

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*