Michinari Sakai

Personal Data

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Work Experience

Apr. 2016 - *Current*

Post-doctoral Scholar, University of California, Los Angeles

CUORE: Currently working on improving Monte Carlo simulation for background modeling to better understand radioactive contamination in the detector. Also worked on bolometric thermal model and its application to develop simulated data for CUORE as well as other data processing techniques such as thermal gain stabilization of bolometer pulses.

Aug. 2009 - Apr. 2016

Research Assistant, University of Hawaii at Manoa

KamLAND: Developed directional reconstruction algorithm for high-energy neutrinos and conducted track reconstruction and particle identification studies in liquid scintillator. First ever physics application (dark matter search) of neutrino directionality in scintillator experiments.

mini-TimeCube: Lead GEANT4 simulation developer for project. Examined trade studies for various neutron capture dopants in scintillator. Contributed to neutrino/neutron directional reconstruction algorithm. Conducted background studies for long-lived isotopes produced from cosmogenic muons.

Aug. 2007 - May. 2009

Teaching Assistant, University of Hawaii at Manoa

Taught two undergraduate physics mechanics laboratory courses per semester. Received positive reviews.

Jan. 2003 - Mar. 2006

Interpreter and Teacher

(Mar. 2006) Part time English lecturer for Korean undergraduate students.

(Mar. 2004 - Dec. 2005) Part time contributing reporter and translator for campus magazine.

(Jul. 2004) Spontaneous trilingual interpreter for W-CARP International Education Conference.

(Mar. 2003 - Mar. 2004) Part time translator for magazine Today's World.

Skills

Software/Tools:	ROOT, Geant4, Pads, AutoCAD
Programming Languages:	C++, Python, Fortran, Perl, Mathematica, Matlab, Bash, VHDL
Human Languages:	English, Japanese, Korean

Education

Apr. 2016	Ph.D. in Physics, Univ. of Hawaii at Manoa Dissertation: High Energy Neutrino Analysis in KamLAND and Application to Dark Matter Search GPA: 3.97/4.00 Advisor: Prof. John G. Learned
Aug. 2005 - Aug. 2006	Graduate Program in Mathematics, Sun Moon Univ., S. Korea GPA: 4.50/4.50 Advisor: Prof. Doe-Wan Kim
Aug. 2005	Double B.S. in Physics and Mathematics, Sun Moon Univ., S. Korea Honors: Summa Cum Laude, GPA: 4.33/4.50 Advisor: Prof. Ki-Won Kim

Scholarships and Awards

2004	Award for Outstanding Academic Achievement, Samsung Corp.
2001 - 2004	Undergraduate Achievement Scholarships, Sun Moon Univ.
2001	Ae-Guk Freshman Scholarship, Sun Moon Univ.

Publications

[1] C. Alduino et al. First Results from CUORE: A Search for Lepton Number Violation via $0\nu\beta\beta$ Decay of ^{130}Te. 2017, 1710.07988.

[2] V. A. Li et al. Invited Article: miniTimeCube. *Rev. Sci. Instrum.*, 87(2):021301, 2016, 1602.01405.

[3] A. Gando et al. Search for electron antineutrinos associated with gravitational wave events GW150914 and GW151226 using KamLAND. *Astrophys. J.*, 829(2):L34, 2016, 1606.07155.

[4] K. Asakura et al. KamLAND Sensitivity to Neutrinos from Pre-Supernova Stars. *Astrophys. J.*, 818(1):91, 2016, 1506.01175.

[5] C. Lane et al. A new type of Neutrino Detector for Sterile Neutrino Search at Nuclear Reactors and Nuclear Nonproliferation Applications. 2015, 1501.06935.

[6] A. Gando et al. ^{7}Be Solar Neutrino Measurement with KamLAND. *Phys. Rev.*, C92(5):055808, 2015, 1405.6190.

[7] T. I. Banks et al. A compact ultra-clean system for deploying radioactive sources inside the KamLAND detector. *Nucl. Instrum. Meth.*, A769:88–96, 2015, 1407.0413.

[8] K. Asakura et al. Study of electron anti-neutrinos associated with gamma-ray bursts using KamLAND. *Astrophys. J.*, 806(1):87, 2015, 1503.02137.

[9] K. Asakura et al. Search for the proton decay mode $p \to \overline{\nu} K^+$ with KamLAND. *Phys. Rev.*, D92(5):052006, 2015, 1505.03612.

[10] J. Kumar, J. G. Learned, M. Sakai, and S. Smith. Dark Matter Detection With Electron Neutrinos in Liquid Scintillation Detectors. *Phys. Rev.*, D84:036007, 2011, 1103.3270.

[11] S. Abe et al. Measurement of the 8B Solar Neutrino Flux with the KamLAND Liquid Scintillator Detector. *Phys. Rev.*, C84:035804, 2011, 1106.0861.

Presentations and Posters

Oct 2017	CUORE and Background Reduction Case Studies for CUPID, DNP 2017, Pittsburgh, Pennsylvania
May 2017	Status of the CUORE $0\nu\beta\beta$ Decay Search, invited talk at the Conference on Science at SURF, South Dakota
Mar 2016	Particle ID and event reconstruction algorithms in scintillator, FROST 2016, Fermilab
Jul 2015	High Energy Analysis and Application to Dark Matter Search in KamLAND, talk for DOE review, Honolulu, Hawaii
Jun 2012	Indirect Dark-Matter Detection Through KamLAND, poster at Neutrino 2012, Kyoto, Japan
Nov 2010, 2011	What is a Neutrino?, mini-TimeCube: The World's Smallest Neutrino Detector, talks at Univ. of Hawaii campus open house, Honolulu, Hawaii
Aug 2010	mini-TimeCube: A Portable Directional Neutrino Detector talk at AAP 2010, Sendai, Japan
Sep 2009	KamLAND Summary, talk for DOE review, Honolulu, Hawaii
Jul 2009	Student presentation: How to solve θ_{23} degeneracy, International Neutrino Summer School, Fermilab

Statement of Research Interests and Experience

I have been involved with the CUORE (Cryogenic Underground Observatory for Rare Events) experiment at the University of California, Los Angeles since April of 2016. My main work currently involves development of the Geant4 Monte Carlo simulation to better understand the radio active backgrounds in the detector. The energy spectrum of the backgrounds in the so called alpha region ($\gtrsim 2.5\,\mathrm{MeV}$) exhibit peculiar features that can better explain the types of sources and their distributions in various parts and materials of the detector. This can help us to better understand our backgrounds and extrapolate this knowledge to the energy region of interest (2465 keV to 2575 keV) for $0\nu\beta\beta$ decay of ^{130}Te. I have also worked on thermal modeling of the detector bolometers and its application toward developing simulated data for CUORE as well as other data processing techniques such as thermal gain stabilization of bolometer signals.

The focus of my work during graduate studies at the University of Hawaii has been in directional neutrino reconstruction and its applications such as indirect dark matter searches, directional geo-neutrino measurements, and anti-nuclear proliferation techniques that involve locating the position of the source.

I have been involved with three projects at the University of Hawaii: the 1 kt liquid scintillator neutrino experiment KamLAND (Kamioka Liquid Scintillator Antineutrino Detector) in Japan, a portable 2.2 L plastic scintillator neutrino experiment called the mini-TimeCube, and scintillator R&D for a future 10 kt-scale deep-sea based neutrino detector HanoHano.

My work in KamLAND has involved developing directional event reconstruction methods for high-energy ∼GeV scale neutrinos and applying this to conduct an indirect dark matter search by looking at excess neutrinos from the core of the Sun and Earth. Studies done with Monte Carlo suggest that the accuracy of reconstructing the neutrino direction using this method is better than that of water-Cherenkov detectors by ∼10° for energies ∼1 GeV and greater. This method was tested against initial events spilling into KamLAND from the T2K neutrino beam-line and the results were consistent with what was expected. I believe this is the first ever physics application of neutrino directionality in a scintillator experiment.

In addition, I have worked as the lead GEANT4 simulation designer for the mini-TimeCube collaboration to conduct case studies for optimizing the detector design, test candidate neutron

capture doping elements in plastic scintillator, and simulate the response of the multi-channel-plate (MCP) PMTs deployed in the detector. These studies were used during construction of the detector, and to develop directional algorithms that are now being tested in analyses of neutrons from test sources as well as neutrinos from nuclear reactors. I have also conducted simulation studies for cosmic-ray muons and long-lived cosmogenic background isotopes such as ^{8}He and ^{9}Li. These backgrounds are extremely difficult to tag due to their long life-time ($>\sim$s scale) and travel distances. The studies have been vital to the project. Working with the mini-TimeCube project has further involved designing and fabricating PCB boards as well as contributing to the FPGA firmware for the readout electronics.

Finally, my work in scintillator R&D for HanoHano has been designing and building apparatus using CAD for measuring light output of LAB based liquid scintillators when put in large electric potential gradients as well as testing their light transmissivity under extreme temperatures and pressures such as those found in deep-sea environments.

As a post-doctorate researcher, I am looking for an integrated work environment where I can get hands-on experience with detector hardware, electronics, and firmware development while, at the same time, applying my skills in simulation and analysis.

References

Supplied upon request or please contact in person.

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John G. Learned	Professor, Univ. of Hawaii at Manoa, +1-808-956-2964 jgl@phys.hawaii.edu
Yury Kolomensky	Professor, Univ. of California, Berkeley, +1-510-642-9619 ygkolomensky@lbl.gov
Brian K. Fujikawa	Staff Scientist, Lawrence Berkeley National Laboratory, +1-510-486-4398 bkfujikawa@lbl.gov
Lindley Winslow	Jerrold R. Zacharias Assistant Professor, MIT, +1-617-253-2332 lwinslow@mit.edu
Thomas O'Donnell	Assistant Professor, Virginia Tech, +1-540-231-3308 todonnel@vt.edu