LAWRENCE R. SULAK - CURRICULUM VITAE

EDUCATION

1970-1971	Ph.D., 1968 A.M., Physics, Princeton University, Advisor: Professor Val L. Fitch, Nobel Laureate (1980) Thesis: "A Precise Measurement of the $K_1^o - K_2^o$ Mass Difference" (the first at the 1% level, cited 15 times)
1966	B.S., Physics, Carnegie Mellon University, citation: "highest academic record in the class of 1966" Advisor: Professor Lincoln Wolfenstein

POSITIONS AND ASSOCIATIONS AFTER HIGHEST DEGREE

2014-15	Chairman, US CMS/HCAL Institution Board
2013-present	CMS HCAL Radiation Damage Taskforce
2013-15	HCAL Radiation Damage Task Force, reporting to Pawel de Barbaro
2012-present	US CMS Upgrade Steering Committee, member
2013-2014	Search Committee for Fermilab Director, Fermi Research Alliance
2013-present	CMS/HCAL Advisory Board, for HCAL Project Manager
2012-14	HCAL Upgrade 1 Implementation Committee, reporting to Slawek Tkaczyk
2011-2014	Board of Directors, Fermi Research Alliance (operator of Fermilab for the DOE)
2011-2013	Chairman, US/CMS/HCAL Collaboration Board
2011-present	Member, CERN Delegation with Ecuador to sign Protocol for Collaboration on Education, Science and Engineering
2011-present	Lead delegate, CERN Delegation to Tunisian to draft Protocol for Collaboration on Education, Science and Engineering
2011-13	CMS Upgrade Steering Committee, for Jeff Spalding and Didier Contrado
2010-present	Technical Advisor to CMS-HCAL Project Manager, to CMS-HCAL Integration Manager, and to CMS Upgrade Manager
2010-present	Attaché scientifique, Physicien, European Center for Nuclear Research (CERN), Geneva, Switzerland
2009-present	Member, Boston Energy Forum: BU, Harvard & MIT physicists and nuclear engineers providing information on US energy and environmental security to Congressmen and the public; co-author of white paper
2009-present	Founding Director, Boston University/CERN Undergraduate Physics Semester Abroad Program, only one in the world
2009-2011	CMS HCAL Upgrade Taskforce
2008-present	"Keep Physicist Bill Foster in Congress," Finance Committee Member
2007-2008	External Advisory Board, Member, "Physics Frontier Center" Proposal, Institute for Advanced Study, Princeton, NJ
2006-present	Board of Directors, University of Quito, Ecuador, in part for initiating BU/Quito scientific collaborations
2003-2005	Guggenheim Foundation Fellow. Project: launching Antares Neutrino Observatory and scaling it to Km^3
2003-2005	Visiting Professor, University of the Mediterranean, Luminy, Marseille, France
2003-2005	Senior Research Scientist, Center for Particle Physics of Marseille (CPPM), Marseille, France
2003	Institut de Français, Villefranche-sur-Mer, France, Diplôme de la langue française
2001-present	Fellow, University Professors Program, Boston University
1993-1994	Distinguished Visiting Scientist, IN2P3 and CEA, Centre d'Etude, Saclay, Gif-sur-Yvette, France
1990-present	David M. Myers Distinguished Professor, Boston University endowed chair
1985-2005	Chairman, Professor of Physics, Boston University; built Physics and facilities to rank among all private US institutions: 1st in citations/paper and 9th or better in # of refereed papers, # of citations, and in external funding (2003 statistics from Spires, AIP, and the Institute for Scientific Information)
1979-1981	Harvard University, Visiting Professor of Physics, Cambridge, MA
1979-1984	Associate Professor of Physics (with tenure), University of Michigan, Ann Arbor, MI
1975-1979	Harvard University, Associate Professor of Physics, Cambridge, MA
1974-1978	Guest Associate Physicist, Brookhaven National Laboratory, Upton, NY
1971-1976	Visiting Physicist, Fermi National Accelerator Laboratory, Batavia, IL
1971-1975	Harvard University, Assistant Professor of Physics, Cambridge, MA
1970-present	Visiting Scientist, European Center for Nuclear Research (CERN), Geneva, Switzerland
1970-1971	Chargé de Recherche, Département de Physique Nucléaire et Corpusculaire, Université de Genève and CERN, Geneva, Switzerland

AWARDS AND HONORS

2015	A founding PI of Super-K, honored by the Nobel Prize in Physics for the Discovery of Neutrino Oscillations; both Super-K and the SNO detector, which shared the prize, are second generation versions of IMB, the pioneering ring-imaging calorimeter invented and developed by LRS
2015	Physics Breakthrough Prize in Fundamental Physics, shared with SNO and collaborators in Super-K.
2013	Nominated for Panofsky Prize of American Physical Society for the invention of massive ring-imaging Cherenkov calorimetry the critical technology in some 9 detectors on 4 continents studying neutrino oscillations and searching for proton decay. LRS has also evolved this technology into the forward quartz calorimeter of CMS at the LHC.
2011	Distinguished Lecture, "Recreating the Big Bang", All Ecuador Science Convocation, including radio interview
2006	Most Distinguished Alumnus Award, 2006, Carnegie Mellon University
2006	All University Lecture, Carnegie Mellon University
2005	Marseille Research Award, for Seminal Contributions to Antares Neutrino Observatory
2001-	Fellow, University Professors Program, Boston University
1998	One of 10 "Greatest Science Achievements of 1998: Discovery of neutrino mass," awarded by *Popular Science* to Super-K
1998	ASAHI Prize, "Discovery of the Finite Mass of Neutrinos," shared with Super-K collaborators
1992	"Faces & Names to Watch…" *Boston Magazine* (see Vol. 48, No. 12, 1992)
1992-present	Who's Who in Science and Engineering
1990-present	David M. Myers Distinguished Professor, Boston University

1989	Bruno Rossi Prize, American Astronomical Society for "Discovery of Neutrinos from Supernova 1987a" awarded to the IMB collaboration
1984	Outstanding Young Scientist Award, "America's 100 Brightest Scientists," *Science Digest* (December 1984)
1984-1986	Faculty Research Honorary Society, University of Michigan Research Club
1984-present	Fellow, American Physical Society
1966-1970	National Science Foundation Fellow, Princeton University
1966-present	Omicron Delta Kappa National, Leadership Honor Society
1963	1963 Outstanding Freshman Physicist, awarded by Carnegie Mellon University
1962-1966	Alfred Noyes Smith Scholar, Carnegie Mellon University

PUBLICATIONS

Before papers appeared from CMS at the LHC in 2012, LRS played a role in > 500 papers cited > 40,000 times. He played a significant role in 22 renown (500+ cites in inSPIRE*), 15 famous (250-499 cites), 52 very well-known (100-249), 58 well-known (50-99), and 203 known papers (10-49 cites). This was on research with neutrinos at Fermilab and Brookhaven, with muons at the g-2 ring at BNL, and with ring-imaging Cherenkov calorimetry, proton decay and neutrino oscillations in IMB, Macro, Super-K, and Antares.

Since 2011, LRS has papers from CMS on the quartz fiber calorimetry and on the Higgs boson discovery. Since the start of LHC publications, LRS appears in the CMS author list of > 330 additional published papers with > 17,000 citations.

In 2015 LRS was co-author on 139 refereed journal articles, essentially all with CMS collaborators, in the top particle physics journals, Phys Rev, PRL, and Phys. Let. These were cited over 3,470 times. The LRS was instrumental in 9 of those papers.

RESEARCH FUNDING

2011-present	DOE awards as co-PI for 1) Super-K and T2K and 2) Physics with CMS Detector at the Large Hadron Collider at CERN 3) The BU Undergraduate Internship Program at CERN
2010-12	Fermilab funding, Ass't to Project Manager of CMS HCAL, CERN
1986	Initiator of U.S. Department of Energy Grant at Boston University; PI or Co-PI of 3 tasks 1) Proton Decay and Neutrino Astrophysics (including IMB to '90, MACRO to '96, Antares Neutrino detector 2003-05), 2) Muon g-2 Experiment, 3) CMS Forward Cherenkov Calorimeter
1978-1984	Founder of IMB Proton Decay DOE Task at University of Michigan, transferred from initial work at Harvard
1971-1978	Particle Physics Contract, US DOE, Neutrino Task for National Accelerator Lab and Brookhaven, Harvard University

SELECTED RECENT SCIENTIFIC PRESENTATIONS

2016 *"Back from the Nobel Prize Ceremony: Gigatesque Detectors Weigh the Lightest of Particles,"* public lecture, BWI.
2015 Nobel Ceremony Colloquium, Uppsala University, *"Pioneering History of the Discovery of Neutrino Oscillations"*
2015 Layman Presentation as External Examiner of PhD candidate Rikard Strom, Uppsala University, *"Catching Neutrinos from the Stars"*
2014 Colloquium (scheduled), Boston College, *"It really looks like, and quacks like, the Boson of Peter Higgs"*
2013 *"Gerontocracy in Physics?"* PBS News Hour interview by Paul Solomon, with Sheldon Glashow
Saturday Morning Live, Goodwin House, Alexandria VA, *"Without those 'sticky' Higgs bosons, you'd be traveling at light speed"*
Special Lecture, Maranatha Collegiate Academy, BWI, *"The Discovery of the Origin of Mass"*
Distinguished Lecture, Dartmouth College, *"Discovery of the Source of mass at the LHC?"*
2012 IXth Latin American Symposium on High Energy Physics, *"Jet Production and Properties at Hadron Colliders"* Sao Paulo, Brazil, joint contribution for both CMS and ATLAS
Collins Memorial Lecture, Massachusetts General Hospital *"Without those 'sticky' Higgs bosons, you'd be traveling at light speed"*
Colloquium, Gran Sasso National Laboratory, "*Observation of a new fundamental boson?...and future prospects, upgrades, etc.*"
Seminar, US DOE, Germantown, "*A head-start in international physics for American undergrads:* The BU Internship at CERN"
Seminar, US DOE, Germantown, *"Fermilab as Viewed from Abroad"*
2011 All Ecuador Symposium on Particle Physics, National Concert Hall, Quito "Recreating the Birth of our Universe," in Spanish
Conference on CERN Physics, Ministry of Education and Research, Quito, "CMS, CERN and Ecuador", in Spanish
Conference on CERN Physics, Ministry of Technology and Higher Education, Tunis, "CMS, CERN and Tunisia", in French
2010 All BU Undergraduate Lecture, "From the Big Bang...to the death of the Universe," inaugural lecture, "Conversations with Physicists" series
2009 "Irradiation Studies of Silicon Photomultipliers," CMS Upgrade Workshop, Fermilab
"Resuscitation of the CMS Forward Hadronic Calorimeter," HCAL Upgrade Workshop
Inaugural talk, "Observations from the Antares Neutrino Telescope," Boston University Particle Physics Seminar Series
"The Boston Junior Semester at CERN," University of Geneva, Switzerland
2008 Keynote presentation: "La naissance de l'astronomie du neutrino et son avenir," joint with R. Aymar, CERN Director General, at 25th Anniversary Symposium, Center for Particle Physics, Marseille, France (delivered in French)
Colloquium, McGill University, "The Birth of Neutrino Astronomy," Montreal, Canada
2007 "Forward Cherenkov Calorimetry at CMS," Center for Particle Physics, University of Marseille, France
University Professors Program Lecture, "Cosmology for the Layman: from the big bang to the demise of the universe,"
2006 Collins Lecture, "Are diamonds forever? the Demise of the Proton," Massachusetts General Hospital, Boston
All University Lecture, Carnegie Mellon University, "From the Big Bang...to the demise of the Universe,"
2005 Invited talk, International Conference on the High Energy Frontier, "The Future of Cherenkov Ring-Image Calorimetry,"

HIF '05, Elba, France, May 28-June 1, 2005

Biannual Antares Collaboration Meeting, CERN, "Status of Electronic Development for Antares," January 2005
Invited presentation to Region of Aix-en-Provence, France: "The Value of the ITER Project to Science," Co-presenters: Mayor of Aix; President of Region of Aix; Director, Cadarache Nuclear Research Lab (French Los Alamos)
Invited talk, 40th Rencontre de Moriond, "Searches for Proton Decay and Neutrino Oscillations: Physics from Cherenkov Ring-Image Calorimetry," French Physical Society International Conference, March 2005
Invited talk, Rencontre d'Aosta, "Progress of the Antares Experiment," Italian Physical Society International Conference
National Presbyterian School, Washington DC, November 21-26, 2005, series of 4 lecture/demonstrations

2004 Invited presentation, 25th International Neutrino Conference, Paris, France
Invited speaker, CPPM Conference on the Future of Particle Physics in Europe, "Megaton and Cubic Kilometer Detectors: the non-accelerator future for particle physics,"
Featured speaker to Ministers of Science from France, Germany, Italy, Great Britain, and Spain, Inauguration of Antares Neutrino Observatory
Invited presentation, Ecole Polytechnique, Rene Turlay Memorial Conference, Paris
3 Invited talks, Int'l School for Particle Astrophysics, Erice, Italy: on Super-K, K2K, and Antares, . .

SELECTED SCIENTIFIC PUBLICATIONS

Discovery of a Fundamental Boson, consistent with the Higgs particle that completes the Standard Model, with collaborators at CMS. Invented and prototyped the forward Cherenkov quartz-fiber calorimeter essential to observing the boson produced in the vector boson fusion channel. "Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC," CMS Collaboration (Serguei Chatrchyan (Yerevan Phys. Inst.) et al.). Jul 2012. Phys.Lett. B716 (2012) 30-61. j.physletb.2012.08.021. e-Print: arXiv:1207.7235. LRS contributed to the H → WW → lνlν analysis. (>680 cites)

Discovery of Oscillation of Neutrinos and of Neutrino Mass...first physics beyond the Standard Model 1978 - 1998
First proposal for a massive underground ring-imaging water Cherenkov detector, focusing on both the detection of proton decay and the identification of the critical signature for neutrino oscillations (the ratio of muon- to electron-neutrino induced events).
"Studies of a Detector to Test for Baryon Stability to a Lifetime of 10^{33} Years," L. R. Sulak, Proceedings of the Seminar on Proton Stability, Madison (D. Cline, ed.) 8 December 1978, p. A1; also Harvard University Particle Physics Preprint HUPP 252. "A Nucleon Decay Search: Design of a New Experiment Sensitive to a Lifetime of 10^{33} Years," B. Cortez et al., Int'l Conf. on Neutrino Physics 1979 (A. Haadtuft and C. Jarlskog, ed.), Trykk: Astvedt Industrier A/S, Vol. 3 (1979), p. 121.

First proposal of the up/down asymmetry technique to search for neutrino oscillations, which led to their discovery.
"A Long Baseline Neutrino Oscillation Experiment Sensitive to Mass Differences of Hundredths of an Electron Volt", B. Cortez and L.R. Sulak, Unification of the Fundamental Particle Interactions (S. Ferrara, J. Ellis, and P. Van Nieuwenhuizen, eds.) Erice, March 17-24, 1980, Plenum Press, (1980), pp. 661-671.

"The Irvine-Michigan-Brookhaven Nucleon Decay Facility: Status Report on a Proton Decay Experiment Sensitive to a Lifetime of 10^{33} Years," and a Long Baseline Neutrino Oscillation Experiment Sensitive to Mass Differences of Hundredths of an Electron Volt, L. Sulak, First Workshop on Grand Unification (Paul H. Frampton, Sheldon L. Glashow, Asim Yildez, eds.), April 10-12, Math Sci. Press, University of New Hampshire, (1980), p. 163.

"Neutrino Oscillation Search With Cosmic Ray Neutrinos," D.S. Ayres, B. Cortez , T. K. Gaisser, A.K. Mann, R. E. Shrock, , L. R. Sulak. Phys. Rev. D29:902,1984. (>30 cites)

With the IMB detector, the first observation of a muon deficit in the cosmic ray atmospheric neutrino, after only one live year of data taking.
"A Search for Nucleon Decay Into Lepton and K^0," B. Cortez, Harvard University Ph.D. Thesis, PhD advisor: LRS, September 1983

First refereed publication of a deficit of atmospheric muon neutrinos (relative to the number of electron neutrinos), precursor to the discovery of neutrino oscillations:
"Calculation of Atmospheric Neutrino Induced Backgrounds in a Nucleon Decay Search," T.J. Haines et al., Phys. Rev. Lett. 57, (1986) (107 cites)

"Measurement of Atmospheric Neutrino Composition with IMB-3, D. Casper *et al*., Phys. Rev. Lett. 66, p 2561, 1991. PhD thesis, LRS as PhD advisor. (>570 cites)

"The Electron-neutrino and muon-neutrino content of the atmospheric flux," R. Becker-Szendy *et al.* Phys.Rev.D46:3720-3724, 1992. (>750 cites)

"Neutrino measurements with the IMB detector," R. Becker-Szendy *et al.* 1995, Nucl.Phys.Proc.Suppl.38:331-336, 1995. (>180 cites)

"A Search for muon-neutrino oscillations with the IMB detector," R. Becker-Szendy *et al.* Phys.Rev.Lett.69:1010-1013,1992. (>170 cites)

"IMB-3: A Large water Cherenkov detector for nucleon decay and neutrino interactions," R. Becker-Szendy *et al.* Nucl. Instrum. Meth. A324:363-382,1993. (>35 cites)

Super-K high statistics proof of the oscillation of muon neutrinos and the unexpected non-zero mass of the neutrino, the first observation of physics beyond the standard model. This paper cited >3400 times; the series of papers on this topic has been cited over 4600 times, the most highly cited experimental particle physics work ever. "Evidence for Oscillation of Atmospheric Neutrinos," Y. Fukuda et al., Phys. Rev. Lett. 81 (1998) p.

1562-1567. (>3400 cites)

"Measurement of a small atmospheric muon-neutrino / electron-neutrino ratio," By Super-Kamiokande Collaboration (Y. Fukuda *et al.*). Phys.Lett.B433:9-18,1998. e-Print: hep-ex/9803006 (>815 cites)

Super-K demonstration that oscillations of muon neutrinos most likely into tau neutrinos. "Tau Neutrinos Favored Over Sterile Neutrinos in Atmospheric Muon Neutrino Oscillation," S. Fukuda et al., Super-Kamiokande Collaboration, Phys. Rev. Lett. (2000). (>760 cites)

Accelerator muon-neutrinos from KEK to Super-K (the K2K experiment) oscillate as atmospheric neutrinos 1998
Confirmation that accelerator muon-neutrinos oscillate with the same characteristics as atmospheric neutrinos.
"Detection of accelerator produced neutrinos at a distance of 250-km," by K2K Collaboration (S.H. Ahn *et al.*). Phys.Lett.B511:178-184, 2001. e-Print: hep-ex/0103001 (>270 cites)

"Evidence for muon neutrino oscillation in an accelerator-based experiment," by K2K Collaboration (E. Aliu *et al.*). Phys. Rev. Lett.94:081802, 2005. e-Print: hep-ex/0411038 (>360 cites)

"Measurement of Neutrino Oscillation by the K2K Experiment," by K2K Collaboration (M.H. Ahn *et al.*) Phys.Rev.D74: 072003, 2006. e-Print: hep-ex/0606032 (>270 cites)

Discovery of Neutrinos from a Supernova collapse 1987
First observation of extra-galactic neutrinos from the gravitational collapse of a supernova (also observed by the Kamiokande Detector).
"Observation of a Neutrino Burst in Coincidence with Supernova 1987A in the Large Magellanic Cloud," R.M. Bionta, *et al.*, Phys. Rev. Lett., Vol. 58, No. 14 (6 April 1987), p. 1494. Bionta was LRS' postdoc (>773 cites)

"Angular Distribution Of Events From SN1987a," by IMB Collaboration (C.B. Bratton *et al.*) Phys.Rev.D37:3361,1988. (>105 cites)

Searches for the Ultimate Decay of the Proton and for Grand Unification 1983
First limit on proton lifetime at Grand Unification scale, 5 orders of magnitude better than previous measurements. Elimination of simplest and most elegant theory, SU5. LRS PI, originator of technology and founding advocate of H_2O ring-imaging Cherenkov calorimetry.
"A Search for Proton Decay into $e^+ \pi^o$," R.M. Bionta *et al*., Phys. Rev. Lett., Vol. 51, No. 1, 27 (4 July 1983) (>150 cites)

"Search for Nucleon Decay into $\mu^- K^\circ$ and νK°," B. G. Cortez et al., Phys. Rev. Lett., Vol., 52 (26 March 1984). (>30 cites)

Limits on 44 decay modes of the nucleon, many remain world records to date.
"A Search for Nucleon Decay Using the IMB-3 Detector," C. McGrew *et al*., Phys. Rev. D59 (1999) p. 5204.

"Massive Cherenkov neutrino facilities: their evolution, their future," Celebration of Twenty-five years of international neutrino conferences. L.R. Sulak (Boston U. & Marseille, CPPM). 2005. 10pp. 21st International Conference on Neutrino Physics and Astrophysics (Neutrino 2004), Paris, France, 14-19 Jun 2004. Published in Nucl. Phys. Proc. Suppl. 143:317-326, 2005. Also in "Paris 2004, Neutrino physics and astrophysics" 317-326

Neutrino astronomy: Development of Massive Water Ring-Imaging Calorimetry for IMB, Super-K, and Antares 1976 - present
First conceptual design for a massive undersea ring-imaging water Cherenkov detector
"Signatures of High Energy Neutrino Interactions and their Detection Via Cherenkov Light", L.R. Sulak et al., Proceedings of the 1976 DUMAND Summer Study, (A. Roberts, ed.) Honolulu, 6-19 September 1976, p. 297

"Search for dark matter wimps using upward through-going muons in Super-Kamiokande," S. Desai *et al.* Phys. Rev. D70:083523, 2004, Desai was LRS's PhD student; this is his thesis work.

"High energy neutrino astronomy using upward-going muons in Super-Kamiokande-I," K. Abe *et al.* Astrophys. J.652:198, 2006.

"First results of the Instrumentation Line for the deep-sea ANTARES neutrino telescope," by ANTARES Collaboration (J.A. Aguilar *et al.*). Astropart. Phys.26:314-324, 2006. e-Print: astro-ph/0606229 (>35 cites)

"Search for Diffuse Astrophysical Neutrino Flux Using Ultrahigh Energy Upward-Going Muons in Super-Kamiokande I," By Super-Kamiokande Collaboration (Molly E.C. Swanson *et al.*). Jun 2006. 10pp. Astrophys. J.652:206-215,2006. e-Print: astro-ph/0606126

Muon g-2 Experiment - development of fast waveform digitizers and fiber calorimetry at BU for the SSC + excellent physics
"Precise measurement of the positive muon anomalous magnetic moment," Muon g-2 Collaboration (H.N. Brown *et al.*). Feb 2001. Phys.Rev.Lett.86:2227-2231,2001. e-Print: hep-ex/0102017 (587 cites)

Development of Novel Detectors and their Technologies
"Very Large Proportional Drift Chambers With High Spatial And Time Resolutions," D.C. Cheng, W.A. Kozanecki, R.L. Piccioni, C. Rubbia, L.R. Sulak, H.J. Weedon, J. Whittaker *In the Proceedings of International Conference on Instrumentation for High-Energy Physics, Frascati,*

Italy, 8-12 May 1973, pp 268-274. (>30 cites)

"A Liquid-Scintillator Total Absorption Hadron Calorimeter for the Study of Neutrino Interactions," A.C. Benvenuti *et al.* Nucl.Instrum.Meth.125:447,1975. (>40 cites)

First demonstration of acoustic detection of particle showers, and its development
"Experimental Studies Of The Acoustic Signature Of Proton Beams Traversing Fluid Media," L. Sulak *et al.* Nucl.Instrum.Meth.161:203,1979. (>25 cites)

"Studies of a full-scale mechanical prototype line for the ANTARES neutrino telescope and tests of a prototype instrument for deep-sea acoustic measurements," M. Ageron *et al.* Nucl.Instrum.Meth.A581:695-708,2007.

Invention of wavelength shifting plates directly coupled to photomultipliers
"A Wave Shifter Light Collector For A Water Cherenkov Detector," R. Claus *et al.* Nucl.Instrum.Meth.A261:540-542, 1987. (>30 cites) (invented by LRS and Claus, his MS thesis student)

Complete development of Quartz - Fiber Cherenkov Calorimetry for Collider Detectors for GEM at SSC and CMS at LHC
"Beam test results from a fine-sampling quartz fiber calorimeter for electron, photon and hadron detection," N. Akchurin *et al.* Nucl. Instrum Meth.A399:202-226, 1997. (14 cites)

"Test beam results of CMS quartz fibre calorimeter prototype and simulation of response to high-energy hadron jets," N. Akchurin *et al.* Nucl.Instrum.Meth.A409:593-597,1998.

"Design, performance and calibration of the CMS forward calorimeter wedges," G. Bayatian *et al.* Eur.Phys.J.C53:139-166, 2008.

"CMS technical design report, volume II: Physics performance," by CMS Collaboration (G.L. Bayatian *et al.*). CERN-LHCC- J.Phys.G34:995-1579, 2007. (>360 cites)

The first observations of Neutral Currents

As lead analysis person of the first observations, concurrently with Gargamelle at CERN "Measurement of Rates for Muonless Deep Inelastic Neutrino and anti-neutrino Interactions," B. Aubert *et al.* Phys.Rev.Lett.32: 1457,1974. (>125 cites)

As co-spokesman and lead physicist in designing and building the world's largest drift chambers (4x4m) and calorimeter (100 T)
"Observation of Elastic Neutrino-Proton Scattering," D. Cline, A. Entenberg, W. Kozanecki, A.K. Mann, D.D. Reeder, C. Rubbia, J. Strait, L. Sulak, H.H. Williams, Phys.Rev.Lett.37:252-255,1976. (>140 cites)

"Observation of Elastic anti-neutrino - Proton Scattering," D. Cline, A. Entenberg, W. Kozanecki, A.K. Mann, D.D. Reeder, C. Rubbia, J. Strait, L. Sulak, H.H. Williams, Phys.Rev.Lett.37:648,1976. (>120 cites)

SELECTED SCIENTIFIC ADVISORY PANELS, EXPERIMENT SPOKESMANSHIPS, AND CONFERENCE ORGANIZATION

2012-present	US CMS Upgrade Steering Committee
2011-present	PAC Reviewer for CMS HCAL papers
2011-2013	Chairman, US/CMS/HCAL Collaboration Board
2011-2012	CMS co-organizer of 3 Production Readiness Reviews, CERN, for 1) Castor, 2) HCAL-HO, and 3) HCAL-HF
2011	Organizer, CMS HCAL Upgrade Workshop, Boston University
2010	NSF Educational Programs, Biennial review committee
2009	Rapporteur, Habilitation Committee for J. Brunner, "Neutrinos: From Oscillations to Astronomy," University of Marseille
2007	Review Board, NASA 5-Year Plan for Astrophysics Experiments
2002	Experts Panel on Physics in Next 10 Years, Canadian Foundation for Innovation. Funded expansion of SNO Laboratory
1998	Convener of Astrophysics Sessions, International Conference on High Energy Physics,
1997	Advisory committee, Int'l Workshop in Supernova Early Detection Network
1995-1996	Int'l Advisory Committee, Int'l Workshops on Proton Decay and Neutron-Antineutron Oscillations,
1994-1996	Technical Board, CMS Detector for the Large Hadron Collider (LHC) at CERN
1994-present	Collaboration Council of CMS
1994-1996	Spokesman, Forward (Quartz Fiber) Calorimetry Detector Group, CMS Collaboration, LHC, CERN
1994-1996	Co-Spokesman of the Forward Calorimeter, CMS
1993-1994	Ten Year Review Committee, French National Plan for Science and Education Policy
1993-1994	Program Advisory Committee, Dep't of Physics, Astrophysics and Instrumentation, Centre d'Etude, Saclay
1993-1995	Co-chairman, United Nations OECD Forum on Megascience, Commission on Astroparticle Physics
1990-1992	Int'l Advisory Committee, Theoretical and Phenomenological Aspects of Underground Physics
1988-1992	Co-Spokesman, TEXAS Detector for the Superconducting Super Collider
1987-1991	HEPAP member, U.S. Department of Energy High Energy Physics Advisory Panel
1984-1988	Scientific Program Committee, National Institute of Nuclear Physics, Italy, Gran Sasso National Laboratory
1984-1985	National Science Policy Committee, Interministerial Commission for Scientific Research, Spain
1984-1986	Executive Committee, Division of Particles and Fields, American Physical Society
1983	Natural Sciences & Engineering Research Council, Committee on New Canadian Projects in Particle Physics

1981 HEPAP subpanel on Long Range Planning, U.S. Department of Energy High Energy Physics Advisory Panel
1980-1982 Executive Committee, Division of Particles and Fields, American Physical Society,

FORMER STUDENTS now accomplished physicists (and their current affiliations)

Former undergraduate mentees: Prof. H. Baranger (Duke), Steve Biller (Oxford), Mark Bregman (VP, Symantec), Rob Cormac (MGH), Prof. George Gollin (Illinois), Prof. David Hanna (McGill), Michael Hedges (Hawaii), Prof. Kay Kinoshita (Kentucky), Harold Lessure (Carnegie-Mellon), Prof. Leonid Levin (Lausanne & PSI), Mike Levy (LBL), Prof. Peter Meyers (Princeton), Prof. Rene Ong (UCLA), Prof. Mark Robbins (Johns Hopkins), Prof. Martin Rocek (Rockefeller), Prof. Marjorie Shapiro (former Physics Chair, Berkeley), Prof. Wesley Smith (Wisconsin, CMS Trigger Director), Prof. Alan Sokal (NYU), Prof. A. Strominger (Harvard)

Former PhD advisees and post-doctoral fellows: Dr. Richard Bionta (Lawrence Livermore Lab), Prof. Dave Casper (Irvine), Dr. Rick Claus (SLAC), Dr. Bruce Cortez (Lucent), Dr. Shantanu Desai (Penn State), Prof. Steve Dye (U. of Hawaii), Dr. Bill Foster (US Congressman & former Fermilab Director of Research), Mark Greenberg, Prof. A. Heister (Aachen), Prof. Joe Incandella (UCSB, former spokesman of CMS), Prof. Soo-Bong Kim (Seoul National) Dr. Witold Kozanecki (SLAC & Saclay), Phil Lawson (Jaguar/Land Rover Labs), Dr. Andre Rosovsky (Saclay), Kate Scholberg (Duke), Prof. Sally Seidel (New Mexico), Dr. Jim Strait (Accelerator Director, Fermilab), William Worstell (PhotoDiagnostic, Inc.), Prof. Chris Walter (Duke).

Former graduate student mentees: Dr. Douglas Brown (KEK, Japan), Dr. Sandra Ciocio (Lawrence Berkeley Laboratory) Dr. Robert Cormac (Head, Radiation Oncology, Harvard Med), Fanny Dufour (University of Geneva), Prof. Chris Henley (Cornell), Sonia Karkar (University of Strasbourg), Prof. Charling Tao (Univ. Marseille and Tsinghua)

Former undergrad mentees, now high school physics teachers: Barbara Kerosky Franks, Dan Welty

SELECTED RECENT REFEREED PAPERS PUBLISHED Papers where LRS played a significant role are listed below, all utilizing the Forward Cherenkov Calorimeter of CMS, invented by LRS initially for the SSC. These were selected from the 126 papers produced by the very large CMS authorship, and have been cited 2299 times, including 3 very well known (100-249), 5 well-known (50-99), and 64 known papers (10-49 cites).

Vector boson fusion channel of Higgs production, using, in part, tagging jets of the forward calorimeter

1) "Observation of a new boson with mass near 125 GeV in pp collisions at s√ = 7 and 8 TeV" CMS Collaboration (Serguei Chatrchyan et al.). Mar 19, 2013. 117 pp. Published in JHEP 1306 (2013) 081, e-Print: arXiv:1303.4571 [hep-ex] 76 cites

Missing Energy Signatures, using the hermiticity provided by the forward calorimeters

2) "Search for new physics in events with opposite-sign leptons, jets, and missing transverse energy in pp collisions at s√=7 TeV" CMS Collaboration (Serguei Chatrchyan et al.). Published in Phys.Lett. B718 (2013) 815-840, e-Print: arXiv:1206.3949 [hep-ex] 31 cites

3) "Search for a standard-model-like Higgs boson with a mass in the range 145 to 1000 GeV at the LHC" CMS Collaboration (Serguei Chatrchyan et al.). Mar 31, 2013. Published in Eur.Phys.J. C73 (2013) 2469, e-Print: arXiv:1304.0213 [hep-ex] 29 cites

4) "Studies of jet mass in dijet and W/Z + jet events" CMS Collaboration (Serguei Chatrchyan et al.). Mar 19, 2013. 49 pp. Published in JHEP 1305 (2013) 090, e-Print: arXiv:1303.4811 [hep-ex] 16 cites

5) "Search for pair-produced dijet resonances in four-jet final states in pp collisions at s√ = 7 TeV" CMS Collaboration (Serguei Chatrchyan et al.). Feb 3, 2013. 23 pp. Published in Phys.Rev.Lett. 110 (2013), e-Print: arXiv:1302.0531 [hep-ex] 19 cites

6) "Search for new physics in final states with a lepton and missing transverse energy in pp collisions at the LHC" CMS Collaboration (Serguei Chatrchyan et al.). Feb 12, 2013. 25 pp. Published in Phys.Rev. D87 (2013), e-Print: arXiv:1302.2812 [hep-ex] 7 cites

7) "Search for supersymmetry in pp collisions at s√=7 TeV in events with a single lepton, jets, and missing transverse momentum" CMS Collaboration (Serguei Chatrchyan et al.). 57 pp. Published in Eur.Phys.J. C73 (2013) 2404, e-Print: arXiv:1212.6428 [hep-ex], 12 cites

8) "Search for supersymmetry in events with photons and low missing transverse energy in pp collisions at s√=7 TeV" CMS Collaboration (Serguei Chatrchyan et al.). Published in Phys.Lett. B719 (2013), e-Print: arXiv:1210.2052 [hep-ex] 14 cites

9) "Search for new physics in events with photons, jets, and missing transverse energy in pp collisions at s√=7 13) TeV" CMS Collaboration (Serguei Chatrchyan et al.). 49 pp. Published in JHEP 1303 (2013), e-Print: arXiv:1211.4784 [hep-ex], 14 cites

Studies of Jets, with major contributions from Phil Lawson, LRS's graduate student

10) "Studies of jet mass in dijet and W/Z + jet events" CMS Collaboration (Serguei Chatrchyan et al.). Mar 19, 2013. 49 pp. Published in JHEP 1305 (2013) 090, e-Print: arXiv:1303.4811 [hep-ex] 16 cites

TEN REFEREED PUBLICATIONS IN 2015 in which LRS played a significant role:

Measurements of jet multiplicity and differential production cross sections of Z + jets events in proton-proton collisions at sqrt(s) = 7 TeV

Measurement of the inclusive jet cross section in pp collisions at sqrt(s) = 2.76 TeV

Search for Dark Matter and Unparticles Produced in Association with a Z Boson in Proton-Proton Collisions at sqrt(s) = 8 TeV

Measurements of the atmospheric neutrino flux by Super-Kamiokande: energy spectra, geomagnetic effects, and solar modulation

Measurement of the underlying event activity using charged-particle jets in proton-proton collisions at sqrt(s) = 2.76 TeV

Limits on the Higgs boson lifetime and width from its decay to four charged leptons

Search for a Higgs Boson in the Mass Range from 145 to 1000 GeV Decaying to a Pair of W or Z Bosons (50+ citations)

Search for dinucleon decay into pions at Super-Kamiokande

Combined Measurement of the Higgs Boson Mass in pp Collisions at s?=7 and 8 TeV with the ATLAS and CMS Experiments (250+ citations)

Search for Physics Beyond the Standard Model in Events with Two Leptons, Jets, and Missing Transverse Momentum in pp Collisions at sqrt(s) = 8 TeV

Performance of the CMS missing transverse momentum reconstruction in pp data at s? = 8 TeV

Test of Lorentz invariance with atmospheric neutrinos

Measurements of jet multiplicity and differential production cross sections of Z+ jets events in proton-proton collisions at root s = 7 TeV

First results of the Instrumentation Line for the deep-sea ANTARES neutrino telescope

The Search for n-n bar oscillation in Super-Kamiokande I

PHYSICS EDUCATION INITIATIVES

2015-present Designing an experiential MA Degree in Physics, based on e-Lab, AdLab, Computational Physics, and Materials Characterization, with many elective courses, with C. Chamon and K. Ludwig.

2012-2016 Transforming senior and graduate level *"Electronics for Scientists"* PY371/681from a course based on 1988 technology to one emulating current work in the departments Scientific Facility, including C programming of microprocessors, with E. Hazen and D. Gastler.

2010-present Modernizing senior and graduate level *"Advanced Laboratory"* PY581 to one with state-of-the-art research stations and electronic data acquisition, with S. Ahlen and G. Zimmerman.

2009-present Conceiving, organizing and obtaining DOE funding for the only long duration undergraduate internship program at CERN, jointly with the Physics Department, University of Geneva. From January through August 15 juniors perform a research project side-by-side with a CERN mentor. During the school term, these are the only undergrads at CERN among the 5000 researchers.

2005-2008 *"What every educated citizen should know: From the Big Bang to the Demise of the Universe,"* developing and presenting modern physics lectures for large audience freshman non-scientists in the BU Core Curriculum.

*Citation numbers are from the inSPIRE database of Stanford Linear Accelerator Center.

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