LAWRENCE R. SULAK

SELECTED SCIENTIFIC PUBLICATIONS
from some 425 papers cited over 18,000 times in Spires database

Discovery of Oscillation of Neutrinos and of Neutrino Mass

1. *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 signals for muon- and 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 appeared as 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.

Introduction of up/down asymmetry technique, which led to the discovery of neutrino mass and oscillations
"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.

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

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. This is Casper's PhD thesis, LRS as advisor. (499 cites)

3. 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. The series of papers 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. (2475 cites)

4. 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). (588 cites)

Precision Measurement of the g-2 Muon Magnetic Moment

5. Invention of high-rate detectors segmented in time and in space for a new generation g-2 experiment at BNL. LRS led conceptual design, prototyping and test beam effort and drafted proposal. Most highly cited experimental particle physics paper in 2001, with 1073 citations for the series of 5 papers.
"Design and Performance of a New Electron Calorimeter for Muon g-2 Experiment", C. W. Heisey et al., Nucl. Instr. and Meth. 1988.

"Scintillating Fiber Calorimeters with Cast Absorbers," D. Brown et al., IEEE Trans. Nucl. Sci. (1991).

"Cast Lead Eutectic Solid and Liquid Scintillating Fiber Shower Calorimeters," T. Coan, W. Worstell, J. Miller, B. L. Roberts, L. R. Sulak, D. R. Winn, P. Cushman, S. Dhawan, and V. W. Hughes, Nucl. Instr. Meth. (1991).

"Improved Measurement of the Positive Muon Anomalous Magnetic Moment", R. Carey et al., Phys. Rev. D. (2000)

"Precise Measurement of the Positive Muon Anomalous Magnetic Moment," H. N. Brown et al., Muon g-2 Collaboration, Phys. Rev. Lett. 86, (2001) (526 entries in Citation Index) First of a series of 5 papers.

Discovery of Neutrinos from a Supernova collapse

6. *First observation of extra-galactic neutrinos from the gravitational collapse of a supernova, also observed by Kamiokande.*
"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. (588 entries in Citation Index)

Searches for the Ultimate Decay of the Proton and for Grand Unification

7. *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 detector.*

"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) (140 citations)

"Search for Nucleon Decay into μ^+ K° and νK°," B. G. Cortez et al., Phys. Rev. Lett., Vol., 52 (26 March 1984).

8. Limits on 44 decay modes of the nucleon, most 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.

The Discovery and Elucidation of Weak Neutral Currents

9. *First observation (with C. Rubbia, Experiment E1A, Fermilab) of neutral-current neutrino events, contemporaneously with measurements at Gargamelle, CERN. Unification of electromagnetism and weak interactions. LRS' responsibility: designing and building first totally active liquid scintillator calorimeter (100 T), first to use total-internal reflection from Teflon, large liquid scintillator trigger counters, and data acquisition electronics. LRS performed analysis of the first events and drafted this paper:*
"Observation of Muonless Neutrino-Induced Inelastic Interactions," A. Benvenuti *et al*., Phys. Rev. Lett., Vol. 32, No. 14, p. 800 (8 April 1974, received 3 August 1973). (224 entries in Citation Index)

10. *The first observation of both elastic neutrino- and antineutrino-proton elastic scattering, the weak analog of beta decay (E613 at Brookhaven). LRS spokesman, responsible for designing and building the world's largest drift chambers (4x4 m), a 60 ton segmented liquid scintillator detector, and the data acquisition system.*
"Observation of Elastic Neutrino-Proton Scattering," D. Cline *et al.*, Phys. Rev. Lett. Vol. 37, No. 5, p. 252 (2 August 1976). (121 entries in Citation Index)

"Observation of Elastic Antineutrino-Proton Scattering," D. Cline, *et al*., Phys. Rev. Lett., Vol. 37, no. 11, p. 648, 1976 (105 cites)

11. *The first determination of the space-time structure of the weak neutral current, showing that it fits the electro-weak theory:*

"Model Independent Determination of Hadronic Neutral Current Couplings", M. Claudson, E. A. Paschos, J. Strait, and L. R. Sulak, Phys. Rev. D, Vol. 19, No. 5, p. 1973, (1 March 1979).

Precision Measurement of K Meson Mass Difference
12. First measurement of the neutral kaon mass difference at the 1% level and the phase of η_{+-} to 5°, at Brookhaven.
"$K_1^o - K_2^o$ Mass Difference," R. K. Carnegie, V. L. Fitch, M. Strovink, and L. R. Sulak, Phys. Rev. D. Vol. 4 (1971), p.1

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