LIGO in Mississippi

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LIGO Scientific Collaboration
Dept. of Physics and Astronomy
University of Mississippi

The University of Mississippi

MAP Fall Meeting – Canton MS, Nov. 3rd, 2007
LIGO-G070633-00-Z

Background picture from http://cgwp.gravity.psu.edu

What is LIGO?

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LIGO

UMISS

LSC

LIGO = Laser Interferometer Gravitational-wave Observatory

LIGO Scientific Collaboration = 

+ …

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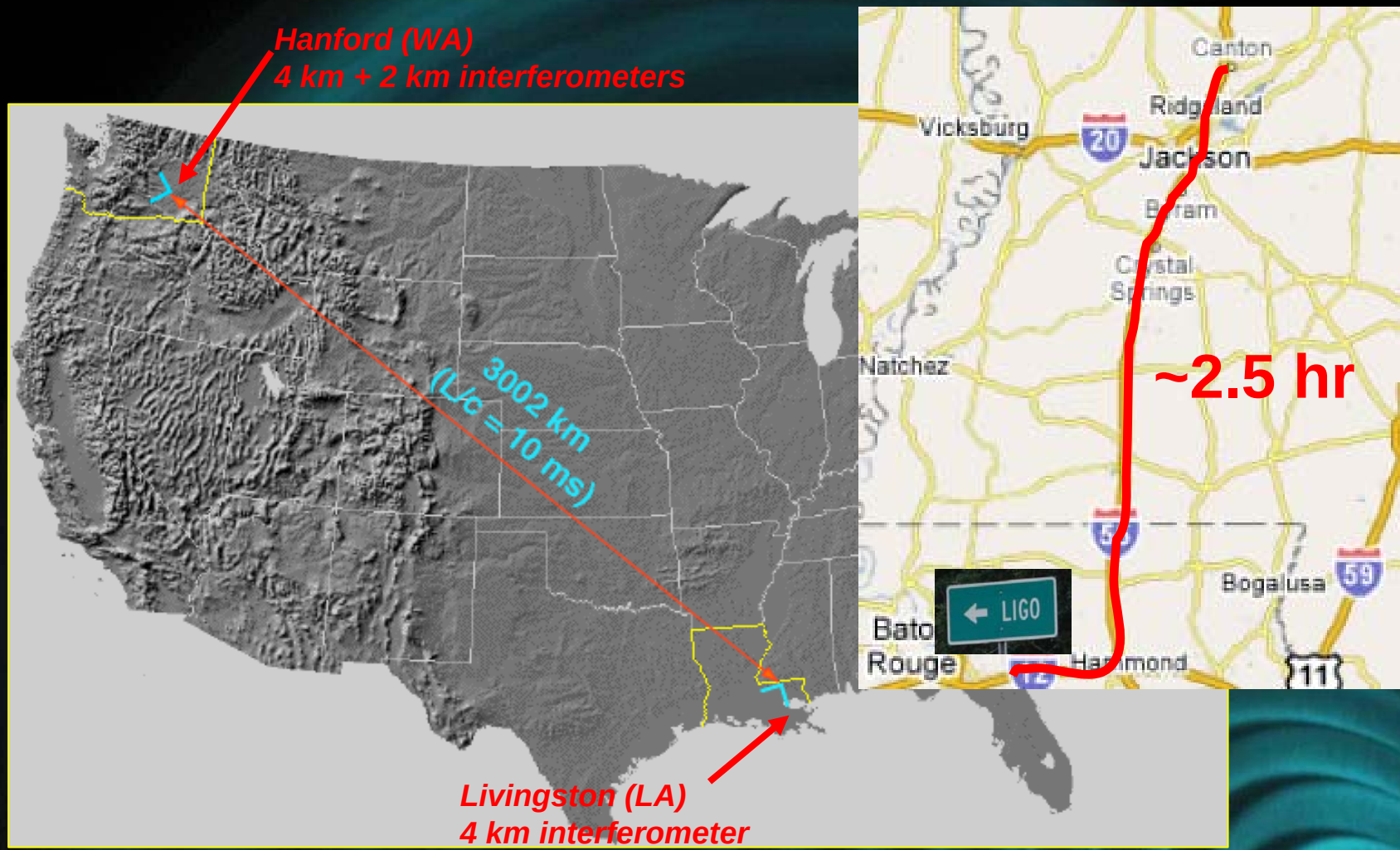
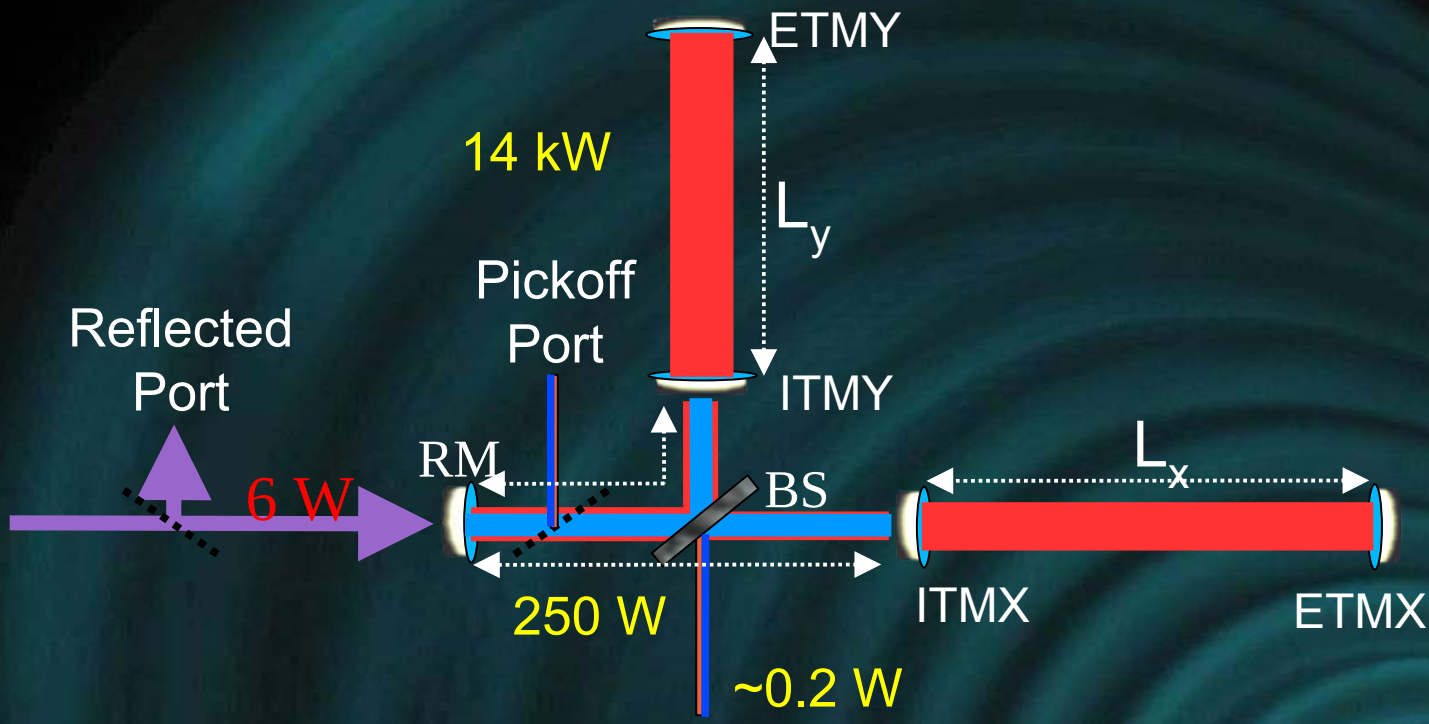
LIGO
Universität Hannover
UMISS
Science & Technology Facilities Council
Rutherford Appleton Laboratory
LSC
UNIVERSITY OF MARYLAND
MICHIGAN
UNIVERSITY OF STRATHCLYDE
ACIGA
MONTANA STATE UNIVERSITY
PAH
LOYOLA UNIVERSITY NEW ORLEANS
STANFORD JUNIOR UNIVERSITY
UNIVERSITY OF WASHINGTON
TRINITY UNIVERSITY
CALIFORNIA INSTITUTE OF TECHNOLOGY 1891
UNIVERSITY of GLASGOW
Università degli Studi del Sannio
San José State UNIVERSITY
UNIVERSITY of WISCONSIN UWMILWAUKEE
ANU THE AUSTRALIAN NATIONAL UNIVERSITY
NASA GODDARD SPACE FLIGHT CENTER
LSU
UTB TSC
THE UNIVERSITY OF WESTERN AUSTRALIA
1754
SYRACUSE UNIVERSITY
R·I·T
Andrews University
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
SOUTHEASTERN
NORTHWESTERN UNIVERSITY
Moscow State University
University of Southampton
EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
SOUTHERN UNIVERSITY Agricultural & Mechanical College
PENNSTATE 1855
SIGILL : COLL : CARLETON
GEO 600
CARDIFF UNIVERSITY
Universitat de les Illes Balears
WASHINGTON STATE UNIVERSITY
UF UNIVERSITY of FLORIDA
HOBART WILLIAM SMITH COLLEGE
CHARLES STURT UNIVERSITY
UNIVERSITY OF ROCHESTER
NAOJ
The University of Mississippi
THE UNIVERSITY OF ADELAIDE AUSTRALIA
UNIVERSITY OF MINNESOTA

Two LIGO Observatories

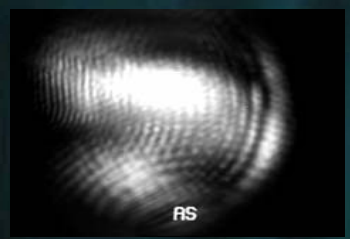



Livingston,
Louisiana

Interferometer design



Strain
Readout
(L_y-L_x)



Anti-Symmetric
Port

Vacuum equipment

LIGO

UMISS

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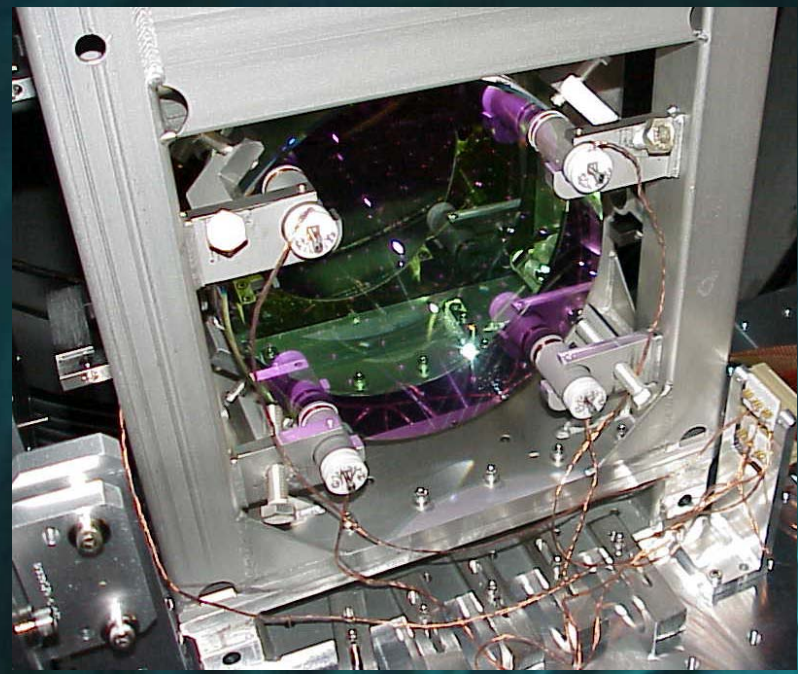
Core optic suspensions



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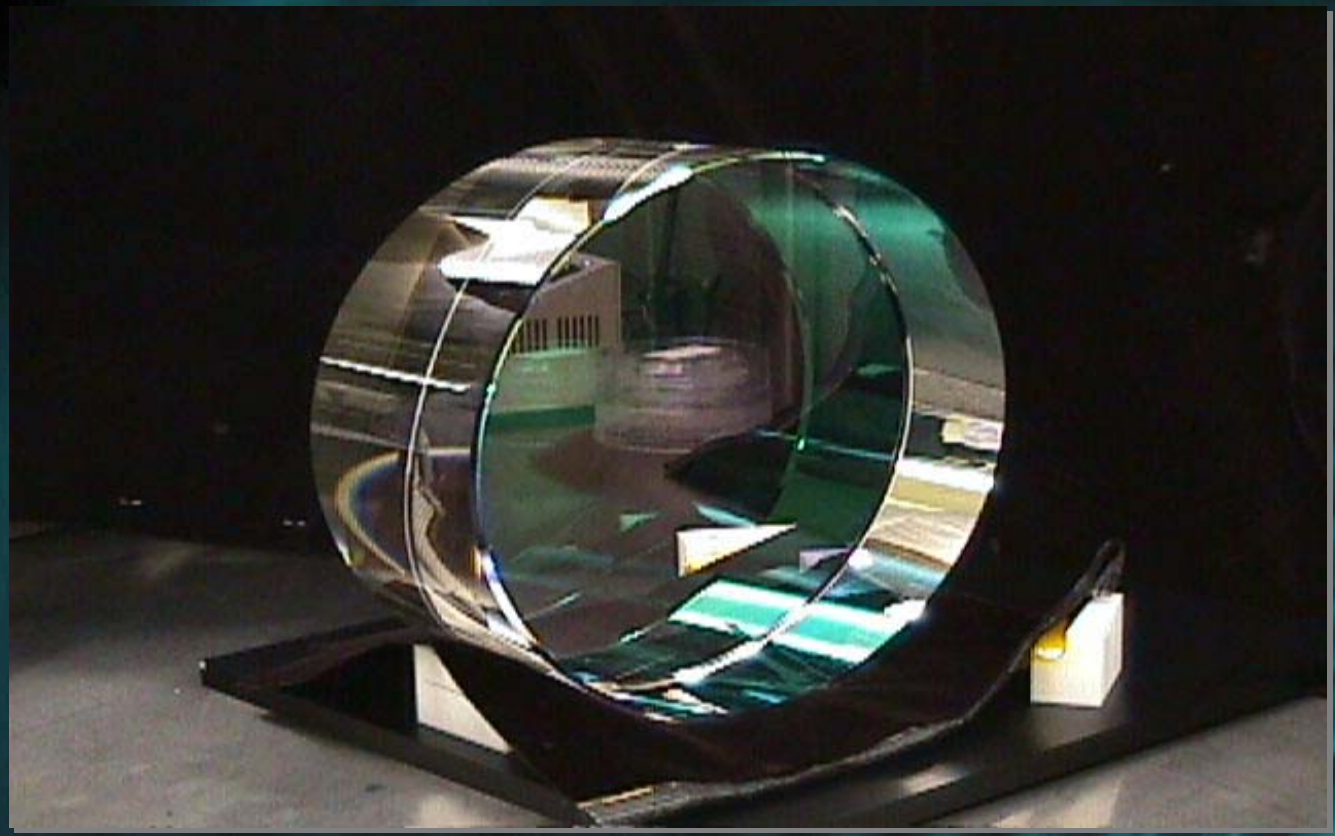
Core optics



The control room

What do we hope to see?

Gravitational waves

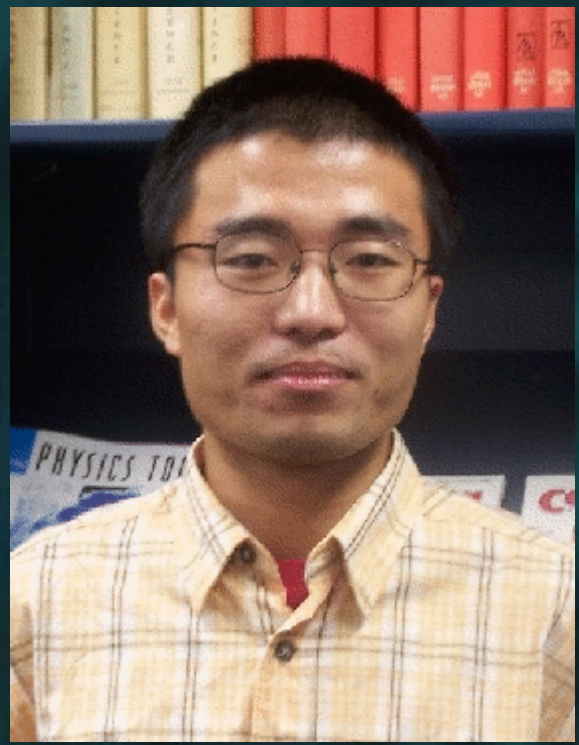
Einstein's General Relativity

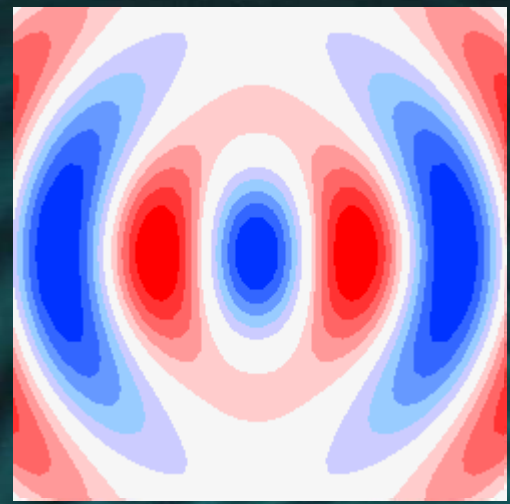
The spacetime geometry is continuously distorted by the presence of mass (=energy).

When masses move rapidly, the spacetime becomes stirred by their motion: *ripples* start traveling outward with the speed of light

What is the effect of a gravitational wave?

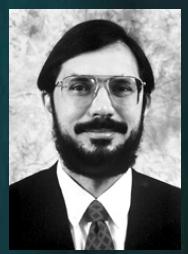
We will experiment on a graduate student





How do we know that gravitational waves exist?

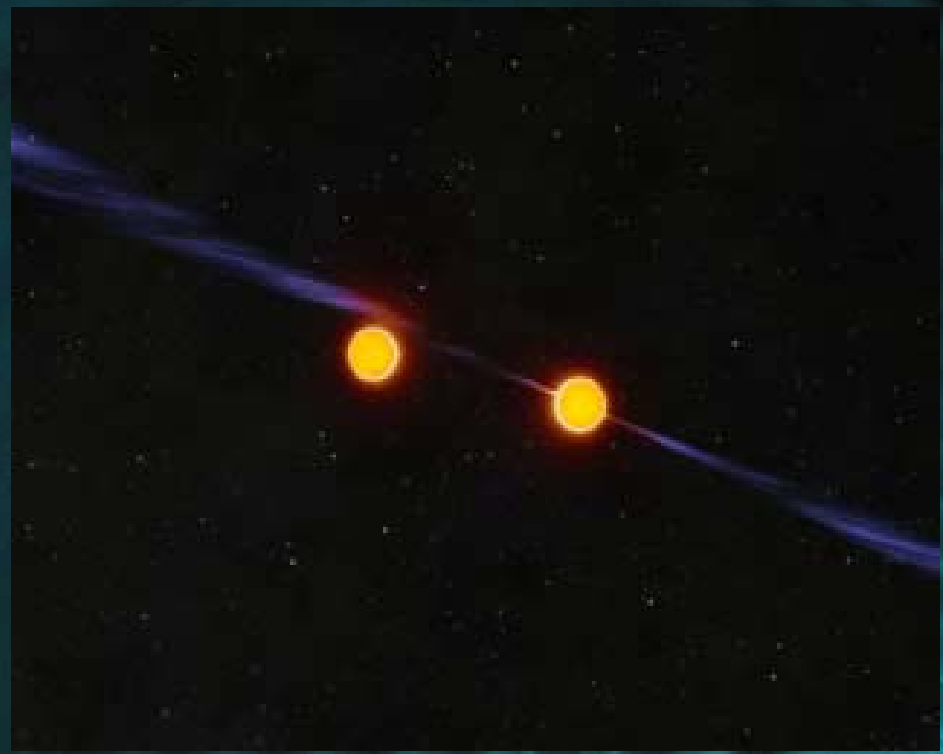
Indirect detection: slow down of a binary pulsar



R. Hulse

J. Taylor

Nobel prize in physics, 1993



John Rowe Animation/Australia Telescope National Facility, CSIRO

Sources of gravitational waves

- Coalescing binary neutron stars or black holes
- Spinning neutron stars
- Gravitational bursts (e.g. supernovae)
- Big bang gravitational echo

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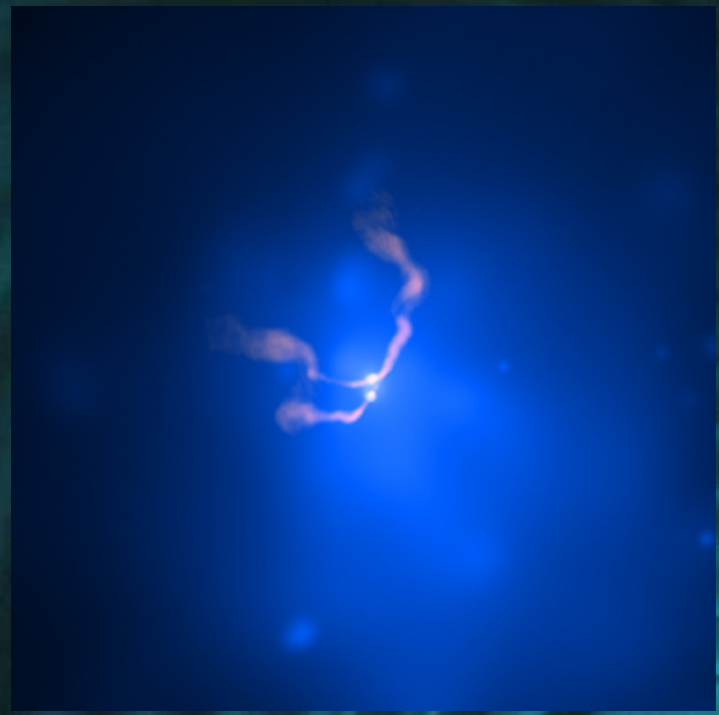

Picture credit: NASA/CXC/AIfA; NRAO/VLA/NRL

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Picture credit: NASA/HST/STScI

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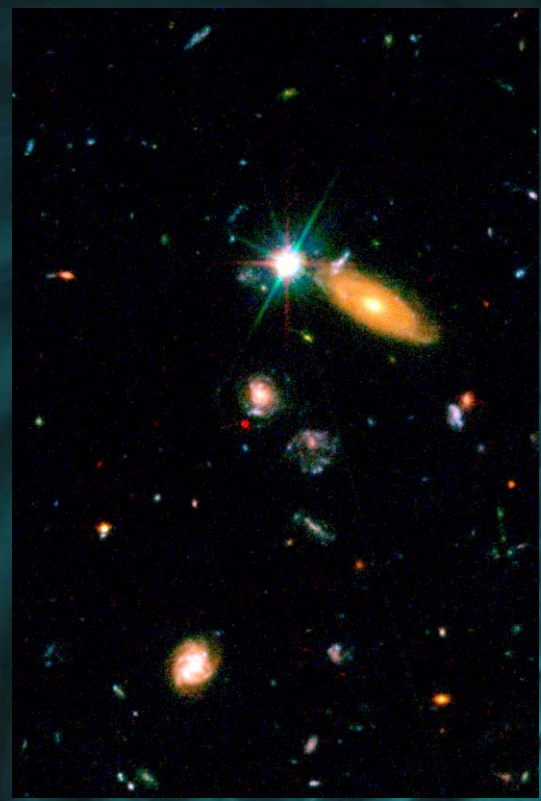

Picture credit: NASA/HST/STScI

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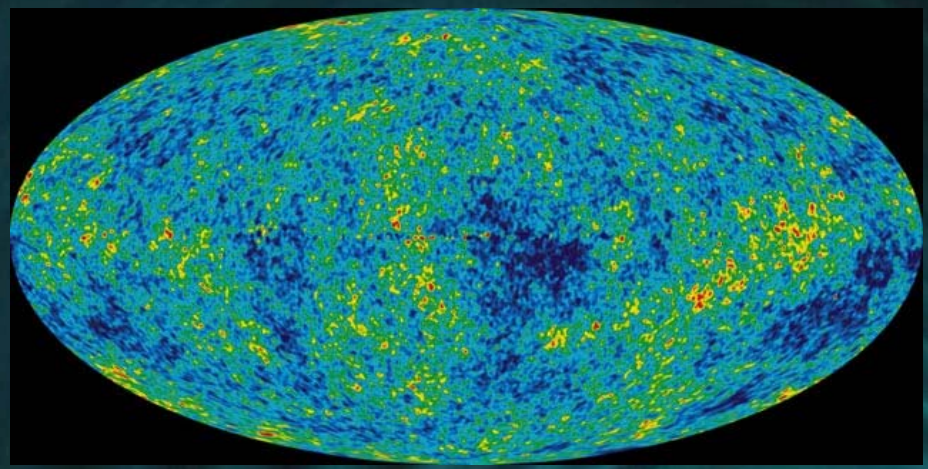
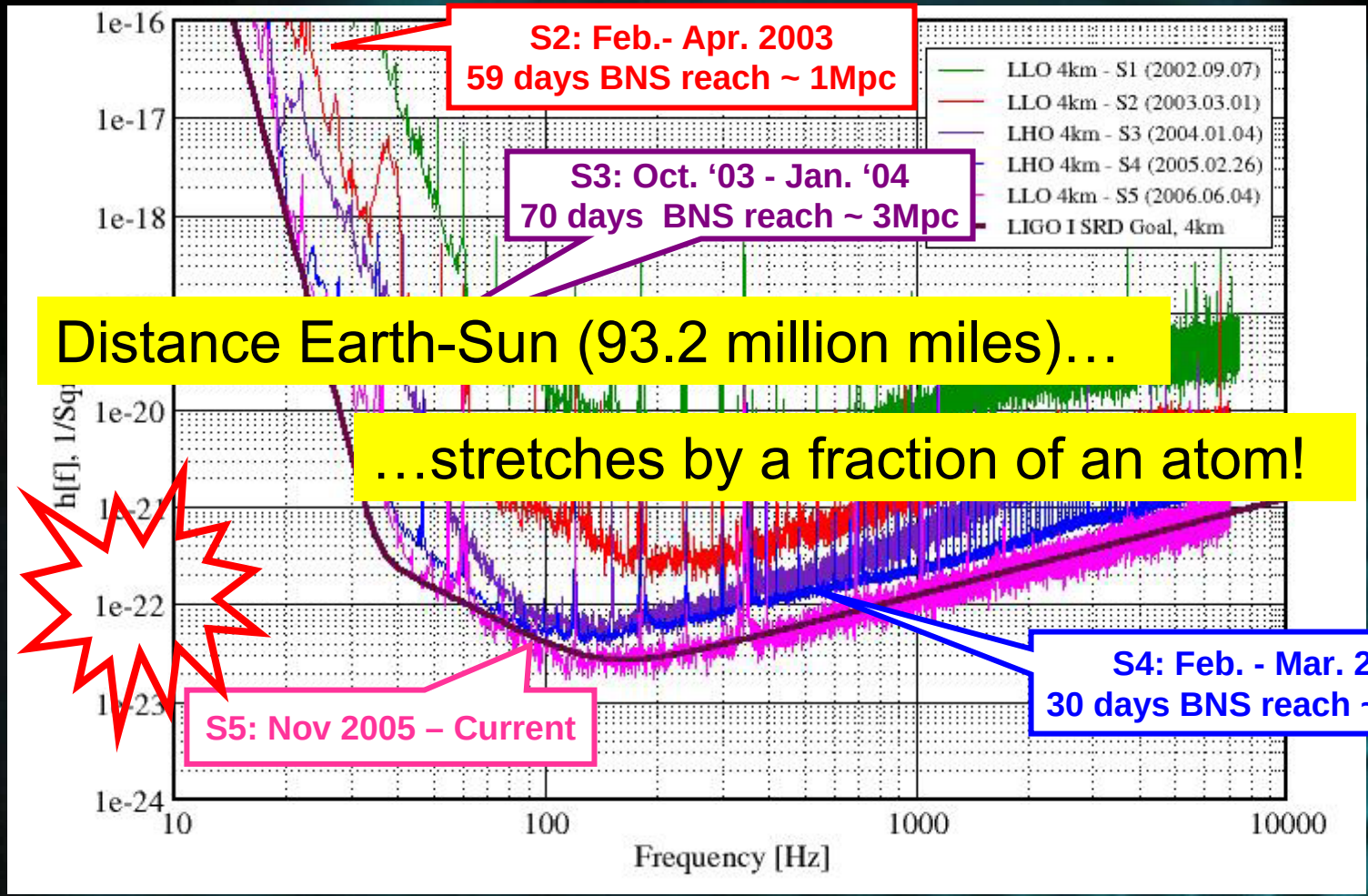


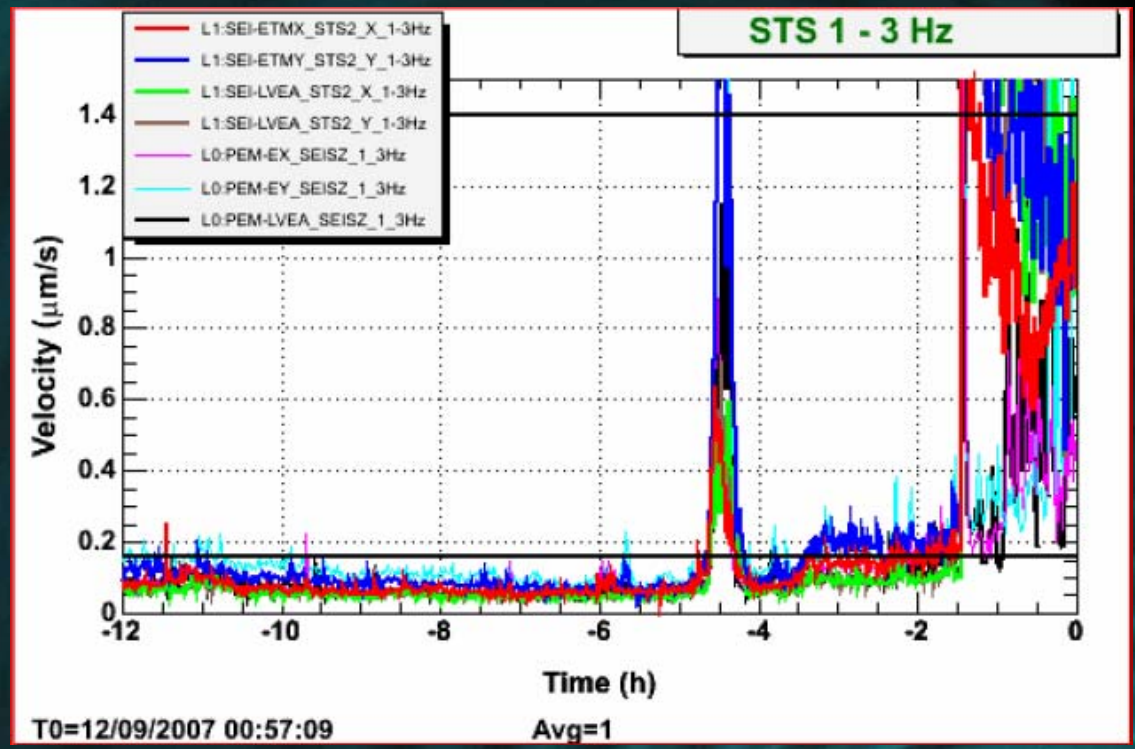
Picture credit: **NASA/WMAP**

LIGO sensitivity



LIGO is so sensitive that it feels…

- Cars and trucks
- Airplanes
- Sea waves
- Earthquakes…



MAP	5.2	2007/09/12 12:21:44	-2.667	100.318	10.0	KEPULAUAN MENTAWAI REGION, INDONESIA
MAP	8.4	2007/09/12 11:10:26	-4.517	101.382	30.0	SOUTHERN SUMATRA, INDONESIA

LIGO outreach

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LIGO Science Education Center

LIGO

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Photos by Ana Sousa

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http://www.ligo-la.caltech.edu

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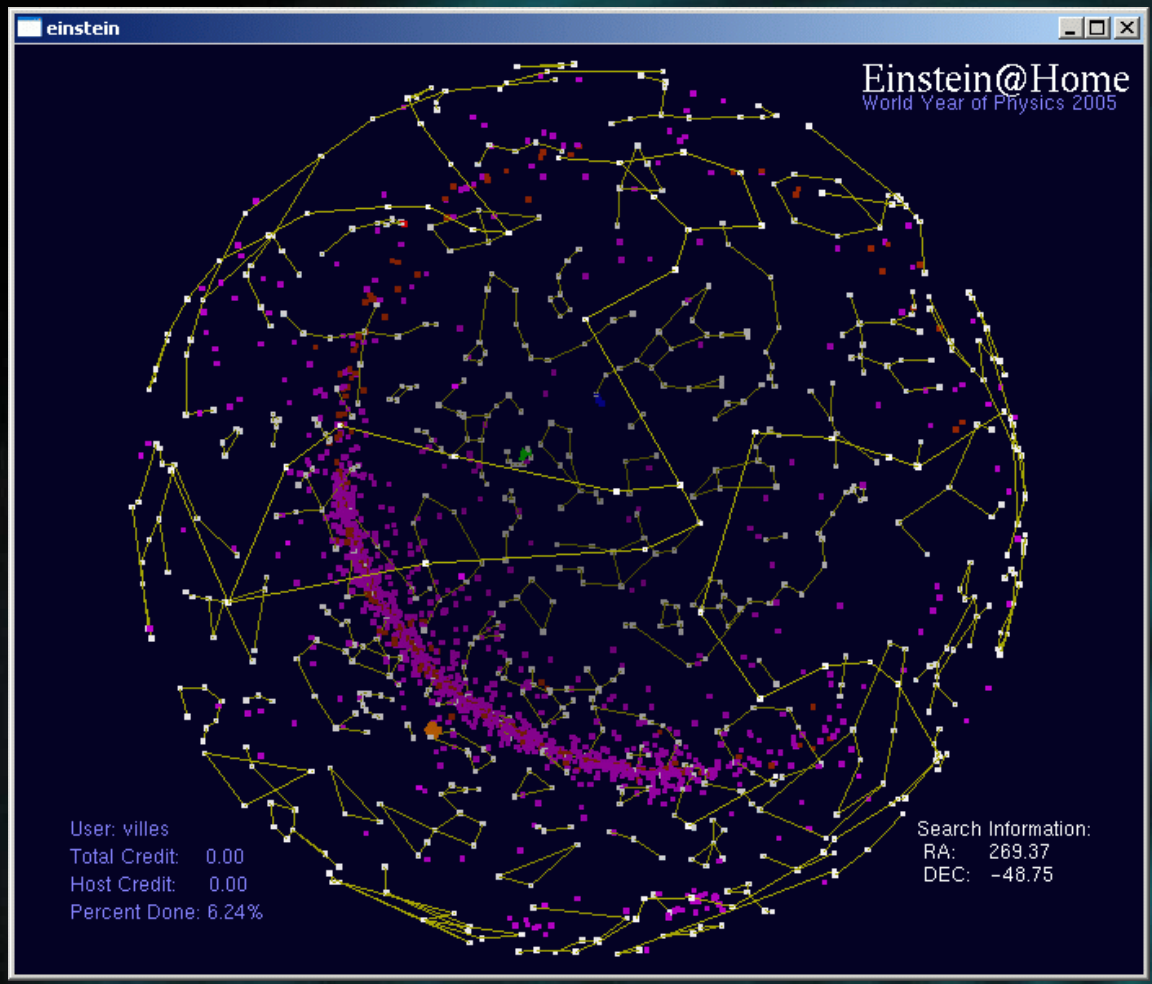
The Einstein@home Project



Users and Computers

Sun Oct 8 2007 17:12 UTC

USERS	Approximate #
in database	288,739
with credit	179,736
registered in past 24 hours	161

HOST COMPUTERS	Approximate #
in database	789,209
registered in past 24 hours	377
with credit	412,701
active in past 7 days	58,125
floating point speed[1)]	68.4 TFLOPS

http://www.einsteinathome.org

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Thank you!

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