Prospects for LIGO Science From the OSG
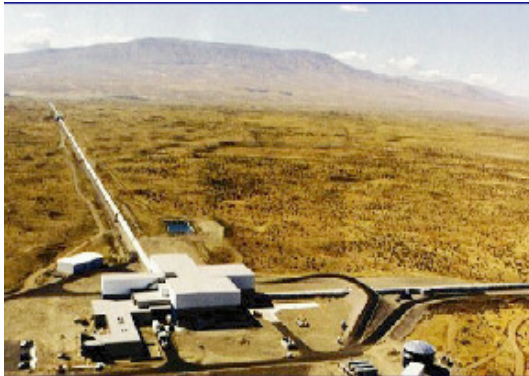
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LIGO

- ## What is LIGO?

    » **L**aser **I**nterferometer **G**ravitational-wave **O**bservatory, i.e. An astronomical observatory

    » About 600 scientists from 55 institutions

    » GEO600, British-German project, is a member of the LSC

    » MOU with Virgo, French-Italian project, in May 2007

    » Five scientific instruments on two continents, all producing data

LIGO Data

- **Scientific Data Taking**

  - » Five science-data-taking runs since 2002

  - » Latest is S5; 1 cumulative year of coincident data from 3 detectors

  - » Next science run (S6) planned for 2009-2011 after instrument upgrades

  - » Instruments collect 0.5PB/year; 1% in GW channel

- **Data Analysis:**

  - » Four types of searches, several instances of each type, over 10 pipelines

  - » Almost all analyses dominated by Fourier transform computations

  - » Least demanding can be done in real time on laptop (stochastic)

  - » Most demanding is a virtually infinite cycle sink - all-sky neutron star search requiring billions of filters - currently done using Einstein@Home

LIGO Scientific Computing

- Performed mostly on the LIGO Data Grid (LDG)

  » Production computing since 2004

  » Came to life during grid development initiated by GriPhyN and iVDGL

  » Uses grid middleware tools (Globus, Condor) drawn from VDT as well as "home-grown" solutions

  » Currently eight centers (Caltech, LIGO instruments,MIT, PSU, UWM, Cardiff, AEI Potsdam). Two more in construction(Syracuse, AEI Hannover)

  » Substantial portions of current data sets are replicated at each center

  » User model different than OSG - shell login to head-nodes on most clusters, to compute nodes on some clusters.

LIGO Science on OSG

- ## Past

  - » LIGO physicists investigated using OSG for flagship search (CBC)

  - » LIGO computer scientists continued investigations with OSG funding

- ## Present

  - » LIGO computer scientist have ported Einstein@Home to OSG

  - » Runs at UWM (55k cpu hours) and BNL (250k cpu hours)

  - » Currently testing and deploying at AGLT2，PSU，Purdue

LIGO Science on OSG (cont.)

- **Future**
  - » As LDG and OSG move toward the grid dream (transparent selection of available resources) distinction between LDG and OSG will disappear.
  - » In the mean time, LIGO users not willing to port pipelines to OSG
    - – If we can't bring users to OSG, can we bring OSG to users?
  - » Perhaps in enhanced LIGO (2009-2011) and definitely in advanced LIGO (2016-?) we should have detections.
    - – To establish confidence at five sigma level, millions of Monte Carlo runs needed to find background rates
    - – LDG insufficient - opportunistic use of OSG to make up difference?
  - » Brave new world when GW astronomy starts in earnest
    - – LIGO may not be in data analysis business by then (other astronomical observatories?)