

## KRISHNA SUBRAMANIAN KUMAR

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**RESEARCH INTERESTS:** Experimental Nuclear and Particle Physics:  
Low energy searches for physics beyond Standard Model,  
QCD structure of the nucleon and other tests of low energy QCD.

### WORK EXPERIENCE:

Sep. '04 - **University of Massachusetts**, Amherst, MA.  
*Professor of Physics.*

Sep. '99 - Aug. '04 **University of Massachusetts**, Amherst, MA.  
*Associate Professor of Physics.*

Sep. '93 - Aug. '99 **Princeton University**, Princeton, NJ.  
*Assistant Professor of Physics.*

Feb. '90 - Aug. '93 **Harvard University**, Cambridge, MA.  
*Research Associate at the L3 experiment at CERN.*

Jan. '85 - Jan. '90 **Syracuse University**, Syracuse, NY.  
*Graduate Research Assistant at the MIT-Bates Linac.*

### EDUCATION:

Sep. '84 - Jan. '90 **Syracuse University**, Syracuse, NY.  
*Ph. D. Physics*, Thesis Advisor: Paul Souder  
Thesis Title: *Parity Violation in Elastic  $\bar{e} - ^{12}\text{C}$  Scattering*

Sep. '79 - Aug. '84 **Indian Institute of Technology**, Bombay, INDIA.  
*M. Sc. Physics*

### AWARDS:

- **2005 Fellow, American Physical Society**, *For his leadership in parity-violating electron scattering experiments, especially those focused on low energy searches for physics beyond the standard model.*
- **1995 Outstanding Junior Investigator Award**, *Precision Electroweak Tests with Polarized Electrons*, awarded by the US Department of Energy, Division of High Energy Physics.
- **1990 Peter T. Demos Award**, Achievement in Graduate Student Research, awarded by the MIT-Bates Linear Accelerator Center Users Group.
- **1990 Doctoral Prize**, awarded by the Graduate School at Syracuse University.

## PUBLICATIONS

(publications where I played a leading role are marked with a \*)

1. "First Observation of the Negative Muonium Ion produced by Electron Capture in a Beam Foil Experiment",  
Y. Kuang *et al.*, *Physical Review* **A36**, RC, 3172, (1987).
2. "Formation of Negative Muonium Ion and Charge Processes for Positive Muons passing through Thin Metal Foils.",  
Y. Kuang *et al.*, *Physical Review* **A39**, No. 12, 6109, (1989).
3. "The Bates Polarized Electron Source.",  
G.D. Cates *et al.*, *Nuclear Instruments and Methods in Physics Research* **A278** No. 2, 293, (1989).
4. \* "Measurement of Parity Violation in the Elastic Scattering of Polarized Electrons from  $^{12}\text{C}$ ",  
P.A. Souder *et al.*, *Physical Review Letters* **65**, No. 6, 694, (1990).
5. "Operation of the LAMPF Stopped Muon Channel for Small Gas Targets.",  
R. Holmes *et al.*, *Nuclear Instruments and Methods in Physics Research* **A303**, 226, (1991).
6. "Mass Limits for Excited Electrons and Muons from  $Z^0$  Decay.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **247B** (1990) 177.
7. "A Determination of Electroweak Parameters from  $Z^0 \rightarrow \mu^+ \mu^- (\gamma)$ .",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **247B** (1990) 473.
8. "A Precision Measurement of the Number of Neutrino Species",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **249B** (1990) 341.
9. "Search for Neutral Higgs Boson in  $Z^0$  Decay.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **248B** (1990) 203.
10. "Determination of  $\alpha_s$  from Jet Multiplicities Measured on the  $Z^0$  Resonance.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **248B** (1990) 462.
11. "A Test of QCD based on 4-Jet Events from  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **248B** (1990) 227.
12. "Test of QED in  $e^+e^- \rightarrow \gamma\gamma$  at LEP.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **250B** (1990) 199.
13. \* "Search for Excited Taos from  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **250B** (1990) 205.
14. "Search for the Neutral Higgs Bosons of the Minimal Supersymmetric Standard Model from  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **251B** (1990) 311.
15. \* "A Search for Heavy Charged and Neutral Leptons from  $Z^0$  Decays",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **251B** (1990) 321.
16. \* "A Determination of Electroweak Parameters from  $Z^0$  Decays into Charged Leptons.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **250B** (1990) 183.

17. "Search for the Charged Higgs Boson in  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **252B** (1990) 511.
18. "Search for a Low Mass Neutral Higgs Boson in  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **252B** (1990) 518.
19. "A Measurement of  $B^0$ - $\bar{B}^0$  Mixing in  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **252B** (1990) 703.
20. "Search for Excited Neutrinos from  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **252B** (1990) 525.
21. "A Measurement of the  $Z^0 \rightarrow b\bar{b}$  Forward-Backward Asymmetry.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **252B** (1990) 713.
22. "Determination of  $\alpha_s$  from Energy-Energy Correlations Measured on the  $Z^0$  Resonance.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **257B** (1991) 469.
23. "Search for the Neutral Higgs Boson.", The L3 Collaboration, B. Adeva *et al.*,  
*Physics Letters* **257B** (1991) 450.
24. "Measurement of the Inclusive Production of Neutral Pions and Charged Particles on the  $Z^0$  Resonance.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **259B** (1991) 199.
25. "Search for Leptoquarks in  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **261B** (1991) 169.
26. "Measurements of  $Z^0 \rightarrow b\bar{b}$  Decays and the Semileptonic Branching Ratio  $\text{Br}(b \rightarrow \ell + X)$ .",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **261B** (1991) 177.
27. "Measurement of Electroweak Parameters from Hadronic and Leptonic Decays of the  $Z^0$ .",  
The L3 Collab., B. Adeva *et al.*, *Z. Phys.* **C51C** (1991) 179.
28. "Search for Narrow High-Mass Resonances in Radiative Decays of the  $Z^0$ .",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **262B** (1991) 155.
29. "A Test of QCD based on 3-Jet events from  $Z^0$  Decays.",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **263B** (1991) 551.
30. \* "Decay Properties of Tau Leptons Measured at the  $Z^0$  Resonance",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **265B** (1991) 451.
31. "Measurement of the Lifetime of B-Hadrons and a determination of  $|V_{cb}|$ ",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **270B** (1991) 111.
32. "Measurement of the Strong Coupling Constant  $\alpha_s$  for Bottom Quarks at the  $Z^0$  Resonance",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **271B** (1991) 461.
33. \* "Search for Lepton Flavour Violation in  $Z^0$  Decays",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **271B** (1991) 453.
34. "A Direct Determination of the Number of Light Neutrino Families from  $e^+e^- \rightarrow \nu\bar{\nu}\gamma$  at LEP",  
The L3 Collaboration, B. Adeva *et al.*, *Physics Letters* **275B** (1992) 209.

35. "Search for the Neutral Higgs Boson at LEP ",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **283B** (1992) 454.
36. "Studies of Hadronic Event Structure and Comparisons with QCD Models at the  $Z^0$  Resonance",  
The L3 Collab., O. Adriani *et al*, *Z. Phys.* **C55C** (1992) 39.
37. "Determination of  $\alpha_s$  from Hadronic Event Shapes on the  $Z^0$  Resonance ",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **284B** (1992) 471.
38. "Measurement of Inclusive  $\eta$  Production in Hadronic Decays of the  $Z^0$ ",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **286B** (1992) 403.
39. "An Improved Measurement of  $B^0 - \bar{B}^0$  Mixing in  $Z^0$  Decays",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **288B** (1992) 395.
40. "A Test of Quantum Electrodynamics in the Reaction  $e^+e^- \rightarrow \gamma\gamma(\gamma)$ "  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **288B** (1992) 404.
41. "Inclusive  $J/\psi$  production in  $Z^0$  Decays",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **288B** (1992) 412.
42. "Measurement of the  $e^+e^- \rightarrow b\bar{b}$  and  $e^+e^- \rightarrow c\bar{c}$  Forward-Backward Asymmetries at the  $Z^0$  Resonance",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **292B** (1992) 454.
43. "Determination of the number of light neutrino species",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **292B** (1992) 463.
44. "Isolated Hard Photon Emission in Hadronic  $Z^0$  Decays",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **292B** (1992) 472.
45. \* "A Measurement of  $\tau$  Polarization in  $Z^0$  Decays ",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **294B** (1992) 466.
46. "Searches for Non-Minimal Higgs Bosons in  $Z^0$  Decays",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **294B** (1992) 457.
47. "High Mass Photon Pairs in  $\ell^+\ell^-\gamma\gamma$  events at LEP",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **295B** (1992) 337.
48. "Isosinglet Neutral Heavy Leptons in  $Z^0$  Decays",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **295B** (1992) 371.
49. "Search for Anomalous Production of Single-Photon Events in  $e^+e^-$ -Annihilations at the Z Resonance",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **297B** (1992) 469.
50. "Determination of Quark Electroweak Couplings from Direct Photon Production in Hadronic Z Decays",  
The L3 Collaboration, O. Adriani *et al*, *Physics Letters* **301B** (1993) 136.
51. "Results from the L3 Experiment at LEP.",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Reports* **236** (1993) 1.
52. "Search for the Neutral Higgs Boson at LEP.",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **303B** (1993) 391.

53. "Search for Narrow Vector Resonances in the Z Mass Range.",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **313B** (1993) 326.
54. "Search for a  $Z'$  at the Z Resonance.",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **306B** (1993) 187.
55. "Measurement of  $\Gamma_{b\bar{b}}/\Gamma_{\text{had}}$  From Hadronic Decays of the Z.",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **307B** (1993) 237.
56. \* "Determination of the Effective Electroweak Mixing Angle from Z Decay",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **309B** (1993) 451.
57. "Inclusive Search for the Charmless Radiative Decay of the B Quark ( $B \rightarrow s\gamma$ )",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **317B** (1993) 637.
58. "An S Matrix Analysis of the Z Resonance",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **315B** (1993) 494.
59. \* "Search for Lepton Flavor Violation in Z Decays",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **316B** (1993) 427.
60. "Measurement of the Average Lifetime of B Hadrons",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **317B** (1993) 474.
61. " $\chi_c$  Production in Hadronic Z Decays",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **317B** (1993) 467.
62. "Measurement of  $\eta_c$  Production in Untagged Two Photon Collisions at LEP.",  
The L3 Collaboration, O. Adriani, *et al*, *Physics Letters* **318B** (1993) 575.
63. "A Study of Four Fermion Processes at LEP.",  
The L3 Collaboration, A. Adam, *et al*, *Physics Letters* **321B** (1994) 283.
64. "Measurement of the Cross-Sections and Leptonic Forward-Backward Asymmetries at the Z Pole and Determination of the Electroweak Parameters",  
The L3 Collaboration, M. Acciarri *et al*, *Z. Phys.* **CC62** (1994) 551.
65. "Measurement of the Inclusive Production of Neutral Hadrons From Z Decays",  
The L3 Collaboration, M. Acciarri, *et al*, *Physics Letters* **328B** (1994) 223.
66. "Measurement of the Inclusive  $B \rightarrow \nu_\tau X$  Branching Ratio.",  
The L3 Collaboration, M. Acciarri *et al*, *Physics Letters* **332B** (1994) 201.
67. "Measurement of  $B^0 - \bar{B}^0$  Mixing Parameter and the  $Z \rightarrow B^0 - \bar{B}^0$  Forward-Backward Asymmetry",  
The L3 Collaboration, M. Acciarri, *et al*, *Physics Letters* **335B** (1994) 542.
68. \* "A Measurement of  $\tau$  Polarization at LEP",  
The L3 Collaboration, M. Acciarri, *et al*, *Physics Letters* **341B** (1994) 245.
69. \* "Electroweak Tests with  $\tau$  Leptons at LEP.",  
K.S. Kumar, *Pramana J. Phys.* **41** (1994) Suppl. 45.

70. \* “Precision Low Energy Weak Neutral Current Experiments”,  
K.S. Kumar *et al.*, *Modern Physics Letters* **A10** (1995) 2979.
71. “A Combined Polarized Target/Ionization Chamber for Measuring the Spin Dependence of Nuclear Muon Capture in Laser Polarized Muonic  $^3\text{He}$ ”,  
P. Bogorad *et al.*, *Nuclear Instruments and Methods in Physics Research* **398A** (1997) 211.
72. “Precision Determination of the Neutron Spin Structure Function  $g_1^n$ ”  
The E154 Collaboration, K. Abe *et al.*, *Physical Review Letters* **79**, 26, (1997).
73. “Next-to-Leading Order Analysis of Polarized Deep Inelastic Scattering Data”  
The E154 Collaboration, K. Abe *et al.*, *Physics Letters* **405B** (1997) 180.
74. “Measurement of the Neutron Spin Structure Function  $g_2^n$  and Asymmetry  $A_2^n$ ”,  
The E154 Collaboration, K. Abe *et al.*, *Physics Letters* **404B** (1997) 377.
75. \* “Parity Violation Experiments at TJNAF”,  
K.S. Kumar, *Nucl. Phys.* **A623** (1997) 258c-267c.
76. \* “Measurement of the Neutral Weak Form Factors of the Proton”  
The HAPPEX Collaboration, K.A. Aniol *et al.*, *Physical Review Letters* **82**, 1096, (1999)
77. “Large Momentum Transfer Measurements of the Deuteron Elastic Structure Function  $A(Q^2)$  at Jefferson Laboratory”  
The Jefferson Lab Hall A Collaboration, L.C. Alexa *et al.*, *Physical Review Letters* **82**, 1374, (1999)
78. “Dynamical Relativistic Effects in Quasielastic  $1p$ -Shell Proton Knockout from  $^{16}\text{O}$ ”  
The Jefferson Lab Hall A Collaboration, J. Gao *et al.*, *Physical Review Letters* **84**, 3265 (2000)
79. “Polarization Transfer in the  $^{16}\text{O}(\vec{e}, e'\vec{p})^{15}\text{N}$  Reaction”  
The Jefferson Lab Hall A Collaboration, S. Malov *et al.*, *Physical Review* **C62** (2000) 057302.
80. \* “Strange Quarks and Parity Violation”  
K.S. Kumar and P.A. Souder, *Prog. Nucl. Part. Phys.* **45** (2000) S333-S395.
81. The Reaction Dynamics of the  $^{16}\text{O}(e, e'p)^{15}\text{N}$  Cross-Section at High Missing Energies”,  
The Jefferson Lab Hall A Collaboration, N. Liyanage *et al.*, *Physical Review Letters* **86** (2001) 5670.
82. \* “New Measurement of Parity Violation in Elastic Electron-Proton Scattering and Implications for Strange Form-Factors”  
The HAPPEX Collaboration, K.A. Aniol *et al.*, *Physics Letters* **B509** (2001) 211.
83. \* “The Future of Fixed Target Physics: Snowmass E5 Working Group Summary”  
K.S. Kumar, R. Ray, P.E. Reimer and M. Strovink, Prepared for the APS/DPF/DPB Summer Study on the Future of Particle Physics, *eConf* **C010630** (2001) E5001.
84. \* “Helicity Correlated Systematics for SLAC Experiment E158”  
P.A. Mastromarino *et al.*, *IEEE Trans. Nucl. Sci.* **49** (2002) 1097-1105.
85. \* “SLAC’s Polarized Electron Source Laser System for the E-158 Parity Violation Experiment”  
A. Brachmann *et al.*, *Proc. SPIE Int. Soc. Opt. Eng.* **4632** (2002) 211-222.

86. "The  $Q^2$  Evolution of the Generalized Gerasimov-Drell-Hearn Integral for the Neutron using a  $^3\text{He}$  Target"  
M. Amarian *et al.*, *Physical Review Letters* **89** (2002) 242301.
87. \* "SLAC's Polarized Electron Source Laser System and Minimization of Electron Beam Helicity Correlations for the E158 Parity Violation Experiment"  
T.B. Humensky *et al.*, *Nuclear Instruments and Methods in Physics Research* **A521** (2004) 261-298.
88. "Backward Electroproduction of  $\pi^0$  Mesons on Protons in the Region of Nucleon Resonances at  $Q^2 = 1.0$   $\text{GeV}^2$ "  
G. Laveissiere *et al.*, *Physical Review* **C69** (2004) 045203.
89. " $Q^2$  Evolution of the Neutron Spin Structure Moments using a  $^3\text{He}$  Target"  
M. Amarian *et al.*, *Physical Review Letters* **92** (2004) 022301.
90. \* "Observation of Parity Nonconservation in Møller Scattering"  
The E158 Collaboration, P.L. Anthony *et al.*, *Physical Review Letters* **92** (2004) 181602.
91. \* "Parity-Violating Electron Scattering"  
K.S. Kumar, prepared for the 15th International Spin Physics Symposium (SPIN2002), published in *AIP Conf.Proc.***675** (2003) 142.
92. \* "Status and Plans for Neutral Weak Form Factor Measurements"  
K.S. Kumar, prepared for the Conference on Quarks and Nuclear Physics (QNP2002), published in *Euro.Phys.J.***A18** (2003) 129.
93. "The Dynamics of the Quasielastic  $^{16}\text{O}(e,e'p)$  reaction at  $Q^2 = 0.8$   $\text{GeV}^2$ "  
K.G. Fissum *et al.*, *Physical Review* **C70** (2004) 034606.
94. \* "Parity-Violating Electroweak Asymmetry in Polarized e-p Scattering"  
HAPPEX Collaboration, K.A. Aniol *et al.*, *Physical Review* **C69** (2004) 065501.
95. "Measurements of the Generalized Polarizabilities of the Proton in Virtual Compton Scattering at  $Q^2 = 0.92$   $\text{GeV}^2$  and  $1.76$   $\text{GeV}^2$ "  
JLab Hall A collaboration, G. Laveissiere *et al.*, *Physical Review Letters* **93** (2004) 122001.
96. "Measurement of the Generalized Forward Spin Polarizabilities of the Neutron"  
JLab Hall A collaboration, M. Amarian *et al.*, *Physical Review Letters* **93** (2004) 152301.
97. "Basic Instrumentation for Hall A at Jefferson Lab"  
JLab Hall A collaboration, J. Alcorn *et al.*, *Nuclear Instruments and Methods in Physics Research* **bf A522** (2004) 294.
98. \* "Frontiers of Polarized Electron Scattering Experiments"  
K.S. Kumar, prepared for the International Workshop on Parity Violation and Hadronic Structure (PAVI04), published in *Eur.Phys.J.***A24S2** (2005) 191.
99. \* "Precision Measurement of the Weak Mixing Angle in Møller Scattering"  
The E158 Collaboration, P.L. Anthony *et al.*, *Physical Review Letters* **95** (2005) 081601.
100. \* "Flux Profile Scanners for High Energy Electrons"  
R.S. Hicks *et al.*, *Nuclear Instruments and Methods in Physics Research* **A553** (2005) 470.

101. \* “Parity-Violating Electron Scattering from  $^4\text{He}$  and the Strange Electric Form Factor of the Nucleon”  
HAPPEX Collaboration, K.A. Aniol *et al.*, *Physical Review Letters* **96** (2006) 022003.
102. \* “Constraints on the Nucleon Strange Form Factors at  $Q^2 \sim 0.1 \text{ GeV}^2$ ”  
HAPPEX Collaboration, K.A. Aniol *et al.*, *Physics Letters* **B635** (2006) 275.
103. \* “Strange Events in the Proton”  
K.S. Kumar, published in *Phys. World***18N9** (2005) 29.
104. \* “Spin Physics Summary”  
P. Di Nezza, K.S. Kumar, M. Stratmann, prepared for the 13th International Workshop on Deep Inelastic Scattering (DIS05), published in *AIP Conf. Proc.***792** (2005) 173.
105. \* “Parity Violation in Møller Scattering”  
K.S. Kumar, prepared for the 13th International Workshop on Deep Inelastic Scattering (DIS05), published in *AIP Conf. Proc.***792** (2005) 353.
106. \* “Precision Measurements of the Nucleon Strange Form Factors at  $Q^2 \sim 0.1 \text{ GeV}^2$ ”  
HAPPEX Collaboration, A. Acha *et al.*, *Physical Review Letters* **98** (2007) 032301.