

# Proposal for Fermilab Participation in the LSC

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# Fermilab

## Formal Statement of Mission

*Fermi National Accelerator Laboratory advances the understanding of the fundamental nature of matter and energy by providing leadership and resources for qualified researchers to conduct **basic research at the frontiers of high energy physics and related disciplines.***



- Strong historical focus on accelerator based research
- Participation in CDMS, SDSS, Auger project
  - Strong Astro Theory Group
- Gravity is a natural future direction
  - This is recognized only by [a] far sighted individual[s] at Fermilab

# WYSIWYG:Fermilab Gravity “Group”

- Assisting in LIGO commissioning
  - Started in Fall, 1999
  - ~2 weeks every 2 months at LHO and LLO
- Why?
  - Long standing interest in gravity
    - undergrad senior thesis on black hole gravity effects
  - An experimentalist’s need to understand detector to understand data
- Who else?
  - 1 or 2 senior scientists with latent interest
  - possibility of a postdoc

# Plan for LSC/LIGO Activities

- Continued participation in commissioning
  - mainly at LLO
- Detector characterization
- Data Analysis White Paper Revision W.G.
- Develop a plan for Fermilab participation in data analysis
- Stochastic Sources Group
  - upper limit working group

# Stochastic Gravity Waves

Unique window to *earliest* universe

- The competition:
  - Photons from CMBR at  $T \approx 500$  eV
  - Last neutrino scattering when  $T \approx 1$  MeV
- Universe transparent to GW back to Planck time  
 $T \approx 10^{19}$  GeV

*“From most of cosmic history (in log space) since the Planck time, and on most scales of structure, only ... gravitational waves survive to the present.”*

*C. Hogan, astro-ph/0009136*

# Earliest universe:

## The ultimate high energy physics lab

- Earliest universe may provide the only experimental information on our most profound and fundamental questions
  - why is the vacuum energy so small?
  - how is gravity quantized?
  - how does it unify with the other forces?
  - how/when did all those extra dimensions curl up and leave us with a 3+1 dimension universe?

# Fermilab a major player in gravity?

- Not now. The plate is full. The budget is thin.
  - CDF/D0 Run II starting
  - LHC accelerator and CMS participation
  - Long baseline neutrinos
  - BTeV? NLC? VLHC?
- CDF/D0 search for evidence of extra dimensions
- FNAL theorists with important contributions
  - C.Hill, J. Lykken, M. Turner, E. Kolb, A Stebbins
- Long range (>2010), I believe it's a natural fit
  - *understanding gravity will be a main focus of HEP*