

Press Conference on the Analysis of the first LIGO data

Results presented by the
LIGO Scientific Collaboration
APS meeting, April 2003, Philadelphia
Erik Katsavounidis, LIGO-MIT

Sessions chaired by Finn (PSU) and Brady (UWM):

Ed Daw (LSU): Search for Bursts

Patrick Brady (UWM): Search for Inspirals

Joe Romano (UTB): Search for Stochastic Radiation

Maria Alessandra Papa (AEI-MP): Search for Continuous Waves

Erik Katsavounidis (MIT): Overview of searches

LIGO S1 Run

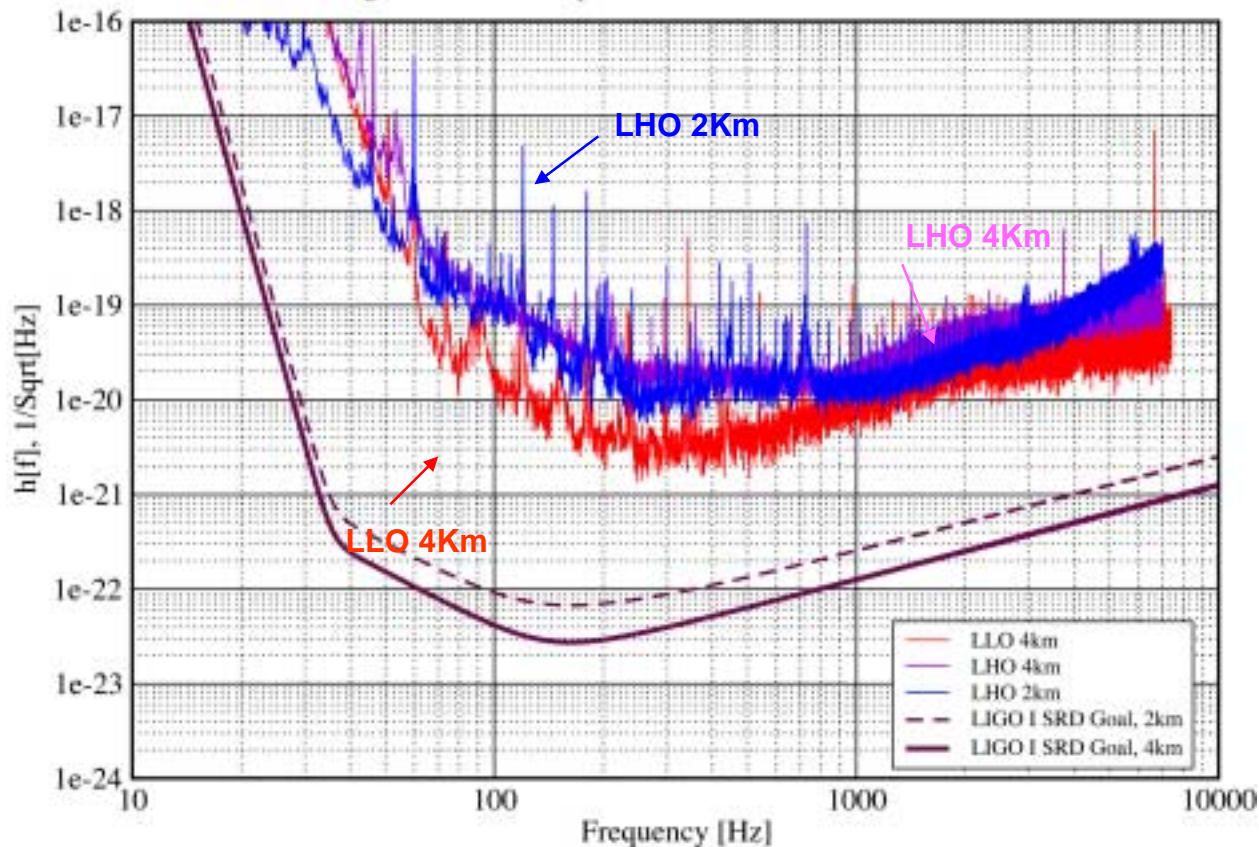
 "First
 Upper Limit
 Run"

- 23 Aug–9 Sept 2002
- 17 days
- All interferometers in power recycling configuration

GEO in S1 RUN

 Ran simultaneously
 In power recycling
 Lesser sensitivity

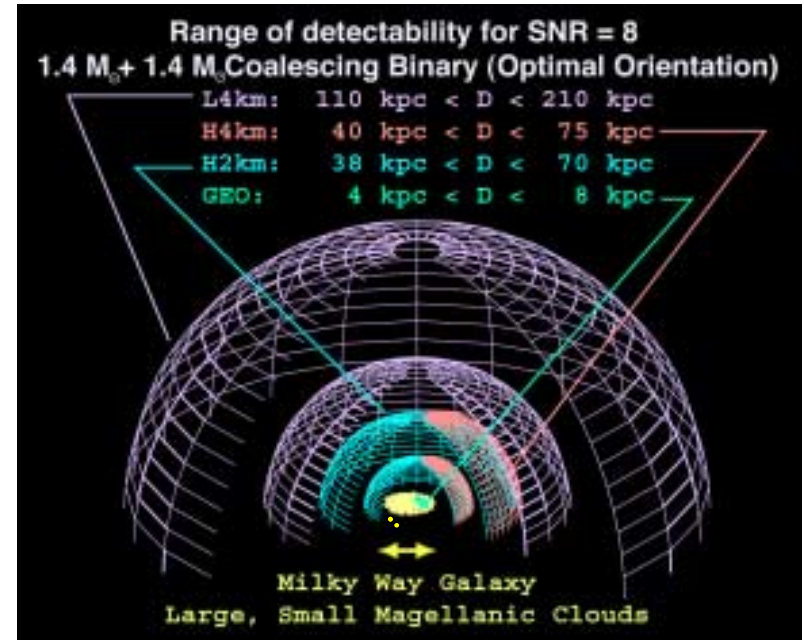
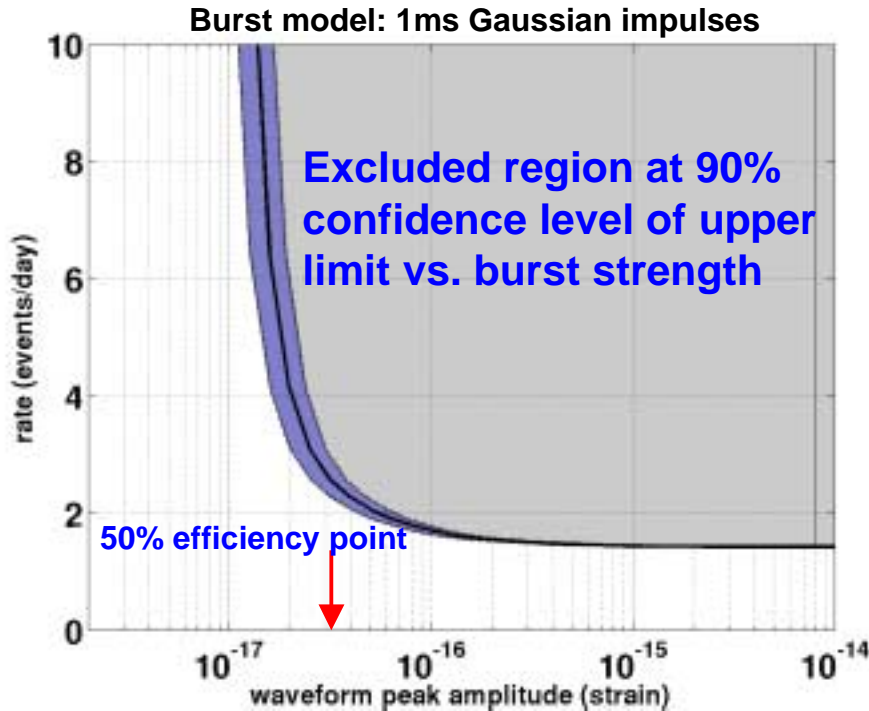
Strain Sensivities for the LIGO Interferometers for S1
 23 August 2002 - 09 September 2002 LIGO-G020461-00-E



• **Triple Coincidence:** L1, H1, and H2 : duty cycle 23.4% ; total 95.7 hours

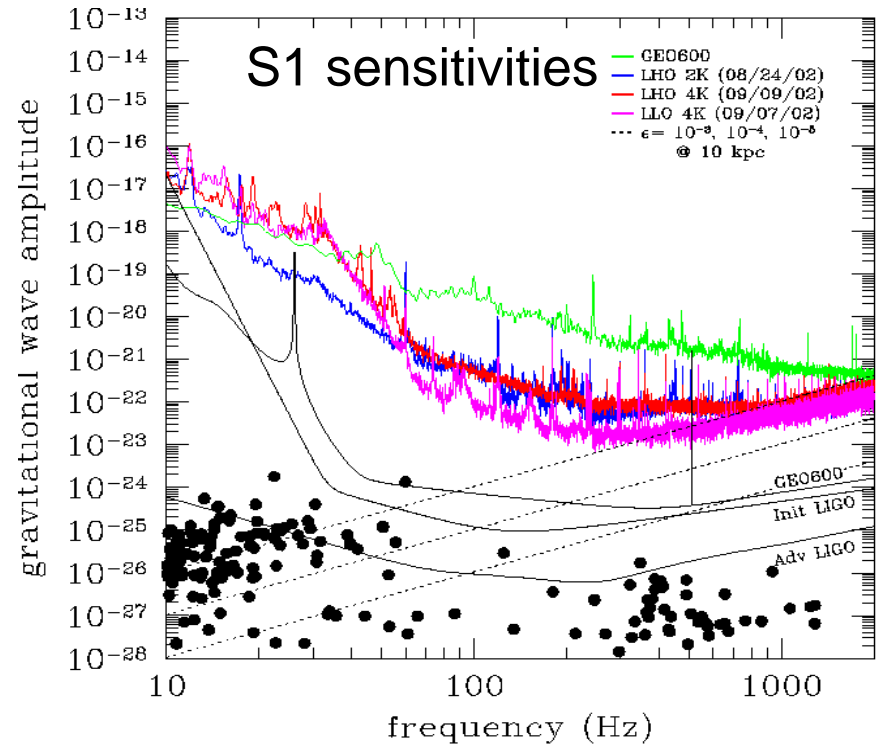
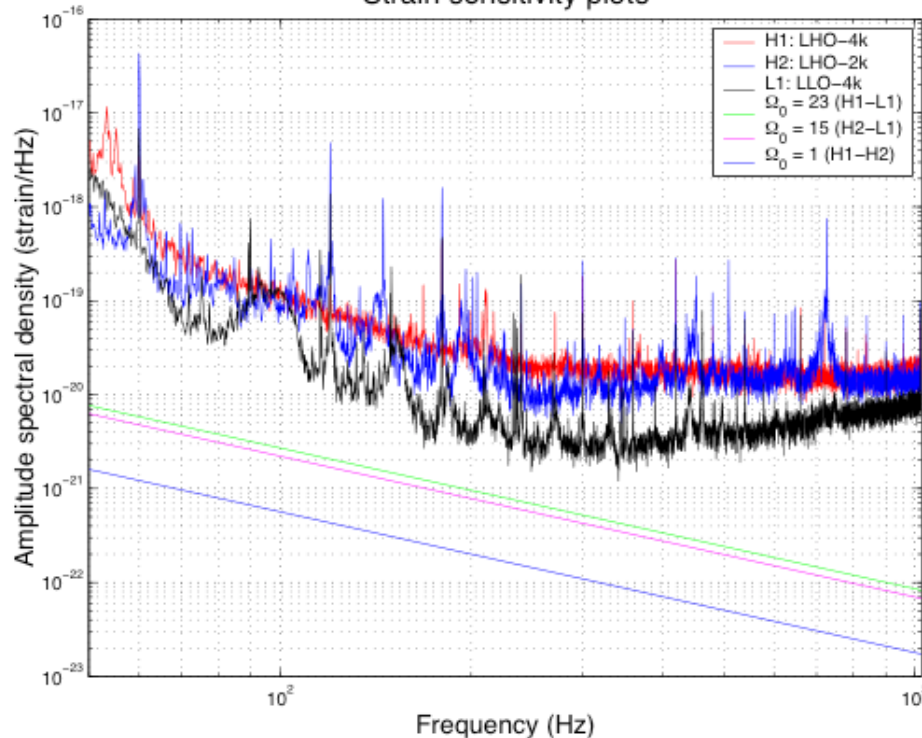
- **No detection expected.**
- **Scientific Milestone:** first coincidence observation by multiple broad-band interferometers at best ever achieved sensitivities.
- **Technical analyses:**
 - » Establish and illustrate **methodology.**
 - » End-to-end analysis **checks.**
 - » Results meet **expectations** from sensitivity.
 - » To be used in **future** running.

Bursts and Inspirals



- **Burst sources:** known (supernovae, black hole merges) and unknown emitting short transients of gravitational radiation of unmodeled waveform: 1.4 events/day.
- **Inspiral sources:** orbital-decaying neutron star binaries: bound their rate at below $R < 164/\text{yr}/(\text{MWEG})$.

Strain sensitivity plots



- **Stochastic sources:** cosmological or astrophysical may contribute to universe's critical density:

$$\int_0^{\infty} (1/f) \Omega_{GW}(f) df = \frac{\rho_{GW}}{\rho_{critical}}$$

constrain Ω_{GW} (40Hz - 314 Hz) < 72.4

- **Continuous sources:** known rotating neutron stars emitting waves due to small distortions of their shape: constrain amplitude, ellipticity. For PSR J1939+2134: $h_0 < 1.0 \times 10^{-22}$
 $\epsilon < 7.5 \times 10^{-5}$

- LIGO's plan of **interleaved science and engineering runs** is bringing the **instruments to their design sensitivity** while giving the opportunity for **first science results**.
- Results close to expected, **confidence** that our design sensitivity is imminent and producing the targeted science results.
- **Second science run ("S2")** began 14 Feb and will **end** 14 Apr:
 - » Sensitivity is ~10x better than S1
 - » Duration is ~ 4x longer
 - Bursts: rate limits: 4X lower rate & 10X lower strain limit
 - Inspirals: reach will exceed 1Mpc -- includes M31 (Andromeda)
 - Stochastic background: limits on $\Omega_{\text{GW}} < 10^{-2}$
 - Periodic sources: limits on $h_{\text{max}} \sim \text{few} \times 10^{-23}$ ($\epsilon \sim \text{few} \times 10^{-6}$ @ 3.6 kpc)
- Ground based interferometers are **collaborating internationally**:
 - » LIGO and GEO (UK/Germany) during "S1"
 - » LIGO and TAMA (Japan) during "S2"