Fundamental Physics at the Intensity Frontier.

J.L. Hewett (SLAC), H. Weerts (Argonne), R. Brock (Michigan State U.), J.N. Butler, B.C.K. Casey (Fermilab), J. Collar (Chicago U., EFI), A. de Govea(Northwestern U.), R. Essig (SUNY, Stony Brook), Y. Grossman (Cornell U., Phys. Dept.), W. Haxton (UC, Berkeley) *et al*. *Show all 468 authors*.

May 2012
229 pp.

ANL-HEP-TR-12-25, SLAC-R-991
e-Print: arXiv:1205.2671 [hep-ex] PDF

Abstract: The Proceedings of the 2011 workshop on Fundamental Physics at the Intensity Frontier. Science opportunities at the intensity frontier are identified and described in the areas of heavy quarks, charged leptons, neutrinos, proton decay, new light weakly-coupled particles, and nucleons, nuclei, and atoms.

Long-Baseline Neutrino Experiment (LBNE) Conceptual Design Report The LBNE Water Cherenkov Detector

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April 10, 2012
386 pp
arXiv:1204.2295v1 [physics.ins-det]

The 2010 Interim Report of the Long-Baseline Neutrino Experiment Collaboration Physics Working Groups.

LBNE Collaboration (T. Akiri *et al*.) *Show all 332 authors*.

Oct 2011
113 pp.

FERMILAB-FN-0941-PPD, LBNE-PWG-004
e-Print: arXiv:1110.6249 [hep-ex] PDF
Experiment: LBNE

Abstract: In early 2010, the Long-Baseline Neutrino Experiment (LBNE) science collaboration initiated a study to investigate the physics potential of the experiment with a broad set of different beam, near- and far-detector configurations. Nine initial topics were identified as scientific areas that motivate construction of a long-baseline neutrino experiment with a very large far detector. We summarize the scientific justification for each topic and the estimated performance for a set of far detector reference configurations. We report also on a study of optimized beam parameters and the physics capability of proposed Near Detector configurations. This document was presented to the

collaboration in fall 2010 and updated with minor modifications in early 2011.

Note: Corresponding author R.J.Wilson (Bob.Wilson@colostate.edu)/ 113 pages, 90 figures

Long Baseline Neutrino Experiments and Underground Facilities.

Maury Goodman (Argonne), Bruce King, Zohreh Parsa (Brookhaven), Fritz de Jong, Steve Geer, Jorge Morfin, Rajendran Raja, Raymond Sefanski (Fermilab), John Krane (Iowa State U.), Paul Nienaber (Marquette U.) J.K. Nelson (Minnesota U.), Robert Shrock (SUNY, Stony Brook), Gerald Blazey (Northern Illinois U.), Heidi Schellman, Gokhan Unel (Northwestern U.), Kevin McFarland (Rochester U.), Vernon Barger (Wisconsin U., Madison) .

Feb 2001
3 pp.

Record created 2010-05-31, last modified 2012-07-14

Large fiducial mass neutrino detectors at an underground facility are of significantinterest as detectors for intense neutrino beams. Many of the detectors
being proposed for astrophysical neutrino physics and for proton decay canserve as detectors for accelerator based experiments with reasonable modifications.
The siting of the underground facility does have some effect on the physics reach; locations either quite close to or very far away from an accelerator are favored. We strongly support construction of an underground research facility and hope to participate in one or more of the large detectors proposed.

Record created 2010-05-31, last modified 2012-07-14

Flavor Physics in the Quark Sector

M. Antonelli, *et al*. *Show all 140 authors*.

(Submitted on 29 Jul 2009 (v1), last revised 19 Feb 2010 (this version, v2))

One of the major challenges of particle physics has been to gain an in-depth understanding of the role of quark flavor and measurements and theoretical interpretations of their results have advanced tremendously: apart from masses and quantum numbers of flavor particles, there now exist detailed measurements of the characteristics of their interactions allowing stringent tests of Standard Model predictions. Among the most interesting phenomena of flavor physics is the violation of the CP symmetry that has been subtle and difficult to explore. Till early 1990s observations of CP violation were confined to neutral K mesons, but since then a large number of CP-violating processes have been studied in detail in neutral B mesons. In parallel, measurements of the couplings of the heavy quarks and the dynamics for their decays in large samples of K, D, and B mesons have been greatly improved in accuracy and the results are being used as probes in the search for deviations from the Standard Model. In the near future, there will be a transition from the current to a new generation of experiments, thus a review of the status of quark flavor physics is timely. This report summarizes the results of the current generation of experiments that is about to be completed and it confronts these results with the theoretical understanding of the field.

Comments: Report of the CKM workshop, Rome 9-13th Sep. 2008, 340 pages, 106 postscript figures, submitted to Phys. Repts

Subjects: High Energy Physics - Phenomenology (hep-ph)

Journal reference: Physics Reports 494 (2010), pp. 197-414

DOI: 10.1016/j.physrep.2010.05.003
Report number: BNL-90299-2009-BC, CERN-PH-TH-2009-112, FERMILAB-PUB-09-323-T, LAL 09-111, MPP-2009-88, MZ-TH/09-22, MKPH-T-09-14, SLAC-R-926, TUM-HEP-728/09,WSU-HEP-0902
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Submission history [v1] Wed, 29 Jul 2009 21:00:53 GMT (4879kb)
[v2] Fri, 19 Feb 2010 14:30:14 GMT (4892kb)

Report of the US long baseline neutrino experiment study

V. Barger, M. Bishai, D. Bogert, C. Bromberg, A. Curioni, M. Dierckxsens, M. Diwan, F. Dufour, D. Finley, B.T. Fleming, J. Gallardo, J. Heim, P. Huber, C.K. Jung, S. Kahn, E. Kearns, H. Kirk, T. Kirk, K. Lande, C. Laughton, W.Y. Lee, K. Lesko, C. Lewis, P. Litchfield, A.K. Mann, A. Marchionni, W. Marciano, D. Marfatia, A.D. Marino, M. Marshak, S. Menary, K. McDonald, M. Messier, W. Pariseau, Z. Parsa, S. Pordes, R. Potenza, R.Rameika, N. Saoulidou, N. Simos, R. Van Berg, B. Viren, K. Whisnant, R. Wilson, W. Winter, C. Yanagisawa, F. Yumiceva, E. D. Zimmerman, R. Zwaska

arXiv.org:hep-ph/arXiv:0705.4396

(Submitted on 30 May 2007)

This report provides the results of an extensive and important study of the potential for a U.S. scientific program that will extend our knowledge of neutrino oscillations well beyond what can be anticipated from ongoing and planned experiments worldwide. The program examined here has the potential to provide the U.S. particle physics community with world leading experimental capability in this intensely interesting and active field of fundamental research. Furthermore, this capability could be unique compared to anywhere else in the world because of the available beam intensity and baseline distances. The present study was initially commissioned in April 2006 by top research officers of Brookhaven National Laboratory and Fermi National Accelerator Laboratory and, as the study evolved, it also provided responses to questions formulated and addressed to the study group by the Neutrino Scientific Advisory Committee (NuSAG) of the U.S. DOE and NSF. The participants in the study, its Charge and history, plus the study results and conclusions are provided in this report and its appendices. A summary of the conclusions is provided in the Executive Summary.
*Comments: 109 pages, 56 figures, Subjects: High Energy Physics - Phenomenology (hep-ph) Report number: Fermilab-0801-AD-E, BNL-77973-2007-IR Cite as: arXiv:0705.4396v1 [hep-ph] .

PROPOSAL FOR AN EXPERIMENTAL PROGRAM IN NEUTRINO PHYSICS AND PROTON DECAY IN THE HOMESTAKE LABORATORY

M. Diwan, Steven H. Kettell, L. Littenberg, W. Marciano, Z. Parsa, N. Samios, S. White (Brookhaven), R. Lanou (Brown U.), W. Leland, K. Lesko (UC, Berkeley) Karsten Heeger, W.Y. Lee (LBL, Berkeley), W. Frati, K. Lande, A.K. Mann, R. Van Berg, K.T. McDonald (Princeton U.), D.B. Cline (UCLA), P. Huber, V. Barger (Wisconsin U., Madison), D. Marfatia (Kansas U.), T. Kirk (Colorado U.)
(Submitted on 8 Aug 2006 (v1), last revised 12 Jan 2007 (this version, v2)

This report is intended to describe first, the principal physics reasons for an ambitious experimental program in neutrino physics and proton decay based on construction of a series of massive water Cherenkov detectors located deep

underground (4850 ft) in the Homestake Mine of the South Dakota Science and Technology Authority (SDSTA); and second, the engineering design of the underground chambers to house the Cherenkov detector modules; and third, the conceptual design of the water Cherenkov detectors themselves for this purpose. Included in this document are preliminary costs and time-to-completion estimates which have been exposed to acknowledged experts in their respective areas. We have included some contingency factors. Nevertheless, we recognize that much more extensive documentation and contingency estimates will be needed for a full technical design report. In this proposal we show the event rates and physics sensitivity for beams from both FNAL (1300 km distant from Homestake) and BNL (2540 km distant from Homestake). The program we propose will benefit from a beam from FNAL because of the high intensities currently available from the Main Injector with modest upgrades. The possibility of tuning the primary proton energy over a large range from 30 to 120 GeV also adds considerable flexibility to the program from FNAL.

Comments: 47 pages, 21 figures, Report prepared as part of the FNAL/BNL joint study on long baseline neutrino oscillations
Subjects: High Energy Physics - Experiment (hep-ex) Report number: BNL-76798-2006-IR Cite as: arXiv:hep-ex/0608023v2
[v1] Tue, 8 Aug 2006 19:05:37 GMT (956kb)
[v2] Fri, 12 Jan 2007 23:07:41 GMT (956kb)

Proposal for an Experimental Program in Neutrino Physics and Proton Decay in the Homestake Laboratory.

M. Diwan, Steven H. Kettell, L. Littenberg, W. Marciano, Z. Parsa, N. Samios, S. White (Brookhaven), R. Lanou (Brown U.), W. Leland, K. Lesko (UC, Berkeley) Karsten Heeger, W.Y. Lee (LBL, Berkeley), W. Frati, K. Lande, A.K. Mann, R. Van Berg, K.T. McDonald (Princeton U.), D.B. Cline (UCLA), P. Huber, V. Barger (Wisconsin U., Madison), D. Marfatia (Kansas U.), T. Kirk (Colorado U.).

Aug 2006
47 pp.

BNL-76798-2006-IR
e-Print: hep-ex/0608023 [hep-ex] PDF

Abstract: This report is intended to describe first, the principal physics reasons for an ambitious experimental program in neutrino physics and proton decay based on construction of a series of massive water Cherenkov detectors located deep underground (4850 ft) in the Homestake Mine of the South Dakota Science and Technology Authority (SDSTA): and second, the engineering design of the underground chambers to house the Cherenkov detector modules: and third, the conceptual design of the water Cherenkov detectors themselves for this purpose. Included in this document are preliminary costs and time-to-completion estimates which have been exposed to acknowledged experts in their respective areas. We have included some contingency factors. Nevertheless, we recognize that much more extensive documentation and contingency estimates will be needed for a full technical design report. In this proposal we show the event rates and physics sensitivity for beams from both FNAL (1300 km distant from Homestake) and BNL (2540 km distant from Homestake). The program we propose will benefit from a beam from FNAL because of the high intensities currently available from the Main Injector with modest upgrades. The possibility of tuning the primary proton energy over a large range from 30 to 120 GeV also adds considerable flexibility to the program from FNAL.

Record created 2006-08-08, last modified 2010-10-09

Intense neutrino beams and leptonic CP violation.

William Marciano, Zohreh Parsa (Brookhaven).

Oct 2006
7 pp.

Nucl.Phys.Proc.Suppl. 221 (2011) 166-172
DOI: 10.1016/j.nuclphysbps.2011.03.114
Contributed to Conference: C06-06-13.1
BNL-HET-06-14
e-Print: hep-ph/0610258 [hep-ph] PDF
Abstract: Effects of the Leptonic CP violating phase,\delta, on 3 generation neutrino oscillation rates and asymmetries are discussed. A figure of merit argument is used to show that our ability to measure the phase \delta is rather insensitive to the value of \theta_{13} (for \sin^22\theta_{13}\gsim0.01) as well as the detector distance (for very long oscillation baselines). Using a study of \nu_\mu\to\nu_e oscillations for BNL-Homestake (2540 km) we show that a conventional horn focused wide band neutrino beam generated by an intense 1-2 MW proton source combined with a very large water Cherenkov detector (250-500 kton) should be able to determine \delta to about \pm 15^\circ$ in 5\times 10^7sec of running. In addition, such an effort would also measure the other oscillation parameters (\theta_{ij}, \Delta m^2_{ij}) with high precision. Similar findings apply to a Fermilab-Homestake (1280 km)baseline. We also briefly discuss features of Superbeams, Neutrino Factories and Beta-Beams. Record created 2006-10-22, last modified 2012-04-27

Physics of an intense neutrino beam from BNL to a very long baseline detector.

Zohreh Parsa
Brookhaven National Laboratory, Physics Dept., 510 A, Upton, NY 11973

AIP Conf. Proc. 698, pp. 307-313; doi:http://dx.doi.org/10.1063/1.1664248 (7 pages)

INTERSECTIONS OF PARTICLE AND NUCLEAR PHYSICS: 8th Conference CIPANP2003

An intense neutrino facility allows probing of the neutrino mixing angles, mass hierarchy, and leptonic CP violation. Physics potential, for making precision measurements of all neutrino oscillation parameters (θij, Δmij^2, δ) using a wide band ν_μ beam, to a (very long baseline) detector is presented. Potential of a Neutrino beam from Brookhaven National Laboratory to a 2540 km baseline (with 0.5 megaton) detector at Homestake Mine in South Dakota, is (under study by our neutrino working group) discussed. Schematics of the beam facility for the AGS upgrade to 1 MW with a cycle time of 2.5 and 10^{14} protons on target at 28 GeV; and a map with possible detector sites are also included.
Record created 2004-08-30, last modified 2012-03-17

Neutrino electron scattering theory.

William J. Marciano, Zohreh Parsa (Brookhaven).

2003
20 pp.

J.Phys.G G29 (2003) 2629-2645
DOI: 10.1088/0954-3899/29/11/013
e-Print: hep-ph/0403168 [hep-ph] PDF
Abstract: Standard Model predictions for neutrino-electron scattering cross-sections, including effects of electroweak radiative corrections, are reviewed. The sensitivity of those quantities to neutrino dipole moments, z' bosons, dynamical symmetry breaking and other types of ``New Physics'' is described. Neutrino indices of refraction in matter are also discussed. A perspective on future initiatives with intense neutrino sources, such as superbeams and neutrino factories, is given.

Record created 2003-12-08, last modified 2011-07-14

The neutrino superbeam from the AGS.

W.T. Weng, D. Beavis, M. Brennan, M. Diwan, Richard C. Fernow, J. Gallardo, S. Kahn, W. Marciano I. Marneris, W. Morse, Zohreh Parsa, D. Raparia, T. Roser, A. Ruggiero, J. Sandberg, N. Samios, Y. Semertzidis, N. Simos, N. Tsoupas, B. Viren (Brookhaven)

2003
4 pp.

J.Phys.G G29 (2003) 1735-1738
DOI: 10.1088/0954-3899/29/8/340
Prepared for Conference: C02-07-01.3

AGS super neutrino beam facility accelerator and target system design: Neutrino working group report II.

M. Diwan, W. Marciano, W.T. Weng, D. Raparia, J. Alessi, D. Barton, D. Beavis, S. Bellavia, J. Brennan, B. Bromley Mu-Chun Chen, Richard C. Fernow, J. Gallardo, R. Hahn, S. Kahn, H. Kirk, Y.Y. Lee, D. Lowenstein, H. Ludewig, I. Marneris, Zohreh Parsa, A. Pendzick, C. Pearson, T. Roser, A. Ruggiero, J. Sandberg, N.P. Samios, C. Scarlet, N. Simos, N. Tsoupas, J. Tuozzolo, J. Beebe-Wang, B. Viren, P. Yamin, M. Yeh, Wu Zhang (Brookhaven), W. Frati, J.R. Klein, K. Lande, A.K. Mann, R. Van Berg, P. Wildenhain (Pennsylvania U.), R. Corey (South Dakota Sch. Mines Tech.), D.B. Cline, K. Lee, B. Lisowski, P.F. Smith (UCLA), R. Potenza (INFN, Catania & Catania U.), G. Evangelakis (Ioannina U.)

May 2003
114 pp.
BNL-71228-2003-IR
e-Print: hep-ex/0305105 [hep-ex] PDF

Abstract: This document describes the design of the accelerator and target systems for the AGS Super Neutrino Beam Facility. Under the direction of the Associate Laboratory Director Tom Kirk, BNL has established a Neutrino Working Group to explore the scientific case and facility requirements for a very long baseline neutrino experiment. Results of a study of the physics merit and detector performance was published in BNL-69395 in October 2002, where it was shown that a wide-band neutrino beam generated by a 1 MW proton beam from the AGS, coupled with a half megaton water Cerenkov detector located deep underground in the former Homestake mine in South Dakota would be able to measure the complete set of neutrino oscillation parameters. This report details the performance requirements and conceptual design of the accelerator and the target systems for the production of a neutrino beam by a 1.0 MW proton beam from the AGS. The major components of this facility include a new 1.2 GeV superconducting linac, ramping the AGS at 2.5 Hz, and the new target station for 1.0 MW beam. It also calls for moderate increase, about 30%, of the AGS intensity per pulse. Special care is taken to account for all sources of proton beam loss plus shielding and collimation of stray beam halo particles to ensure equipment reliability and personal safety. A preliminary cost estimate and schedule for the accelerator upgrade and target system are also included. Record created 2003-05-30, last modified 2011-07-15

Very long baseline neutrino oscillation experiments for precise measurements of mixing parameters

and CP violating effects.

M.V. Diwan, D. Beavis, Mu-Chun Chen, J. Gallardo, S. Kahn, W. Marciano, W. Morse, Zohreh Parsa, N. Samios Y. Semertzidis, B. Viren, W. Weng, P. Yamin (Brookhaven), W. Frati, K. Lande, A.K. Mann, R. Van Berg, P. Wildenhain (Pennsylvania U.), J.R. Klein (Texas U.), I. Mocioiu (Arizona U.), R. Shrock (SUNY, Stony Brook), K.T. McDonald (Princeton U.)

Mar 2003
10 pp.

Phys.Rev. D68 (2003) 012002
DOI: 10.1103/PhysRevD.68.012002
e-Print: hep-ph/0303081 [hep-ph] PDF

Abstract: We analyze the prospects of a feasible, Brookhaven National Laboratory based, very long baseline (BVLB) neutrino oscillation experiment consisting of a conventional horn produced low energy wide band beam and a detector of 500 kT fiducial mass with modest requirements on event recognition and resolution. Such an experiment is intended primarily to determine CP violating effects in the neutrino sector for 3-generation mixing. We analyze the sensitivity of such an experiment. We conclude that this experiment will allow determination of the CP phase δ_CP and the currently unknown mixing parameter θ_13, if $\sin^2 2\theta\_13 \geq 0.01$, a value ~15 times lower than the present experimental upper limit. In addition to θ_13 and δ_CP, the experiment has great potential for precise measurements of most other parameters in the neutrino mixing matrix including Δm^2_32 , $\sin^2 2\theta\_23$, $\Delta m^2\_21 \times \sin^2 \theta\_12$, and the mass ordering of neutrinos through the observation of the matter effect in the $\nu\_\mu \rightarrow \nu\_e$ appearance channel. Record created 2003-03-11, last modified 2011-07-15

Scenarios for BNL neutrino superbeam and oscillation experiment.

Zohreh Parsa (Brookhaven).

Jun 2002
3 pp.

Prepared for Conference: C02-06-03.1, p.1037-1039
Keyword(s): INSPIRE: talk: Paris 2002/06/03
Record created 2003-10-01, last modified 2010-05-08

Physics of an intense neutrino beam from BNL to a very long baseline detector.

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AIP Conf. Proc. 698, pp. 307-313; doi:http://dx.doi.org/10.1063/1.1664248 (7 pages)

INTERSECTIONS OF PARTICLE AND NUCLEAR PHYSICS: 8th Conference CIPANP2003

An intense neutrino facility allows probing of the neutrino mixing angles, mass hierarchy, and leptonic CP violation. Physics potential, for making precision measurements of all neutrino oscillation parameters (θij, Δmij^2, δ) using a wide band ν_μ beam, to a (very long baseline) detector is presented. Potential of a Neutrino beam from Brookhaven National Laboratory to a 2540 km baseline (with 0.5 megaton) detector at Homestake Mine in South Dakota, is (under study by our neutrino working group) discussed. Schematics of the beam facility for the AGS upgrade to 1 MW with a cycle time of 2.5 and 10^{14} protons on target at 28 GeV; and a map with possible detector sites are also included.

Record created 2004-08-30, last modified 2012-03-17

Neutrino oscillation experiments for precise measurements of oscillation parameters and search for muon-neutrino ---> electron-neutrino appearance and CP violation: Letter of intent to Brookhaven National Laboratory.

D. Beavis, M. Diwan, Richard C. Fernow, J. Gallardo, S. Kahn, H. Kirk, W. Marciano, W. Morse, Zohreh Parsa, R. Palmer *et al*. *Show all 42 authors*.

Apr 2002
39 pp.

e-Print: hep-ex/0205040 [hep-ex] PDF

Abstract: The possibility of making a low cost, very intense high energy proton source at the Brookhaven Alternating Gradient Synchrotron (AGS) along with the forthcoming new large underground detectors at either the National Underground Science Laboratory (NUSL) in Homestake, South Dakota or at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, allows us to propose a program of experiments that will address fundamental aspects of neutrino oscillations and CP-invariance violation. This program of experiments is unique because of the extra-long baseline of more than 2500 km from Brookhaven National Laboratory to the underground laboratories in the West, the high intensity of the proposed conventional neutrino beam, and the possibility of constructing a very large array of water Cerenkov detectors with total mass approaching 1 Megaton. As part of this program we also consider experiments at moderately long baselines (~400 km) using other detector technologies that can yield valuable and complementary information on neutrino oscillations. This letter of intent focuses on the design and construction of the necessary AGS upgrades and the new neutrino beam which will initially have a proton beam of power ~0.5 MW: the power will then be upgraded to ~1.3 MW in a later phase. Record created 2002-05-16, last modified 2011-07-15

A Scenario for a Brookhaven neutrino super beam experiment.

M.V. Diwan, S.A. Kahn, R.B. Palmer, Zohreh Parsa, I. Stumer (Brookhaven), K.T. McDonald (Princeton U.).

Jun 2001
5 pp.

eConf C010630 (2001) E103
Prepared for APS / DPF / DPB Summer Study on the Future of Conference: C01-06-30
SNOWMASS-2001-E103

Record created 2002-08-13, last modified 2011-10-22

Earlier papers & notes

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