

Chen-Yu Liu

Physics Division, P-23, MS H803
Los Alamos National Laboratory
Los Alamos, NM 87545

Tel.: (505) 665-9804
Fax.: (505) 665-4121
E-Mail: cyliu@lanl.gov

Objective

A research faculty position in experimental physics, dedicated to precision measurements of fundamental particle physics.

Education

- 1997–2002 Ph.D., Physics, Princeton University, Princeton, NJ
Doctoral dissertation: “Superthermal Ultra-cold Neutron Sources”
Advisor: Albert R. Young
- 1994–1997 B.S., Physics, National Taiwan University, Taipei, Taiwan

Research Experiences

- 2002–present Director’s Funded Post-Doctoral Fellow, Los Alamos National Laboratory
Mentor: Steve K. Lamoreaux

Current projects:

- Devoting to a search for the electron electric dipole moment using a paramagnetic insulator to test the time reversal symmetry.
- Leading a development effort of a novice solid oxygen ultra-cold neutron source using the magnon mechanism.
- Participating in high-precision measurements on angular correlations of neutron β -decay using ultra-cold neutrons (UCN) to test the standard model (UCNA collaboration).

- 1997–2002 Assistant in Research, Princeton University
Advisor: Albert R. Young
- Made a breakthrough in applying solid deuterium as a superthermal ultra-cold neutron source by solving both theoretically and experimentally the decades-long problem of a short ultra-cold neutron lifetime, and succeeded in constructing the most intense UCN source in the world (This work won the 2001 Distinguished Performance Award at Los Alamos National Laboratory).
 - Designed and built an ortho/para-D₂ paramagnetic conversion system operated at cryogenic temperatures to control the ortho/para-D₂ ratio and solve the short UCN lifetime problem.
 - Developed a high-precision Raman laser spectroscopy system to monitor the ortho/para ratio of molecular deuterium/hydrogen.
 - Constructed and characterized a novel adiabatic UCN spin flipper using a bird-cage resonator (LC resonators in series), which produced a highly homogeneous field; tested with ultra-cold neutrons in Institut Laue-Langvin, France. This effort provided a proof-of-principle spin flipper for the UCNA experiment.
- 1996–1997 Assistant in Research, National Taiwan University
Advisor: Ting-Wai Chiu
- Conducted theoretical lattice QCD calculations of Dirac propagators on a computer using the Monte Carlo method.
 - Learned proficient theoretical and computational skills.
- 1995–1996 Assistant in Research, National Taiwan University
Advisor: Hong-Chang Yang
- Conducted an experimental investigation to image magnetic vortices in high T_c superconducting materials using Bitter decoration technique.
 - Learned proficient experimental skills in condensed matter physics.

Teaching Experiences

- 2000 spring Assistant in Instruction, Princeton University
Taught Physics for Poets (laboratory sessions and preceptor sessions)
- 1995–1996 Tutor
Tutored several high school students in math and physics for 2 years.

Organizational Experiences

1997 Organized the 11th Taiwan Spring School (conference) on QCD, Taipei
Served as an assistance in this international conference.

Academic Honors

2003 19th Louis Rosen Prize for outstanding thesis, Los Alamos Neutron Science Center (LANSCE) User Group.

2002 Director's Funded Post-Doctoral Fellow, Los Alamos National Laboratory.

1997 Graduated with the Rank 1/60 (highest honor) from the Physics Department of National Taiwan University.

1995–1997 6 Dean's Awards (top 5% students in the class), National Taiwan University.

1993 Top 10 Taiwan high school students, Ministry of Education.

1993 3rd Prize, National Earth Science Competition, Ministry of Education.

1990 Ranked the national 1st in the screening of art-talented students, Taiwan.

Grants and Fellowships

1998 Summer Travel Grant to Russia (\$500), Association of Princeton Graduate Alumni, Princeton University.

1997–2002 Graduate School Tuition Fellowship, Princeton University.

1996 Mr. J. S. Lin Fellowship (\$1K), Culture and Social Welfare Foundation.

1995 University Fellowship (\$800), National Taiwan University.

1994–1997 Prestigious 6th Dr. Paul C. W. Chu Material Science Scholarship (\$8K), CTCI Foundation.

Computer Proficiency

OS Linux (system administration), Unix, Mac Os X, MS DOS Windows.

Language C, C++, Fortran.

Analysis tool Matlab, Mathematica, Root (upgrade of PAW), Gnuplot, Origin.

CAD Ashlar-Vellum Cobalt (3D modeling designing tool).

Instrumentation LabView.

Languages

Chinese (native), English (fluent)

Creative Activities

Oil painting, watercolor, Chinese watercolor, artistic lamp making.

Attended 2002 summer art program in Lyme Art Academy, Old Lyme, CT.

Publications

- C.-Y. Liu** and A. R. Young, “Solid Oxygen as a Superthermal Ultra-cold Neutron Source,” accepted for publication by *Phys. Rev. B*, 2004.
- C.-Y. Liu et al.**, “An Experimental Test of Solid Oxygen as a Superthermal Ultra-cold Neutron Source,” submitted to *Phys. Rev. B*, 2004.
- R. E. Hill and **C.-Y. Liu**, “Temperature Dependent Neutron Scattering Cross Sections for Polyethylene,” accepted for publication by *Nucl. Instr. Meth. A*, 2004; arXiv:nucl-th/0309011.
- C.-Y. Liu** and S.K. Lamoreaux, “A New Search for a Permanent Electric Dipole Moment of the Electron in a Solid State System”, *Mod. Phys. Lett. A* **19**, 1235 (2004).
- C.-Y. Liu**, Steve K. Lamoreaux, Thomas J. Bowles, and Christopher Morris, “A New Source of Ultracold Neutrons” *Los Alamos Science—Celebrating 60 Years* (Los Alamos, NM, 2003) p. 202
- UCN collaboration, A. Saunders, *et al.*, “Demonstration of a Solid Deuterium Source of Ultracold Neutrons,” *Phys. Lett. B*, **593**, 55 (2003).
- C.-Y. Liu et al.**, “An Apparatus to Control and Monitor the Para-D₂ Concentration in a Solid Deuterium, Superthermal Source of Ultra-cold Neutrons,” *Nucl. Instr. Meth. A* **508**, 257 (2003); arXiv:nucl-ex/0307008.
- UCN collaboration, C. L. Morris *et al.*, “Measurements of Ultra-cold Neutron Lifetimes in Solid Deuterium,” *Phys. Rev. Lett.* **89**, 272501 (2002).
- UCN collaboration, A. Young *et al.*, “A Measurement of the Neutron Beta-Asymmetry using Ultra-Cold Neutrons,” *Fundamental Physics with Pulsed Neutron Beams* (World Scientific, Singapore, 2000).
- UCN collaboration, K. Kirch *et al.*, “Status of the New Los Alamos UCN Source,” *CAARI Conference Proceedings* (Denton, TX, 2000).
- UCN collaboration, R. E. Hill *et al.*, “Performance of the Prototype LANL Solid Deuterium Ultra-cold Neutron Source,” *Nucl. Instr. Meth. A* **440**, 674 (2000).
- C.-Y. Liu**, A. R. Young, and S. K. Lamoreaux, “UCN Upscattering Rates in a Molecular Deuterium Crystal,” *Phys. Rev. B* **62**, No 6, R3581(2000).

Invited Talks

- “A New Search for a Permanent Electric Dipole Moment of the Electron in a Solid State System,” Physics division postdoc symposium (Los Alamos, NM, Mar. 2004).
- “Experimental Particle Physics at Milli-Kelvin Temperatures – Ultra-cold Neutrons and the Electron Electric Dipole Moment,” Nuclear physics seminar in the physics department of Indiana university (Bloomington, IN, Feb. 2004).

- “A Search for Electric Dipole Moment,” Physics seminar at the National Center for Theoretical Sciences (Hsinchu, Taiwan, Nov. 2003).
- “An Electric Dipole Moment Search to Test the CP Violation,” 2003 International Symposium on Cosmology and Particle Astrophysics (The Center for Academic Excellence on Cosmology and Particle Astrophysics, Taipei, Taiwan, Nov. 2003).
- “Superthermal Ultra-cold Neutron Sources: A Current Overview and Future Prospects,” Physics/Theory colloquium (Los Alamos National Laboratory, Los Alamos, NM, Feb. 2003).
- “A Solid Deuterium UCN Source at LANSCE,” $n\bar{n}$ conference (Bloomington, IN, Sep. 2002).
- “Solid Deuterium UCN Source,” Atomic physics seminar at Kyoto University (Kyoto, Japan, May 2001).
- “Superthermal Ultra-cold Neutron Sources: A Current Project and Future Possibilities,” Nuclear seminar at the Indiana University (Bloomington, IN, Feb. 2001).
- “Solid Deuterium UCN Source,” UCN workshop (Los Alamos, NM, Sep. 2000).

Contributed Talks

- “Search for a Permanent Electric Dipole Moment (EDM) of the Electron using a Paramagnetic Crystal,” Symposium 2003 (Los Alamos, NM, Aug. 2003).
- “Solid Oxygen as a Source of Ultra-Cold Neutrons,” The APS April Meeting (Albuquerque, NM, Apr. 2002).
- “An Apparatus to Store, Polarize and Spin-Flip Ultra-Cold Neutrons,” The APS April Meeting (Albuquerque, NM, Apr. 2002).
- “Implementation of an Intense UCN Source Coupled to a Spallation Target at LANSCE,” International Nuclear Physics Conference (Berkeley, CA, Aug. 2001).
- “Physics of Superthermal Sources,” The Third International UCN Workshop (Pushkin, Russia, June 2001).
- “A Solid Ortho Deuterium Ultra-cold Neutron Source,” The APS April Meeting (Washington, D.C., April 28-May 1, 2001).
- “An Apparatus to Convert Para to Ortho Deuterium and Measure the Para Concentration,” Division of Nuclear Physics Fall Meeting 2000 (Williamsburg, VA, Oct. 4-7, 2000).
- “Anomalous Up-scattering of UCN by Para Impurities in a Deuterium Superthermal UCN Source at LANSCE,” The APS April Meeting (Long Beach, CA, April 29-May 2, 2000).

“Overview of a Solid Deuterium Superthermal UCN Source at LANSCE,” The Second International UCN Workshop (Pushkin, Russia, June 1999).

“A Solid Deuterium Superthermal Source of Ultra-Cold Neutrons Coupled to Spallation Targets at LANSCE,” Division of Nuclear Physics Fall Meeting 1998 (Santa Fe, NM, Oct. 1998).

References

Dr. Steve K. Lamoreaux, Laboratory Fellow
Post-doctoral mentor
(505) 665-1768
lamore@lanl.gov
Los Alamos National Laboratory
P-23, MS H803
Los Alamos, NM 87545

Prof. Albert R. Young
(Previously, an assistant professor at Princeton University;
currently, an associate professor at North Carolina State University)
Ph.D. advisor
(919) 513-4596
aryoung@unity.ncsu.edu
Department of Physics
North Carolina State University
Cox Hall, Box 8202
Raleigh, NC 27695

Dr. Christopher Morris, Laboratory Fellow
Principal investigator, UCN project (closest colleague)
(505) 667-5652
cmorris@lanl.gov
Los Alamos National Laboratory
P-25, MS H846
Los Alamos, NM 87545

Dr. Alexander Saunders, Staff Scientist
Peer
(505) 665-3090
asaunders@lanl.gov
Los Alamos National Laboratory
P-25, MS H846
Los Alamos, NM 87545