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BLV-2011 Workshop, September 22-24, 2011

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The 3-rd International 3-days Workshop "Baryon and Lepton Number Violations: BLV-2011" took place at Gatlinburg, TN for September 22-24, 2011. Workshop was organized by the International Organizing Committee and had received advice from the International Program Advisory Committee (see Appendix 1). Workshop was co-chaired by Pavel Fileviez Perez (University of Wisconsin) for theory and Yuri Kamyshkov (University of Tennessee) for experiment and local organization. Workshop was supported and sponsored by the University of Tennessee, Indiana University, North Carolina State University together with TUNL, and by the HEP office of the Department of Energy. DOE financial support in this sponsoring grant was $8,000; that was 23% of the overall budget of the Workshop. Remaining 77% were provided by the sponsoring Universities. Workshop sponsors including DOE are shown on the Workshop webpage [3].

There were 90 workshop participants with 52 from US and remaining from Bosnia/Herzegovina (1), Brazil (1), China (1), Columbia (1), France (1), Germany (10), Italy (9), Japan (4), Russian Federation (3), Slovenia (2), Spain (4), and Switzerland (1). Among Workshop participants there were 17 postdocs and young researchers and 11 graduate students. Total 67 talks and 14 posters were presented at Workshop during 3 days of sessions. Appendix 2 shows the list of talks and posters.

Main topic of the Workshop was Baryon and Lepton number violation that has become a vital part of the current discussions of the physics beyond the Standard Model (SM), specifically in connection with understanding the nature of neutrinos, origin of matter in universe, as well as possible Grand Unification of matter and forces. The goal of the Workshop was to have a focused comprehensive discussion of the Baryon (B) and Lepton (L) number violating processes, and possible new physics combining violation of both, including (B−L) violation, as a probe of unification, baryo- and lepto-genesis, Left-Right symmetry restoration, matter-antimatter asymmetry, sterile matter, mirror matter, dark matter, low-scale gravity, etc. Related experimental observations to these physics aspects included searches for Majorana neutrinos ($2\beta0\nu$ decays), proton decays, neutron-antineutron oscillations, μ-e transitions, mirror and sterile matter transformations, and possible other new phenomena that can be seen at LHC and future colliders. Combination of theoretical and experimental discussions at the Workshop was most stimulating for germinating of new theoretical ideas and promoting new experimental efforts in particle physics. As one of new developments stemmed from this Workshop was an idea of performing new neutron-antineutron transformation search [1] at the Project X accelerator to be built at Fermilab [2].

BLV2011 Workshop website: http://www.phys.utk.edu/BLV2011/ [3] contains all the talks delivered at this Workshop. Agenda of the Workshop can be found in Appendix 2 to this report. During the Workshop all presentation talks were available at the web in parallel with the talks. This made the discussions of the new ideas and results at the meeting more prompt and efficient.

Previous Workshops on Baryon and Lepton Number Violation search in 2007 at LBL [4] and 2009 at the University of Wisconsin [5] were organized essentially by the same initiative group of people as this Workshop. We are observing increased interest in the community to this physics topic. Next BLV-2013 Workshop [6] now at bi-annual basis is being organized at the Max Plank Institute at Heidelberg by Pavel Fileviez Perez.

References

[1] K Ganezer et al., (*The NNbarX Collaboration),* "Expression of Interest to Search for Neutron-Antineutron Transformation at Fermilab", Fermilab, September 4, 2012.
[2] Project X at Fermilab http://projectx.fnal.gov/

[3] 3-rd International Workshop on Baryon and Lepton number Violation, BLV-2011, Gatlinburg, TN, September 22-24, 2011, http://www.phys.utk.edu/BlV2011/index.html.

[4] 1-st International 2007 Workshop on "Search for Baryon and Lepton Number Violations", BLV-07, LBNL, Berkeley, September 20-22, 2007; http://inpa.lbl.gov/BLNV/blnv.htm.

[5] 2-nd International 2009 Workshop on "Lepton and Baryon Number Violation (LBV09)", University of Wisconsin, Madison, September 21-23, 2009 http://www.physics.wisc.edu/groups/particle-theory/LBV09-July18.htm.

[6] 4-nd International 2013 Workshop on "Baryon and Lepton Number Violation (LBV2013)", MPIK Heidelberg, Germany, April 8-12, 2013; http://www.mpi-hd.mpg.de/BLV2013/

Appendix 1

Workshop chair persons:

P. Fileviez Perez,	University of Wisconsin,	co-chair
Y. Kamyshkov,	University of Tennessee,	co-chair

International Organizing Committee of BLV-2011 Workshop

K. Babu, Oklahoma State U., US
V. Barger, U. of Wisconsin, US
A. Dolgov, Ferrara U., Italy
P. Fileviez Perez, U. of Wisconsin, US (co-chair)
T. Kajita, ICRR, Japan
Y. Kamyshkov, U. of Tennessee, US (co-chair)
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M. Lindner, MPI for Nuclear Physics, Germany
R. Mohapatra, U. of Maryland, US
P. Nath, Northeastern U., US
L. Oberauer, TU Munich, Germany
A. Rubbia, ETH, Switzerland
G. Senjanovic, ICTP, Italy
J. Siegrist, LBL, US
M. Snow, Indiana Univ., US
A. Suzuki, KEK, Japan
M. B. Wise, Caltech, US
A. Young, NCSU, US

International Advisory Committee of BLV-2011 Workshop

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Zurab Berezhiani (Gran Sasso)
Marcela Carena (FNAL)
Raman Cowsik (WU)
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Steve Elliot (LANL)
Gianni Fiorentini (Ferrara)
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Maria C. Gonzalez-Garcia (Stony Brook)
Giorgio Gratta (Stanford)
Yuval Grossman (Cornell)
Francis Halzen (Wisconsin)
Tao Han (Wisconsin)
Ed Kearns (Boston)
Ken Lande (Pennsylvania)
Kevin Lesko (LBL, DUSEL)
Bruce Mellado (Wisconsin)
Ann Nelson (Washington)
Lev Okun (ITEP)
Jogesh Pati (UMD/SLAC)
Stuart Raby (Ohio)
Michael Ramsey-Musolf (Wisconsin)
Valery Rubakov (IAE)
Mikhail Shaposhnikov (Lausanne)
Robert Schrock (Stony Brook)
Alexei Smirnov (ICTP)
Hank Sobel (UCI)
Yoichiro Suzuki (ICRR, Japan)
Mikhail Voloshin (Minnesota)
Steven Weinberg (Texas)
Edward Witten (IAS, Princeton)

Appendix 2

BLV-2011 Scientific Program

Talks Thursday, September 22, 2011

- **Session 1: Overview of the Field**
    - B, L Violation Theoretical Overview (Goran Senjanovic)
    - View of Experimental B and L Violation Search Field (Stuart Freedman)
    - US Underground Experimental Opportunities (Eli Rosenberg)
- **Session 2: Baryon and (B-L) Number Violation (Theory)**
    - What Can N-N-Bar Oscillation Search Teach Us About Physics BSM (Rabindra Mohapatra)
    - Baryon Number and a Fourth Generation (Mark Wise)
    - Perspectives on Proton Decay and GUTs (Pran Nath)
    - Light Leptoquarks in Grand Unified Theories (Ilja Doršner)
- **Session 3: Baryon and (B-L) Number Violation (Experiment)**
    - Search for Nucleon Decay (Makoto Miura)
    - Water Cherenkov Detectors for Proton Decay (Robert Svoboda)
    - Search for Proton Decay in the GLACIER Detector (Andre Rubbia)
    - Search for Nucleon Decay in the Future LENA Detector (Michael Wurm)
- **Session 4: Baryon and (B-L) Number Violation (Theory)**
    - Problems with the MSSM: Mu and Proton Decay (Stuart Raby)
    - SUSY GUTs on the Edge: Proton Decay (Kaladi Babu)
    - Supersymmetry Breaking and Proton Decay (Borut Bajc)
- **Session 5: Baryon and (B-L) Number Violation (Theory)**
    - The B-L MSSM from String Theory (Burt Ovrut)
    - Unification and Cogeneration of Dark Matter and Baryons (Stephen Barr)
    - Dark Matter, Baryogenesis and N-Nbar Oscillation (Bhaskar Dutta)

- **Posters Theory**
    - Freed Leptogenesis (Dmitry Zhuridov)  (Winner in Poster Competition)
    - Soft Masses in SUSY SO(10) GUTs With Sliding Intermediate Scales (Michal Malinsky)
    - Black Holes on Tense Branes (Usama al-Binni)
    - NNBar Suppression for Deuterium and Heavier Nuclei (Vladimir Kopeliovich)
    - More About Neutron-Antineutron Oscillations (Andrea Addazi)
    - Light Dark Matter & the Electroweak Phase Transition in the NMSSM (Nausheen Shah)
    - Long Range Lepton Flavor Interaction and Neutrino Oscillations (Hye-Sung Lee)
    - Neutrino masses, Dark Matter and B-L Symmetry at the LHC (Tong Li)
    - 3D EoS for Core-Collapse Supernovae and Neutron Stars Simulations (Helena Pais)
    - TeV Left-Right Symmetry and Neutrinoless Double Beta Decay (Vladimir Tello)
- **Posters Experiment**
    - From Cuoricino Result to Cuore-0 Startup: Cuore Begins (Matteo Biassoni)
    - Status of Double Chooz Experiment (Pau Novella)
    - NOvA Experiment at Fermilab (Athanasios Hatzikoutelis)
    - Majorana Demonstrator -> Path To the Low Background 0nu2b Experiment (Sergey Vasilyev)
- **Session 6: Baryon and (B-L) Number Violataion (Experiment)**
    - Neutron-Antineutron Oscillations at SNO (Marc Bergevin)
    - NNbar Search With Cold Neutron Beams (William Snow)
    - Slow Neutron Optics for a Long Distance Free Flight (Hirohiko Shimizu)
    - Experimental Searches for NNBar with UCN (Albert Young)

Talks Friday, September 23, 2011

- **Session 7: Lepton Flavour Violation (Experiment)**
    - Reactor Antineutrino Flux Anomaly (David Lhuillier)
    - Lepton Flavour Violation Exp. Search and Last MEG Results (Giovanni Signorelli)
    - DAEdALUS Project (Kate Scholberg)
    - Mini-BooNE and Very-Short-Baseline Decay-at-Rest (Michael Shaevitz)
- **Session 8: Lepton Flavour Violation (Theory)**
    - The Scalar Potential of Minimal Flavour Violation (Belen Gavela)
    - Search for Charged LFV Using a Muonic Atoms (Jo Sato)
    - Neutrino Oscillations in Quantum Mechanics and QFT (Eugeny Akhmedov)
    - Phenomenological Aspects of Charged Lepton Flavor Violation (Andre de Gouvea)
    - Hint of Light Sterile Neutrinos in the CMB? (Yvonne Wong)
    - Reaction Neutrino Fluxes (Patrick Huber)
- **Session 9: Lepton Number Violation Search (Theory)**
    - The Fate of R-Parity (Sogee Spinner)
    - Signatures of Leptoquarks in Low-Energy Phenomenology (Svjetlana Fajfer)
    - Neutrinoless Double Beta Decay and Neutrino Masses (Michael Duerr)
    - Neutrinoless Double Beta Decay: Neutrino and Particle Physics (Werner Rodejohann)

    Additional Talks

    - Measurement of the Neutrino Velocity with the OPERA Detector and the CGNS Beam (Andre Rubbia)
    - On Superluminal Photons (Alexander Dolgov)
- **Session 10: Lepton Number Violation Search (Experiment)**
    - Approach to Relic Neutrino Detection (Joe Formaggio)
    - 2b0nu in Xenon EXO and NEXT (Michelle Dolinski)
    - European Efforts in 2b0nu Search (Bernhard Schwingenheuer)
    - 2b0nu in KamLAND-Zen and SNO++ (Kunio Inoue)
    - Challenges in 2b0nu Search and Majorana Project (Reynold Cooper)
- **Session 11: Leptogenesis and Baryogenesis (Theory)**
    - Cosmic Antimatter (Alexander Dolgov)
    - Flavour Oscillations in Electroweak Baryogenesis (Vincenzo Cirigliano)
    - Supersymmetry and Baryogenesis at the Electroweak Phase Transition (Carlos Wagner)
    - Baryon Asymmetry of the Universe from the Scalaron Decay (Dmitry Gorbunov)

Talks Saturday, September 24, 2011

- **Session 12: New Searches and Dark Matter (Experiment)**
    - Future Physics in Project X (Robert Tschirhart)
    - Dark and Mirror Matter Search with UCN (Anatolii Serebrov)
    - EDM, UCN, Lorentz Invariance (Peter Fierlinger)
- **Session 13: BLV In Cosmology and Dark Matter (Theory)**
    - Constraining Asymmetric Dark Matter (Matthew Buckley)
    - Relic Abundance of Asymmetric Dark Matter (Weurnisha Yimingniyazi)
    - Neutron Oscillations: A Window to Parallel World? (Zurab Berezhiani)
    - Global B-L, Neutrino Mass and Dark Matter (Thomas Schwetz)
- **Session 14: BLV in Cosmology and Dark Matter (Theory)**
    - Sterile Neutrino Dark Matter in Unified Theories (Fedor Bezrukov)
    - Status of Dark Matter Searches (Mariangela Lisant)
    - DM, Charge, and Force: Signals of Hidden and Visible Symmetries (Daniel Feldman)
- **Session 15: New Physics at LHC (Theory)**
    - B Violation at the LHC (Tao Han)
    - New Processes at LHC and N-Nbar (Ilia Gogoladze)
    - L Violation at LHC (Miha Nemevsek)
    - Testing Minimum Flabour Seesaw Models at the LHC (Oscar Eboli)
- **Session 16: New Physics Search at LHC (Experiment)**
    - Overview of New Physics Searched in CMS (Greg Landsberg)
    - Higgs Searches at LHC (Bruce Mellado)
    - B. L., B-L Violation Searches at ATLAS (Vladimir Savinov)
    - L and B Violation at the LHC (Daniel Whiteson)
- **Session 17: Workshop Summary Talks**
    - Experimental Summary (Ed Kearns)
    - Theoretical Summary (Manfred Lindner)
    - Closing Comments (Pavel Fileviez Perez)