technologically the most advanced

100 Watt (recycled) laser

Seismic isolation down to 40 Hz

Power and signal recycling to improve signal visibility
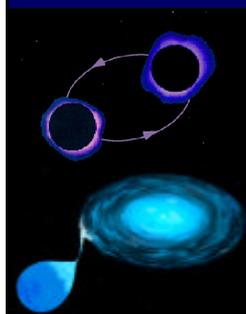
Monolithic suspension for low thermal noise

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Gravitational Wave Astronomy

Binaries of black holes and neutron stars

Non-spherical spinning neutron stars

Neutron stars in X-ray binaries

Supernovae

Astrophysical and cosmological stochastic backgrounds

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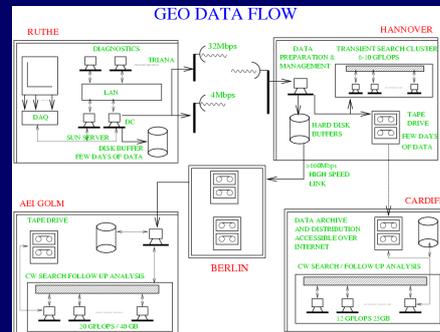
"Network" Analysis from the word GO!

Strong ties among different detector projects

Data exchange - 100's of Tbytes per year

Common data formats and software standards

Collaborative search software and analysis

Data Flow In GEO600

GEO DATA FLOW

Data Rates

100's of channels consisting of GW data and other environmental monitors

15 Tbytes per year in GEO, 400 Tbytes per year in LIGO

Data must be transported to analysis sites - need for European and transatlantic networks

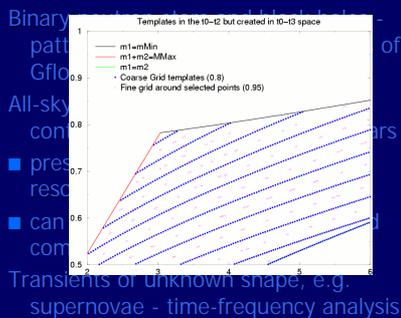About 10% of this data-set needs to be looked at continuously

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Data Conditioning

Detector diagnostics - help in detector debugging and monitoring

Data preparation - calibration, quality indicators, cavity lock status

Data conditioning and reduction - line identification and removal, tracking transients, etc.

Searches and Algorithms

Binary ... - pattern ... of Gflo...

All-sky ... con... rs

- pres... reso...
- can ... com...

Transients of unknown shape, e.g. supernovae - time-frequency analysis

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Computing Software and Hardware

- Common data formats and software standards
- Collaborative software development
- A number of distributed Beowulf clusters
- Exploring SETI@home, Entropia, etc.

How research in GW data analysis can contribute to and benefit from Astrogrid

Triana can work as an API to run programs on a heterogeneous network of computers in Grid

GW searches for neutron star and black hole binaries can benefit from data base and data mining techniques of Astrogrid

Distributed computing developed for all sky, broad band searches for neutron stars can be used in other astrophysical applications

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