

**FRANK T. AVIGNONE, III**  
**Carolina Endowed Professor of Physics and Astronomy**  
**Department of Physics and Astronomy**  
**University of South Carolina**  
**Columbia, SC 29208 USA**

**Education**

B.S. in Physics, Georgia Institute of Technology ( $\tau\beta\pi$ , $\Sigma\pi\Sigma$ , $\Phi K\Phi$ )	1960
M.S. in Physics, Georgia Institute of Technology	1962
Ph. D. in Physics, Georgia Institute of Technology	1965

**Employment History**

Georgia Institute of Technology, Instructor	1962-1965
University of South Carolina, Assistant Professor	1965-1968
University of South Carolina, Associate Professor	1968-1973
University of South Carolina, Professor	1973-Present
International Centre for Theoretical Physics Trieste, Italy, Visiting Professor	1974
Oak Ridge National Laboratory, Visiting Scientist	1975, 1976
Georgia Institute of Technology, Visiting Professor	1976-1979
University of South Carolina, Chairman, Department of Physics and Astronomy	1979-1998
University of South Carolina, First Carolina Endowed Professor of Physics and Astronomy (Chair Professorship)	1985-Present
Distinguished Visiting Scientist, Oak Ridge National Laboratory	1999-Present

**Other History**

National Defense, Education, and Welfare Fellowship, (GA Tech.)	1960-1963
National Science Foundation Graduate Research Fellowship, (GA Tech.)	1963-1965
Oak Ridge Institute of Nuclear Studies, Summer Fellowship	1965
Oak Ridge Associated Universities, Councilor for the University of South Carolina	1979-1998
Chairman, Executive Committee, Universities Isotope Separator, Oak Ridge	1974-1976
Recipient of the Russell Research Award in Science and Engineering (USC)	1972
Deputy Director of Technology Mobilization Program at the Office of the Chief of Naval Research	1984-1986
Awarded Navy Commendation Medal by the Secretary of the Navy	1984
Director of the Technology Mobilization Program at the Office of the Chief of Naval Research	1986-1988
Awarded Meritorious Service Medal by the Secretary of the Navy	1988
Recipient of the Russell Research Award in Science and Engineering (Second Award)	1991
Chairman, Southeastern Section of the American Physical Society	1991
Awarded 2nd Meritorious Service Medal by Commander and Chief, Atlantic Fleet	1991
Elected to Fellowship in the American Physical Society	1991
Awarded the Jesse W. Beams Medal of the American Physical Society	
“ For Significant Research in Physics”	1994
Received the South Carolina Governor’s Award for “Excellence in Science’	1995
Named Spokesman of the Oak Ridge Large Neutrino Detector Collaboration	1998
Elected to the Board of Directors, Oak Ridge Associated Universities	1998-2004
Awarded a Senior Fulbright Scholar Award to Italy	2002
Awarded the “Outstanding Leadership Award” of the Oak Ridge Associated Universities	2003
Elected Director of Science of the Majorana Double Decay Project	2003
Awarded Honorary Doctorate Degree “ Honoris Causa’ by the University of Buenos Aires	2004

### Experience Summary

Research in elementary interactions of neutrinos, in experimental nuclear structure physics, and most recently in low energy tests of Grand Unified Theories (neutrinoless double-beta decay; searches for the axion, and cold dark matter). Half of the available research time is spent on the development of the proposal for the Cryogenic Underground Observatory for Rare Events (CUORE) for search for neutrinoless double beta decay and Cold Dark Matter, and the operation of the pilot experiment, CUORICINO.

### Current Fields of Interest

1. Search for neutrinoless double beta decay (particularly of  $^{76}\text{Ge}$  and  $^{130}\text{Te}$ ) to detect and measure the effective Majorana mass of the electron neutrino. This is one of the most important problems in elementary particle physics, astrophysics, and cosmology.
2. Experimental searches for cold dark matter particles using Ge detectors with very low radioactive background. These experiments concentrate on the search for annual and diurnal variations in the average energy per scattering event and for oscillatory shifts in spectral shape.
3. Neutrino interactions with matter. Development of more sensitive techniques to detect neutrinoless double beta decay using new low-temperature techniques and coherent neutral current scattering.
4. Searches for the elusive elementary particle, the axion, both the hadronic axion and that with significant coupling to photons.

### Leadership Experiences

Chairman of the Department of Physics and Astronomy at the University of South Carolina from 1 May 1979 to 30 June 1998. During this period the department grew to the status claiming three of its five disciplines had reached international recognition. Federal funding grew by more than a factor of 12. Sixteen of the present twenty-seven faculty were hired during that period.

Spokesman and International Coordinator of the International Germanium Experiment IGEX. This became one of the two most sensitive double beta decay experiments ever performed. It placed one of the two best limits in the world on the mass of neutrinos. It continues to develop new technology for next generation experiments. IGEX was a collaboration of the University of South Carolina, the Pacific Northwest National Laboratory, the Institute for Theoretical and Experimental Physics (Moscow) and the Institute of Nuclear Research and its Baksan Neutrino Observatory, in the Kabardino Balkarian Republic in Russia, and the University of Zaragoza in Spain. It was performed in the Homestake Goldmine in Lead South Dakota, and completed in the Canfranc Underground Laboratory in Spain.

Spokesman of the SOLAX axion search experiment in the Hiparsa Iron Mine in Sierra Grande, Argentina. This experiment utilized a new technique involving the coherent Primakoff conversion of solar axions into Photons when the angle of incidence of the sun's axions satisfied a Bragg condition in the diamond structure of a germanium detector. It produced bounds on the axion's mass and coupling significantly better than previous laboratory experiments. SOLAX was a collaboration of: The University of South Carolina, the Pacific Northwest National Laboratory, the TANDAR Laboratory in Buenos Aires, Argentina, The University of Zaragoza, Spain, The University of Thessaloniki, Greece, Tel Aviv University, Israel, and CERN, the European Laboratory of Nuclear research.

Spokesman of the DEMOS, Cold dark matter search in the Hiparsa Iron Mine in Sierra Grande, Argentina. This experiment searched for Cold Dark Matter Candidates using a Ge detector using the annual modulation technique, and for the first time the diurnal modulation of WIMP (Weakly Interacting Massive Particles) signal due to the scattering of WIMPs of a certain range in mass and couplings in the matter in the earth. This was a collaboration led by the University of South Carolina, and including the University of Zaragoza, the Pacific Northwest National Laboratory, (PNNL), and the TANDAR accelerator laboratory in Buenos Aires.

Spokesman of the PNNL-USC low background Cold Dark Matter (CDM) Search, which was the first published terrestrial experimental search for CDM. It eventually eliminated Dirac Neutrinos as dominant candidates for Cold Dark Matter. This was a collaboration of the University of South Carolina, The Pacific Northwest National Laboratory (PNNL), The Harvard Smithsonian Center for Astrophysics, and Boston

University. This seminal experiment was the first such effort and launched an industry of literally dozens of experiments using a variety of experimental techniques.

In 1998, elected Spokesman of the ORLaND collaboration, the prime goal of which was to build an underground bunker, adjacent to the first target station of the \$1.4 billion Spallation Neutron Source (SNS), to house a neutrino research laboratory. This project, the Oak Ridge Laboratory for Neutrino Detectors (ORLaND), would cost \$60 million. It was proposed by a collaboration of 20 universities and institutes, the Oak Ridge National Laboratory, and the Oak Ridge Associated Universities. The full project has been delayed by the DOE, and a smaller version is under construction; it will be expanded in 6 to 7 years.

Served as a member of the Board of Directors of the Oak Ridge Association of Universities (ORAU). This is an organization of 87 universities throughout the country, but predominantly in the Southeast. It manages the Oak Ridge Institute for Science Education for the U.S. DOE, the Graduate Fellowship Program for the NSF, a number of visitor research programs to National Laboratories, acts as an outreach organization for the Laboratories and government research and education programs. ORAU acts as a central agent to form collaborative efforts between universities and between universities and national laboratories or industry. The ORAU President has a seat on the 7 member Board governing the basic science Programs at the Oak Ridge National Laboratory.

As a Naval Reserve Officer, Captain F.T. Avignone: Created the Navy's Technology Mobilization Program under the Chief of Naval Research and served as its Deputy Director and later as its Director. Commanded Mine-Division 126, consisting of four ocean-going mine sweepers (MSOs), and later commanded Mine Squadron-22, an organization of 12 mine hunters and units in coastal cities from Boston to Galveston, with a complement of 600 personnel during the Gulf War of 1990-1991.

Coordinator and Project Director of the University of South Carolina, Department of Defense three-year grant, (\$9.3 million) for Combat Readiness. This was an interdisciplinary Program involving Chemistry, Biology, Mathematics, Computer Science, Statistics, and Marine Science.

Principal Investigator and Project Director of the \$2 million grant from the Department of Energy for academic support of the "Accelerator Production of Tritium" program. This included basic science applications of the facility—neutrino research, for example.

Served as the first co-spokesman, and presently as Head of the Detector design and production group, of the ~\$ 100,000,000. Majorana proposal involving five national laboratories and nine universities. This proposal has been reviewed for its science and has passed with flying colors. The technical review by the Office of Science of the Department of Energy will occur when the DOE invites the proposal formally in the spring of 2006. This will be a long process but all indications are positive at this point.

Presently serving as the senior US scientist and US Coordinator of the CUORE/CUORICINO double beta decay experiment.. The CUORICINO experiment is operating in the Laboratori Nazionale del Gran Sasso in Assergi, Italy. CUORICINO produced its first experimental results which were published in PHYSICS LETTERS. More recent results have been submitted to Physical Review Letters.

### Publications

1. "Conversion-Electron-Gamma Directional Correlation in  $^{133}\text{Cs}$ ," with C. H. Braden, E. T. Patronis, Jr. and L. D. Wyly, Nuclear Physics 80, 314 (1966).
2. "K/(L+M+ $\gamma$ ) Ratio of the 355 keV Transition in  $^{133}\text{Cs}$ ," with L. D. Hendrick, Physical Review 158, 1181 (1967).
3. "Theoretical Fission Antineutrino Spectrum and Cross Section for the Reaction  $^3\text{He}(n^-, e^+)^3\text{H}$ ," with S. M. Blankenship and C. W. Darden, III, Phys. Rev. 170, 931 (1968).
4. "Angular Correlation and Distribution Attenuation Coefficients for Planar and Coaxial Ge(Li) Detectors," with G. D. Frey, Rev. Sci. Inst. 39, 1941 (1968).

5. "Single Detector Method for High Resolution Internal Conversion Coefficient measurements," with H. H. Knox, Rev. Sci. Inst. 40, 1046, (1969).
6. "Internal Conversion Penetration Effects in M1 Transitions in  $^{133}\text{Cs}$ ," with G. D. Frey and L. D. Hendrick, Phys. Rev. 1, 635 (1970).
7. "V-A Elastic Scattering of Electrons by Fission Antineutrinos," Phys. Rev. D2, 2609 (1970).
8. "Directional Correlation and Intensity Studies of Electromagnetic Transitions in  $^{181}\text{Ta}$ ," with J. H. Trueblood and Z. W. Grabowski, Nucl. Phys. A167, 129 (1971).
9. "Further Investigation of Penetration Effects in  $^{133}\text{Cs}$ ," with J. H. Trueblood, Phys. Rev. 3, 2011 (1971).
10. "Internal Conversion and  $\gamma$ - $\gamma$  Directional-Correlation Studies in the Decay of  $^{103}\text{Ru}$ ," with G. D. Frey, Phys. Rev. 4, 912 (1971).
11. "Experimental Search for Higher Order Effects in K-, L- and M-Shell E2 Conversion-Electron Particle Parameters in  $^{654}\text{Gd}$ ," with J. H. Trueblood, Phys. Rev. 4, 1490 (1971).
12. "Indirect Interference of Cosmic Ray-Muons with Low Background Coincidence Experiments," with C. W. Darden, III, Nucl. Inst. and Meth. 97, 343 (1971).
13. "A Method for Rapid Comparison of Angular Distribution Attenuation Coefficients for Detectors of Arbitrary Geometry," Nucl. Inst. and Meth. 103 225 (1972).
14. "Gamma-Gamma Directional Correlation Experiment for the Nuclear or Advanced Laboratory," with J. E. Pinkerton, Amer. J. of Phys. 40, 1542, (1972).
15. "Experiments to Demonstrate the Creation for Positron-Electron Pairs by Gamma Rays," Amer. J. of Phys. 41, 71 (1973).
16. "Directional Correlation Measurements of Gamma-Rays in  $^{106}\text{Pd}$ ," with J. E. Pinkerton, Phys. Rev. C7, 1238 (1973).
17. "The UNISOR Project," with E. H. Spejewski et al., Proceedings of the Eighth International EMIS Conference, DKOVDE, Sweden, June (1973), 318.
18. "Combination Magnetic-Si(li), Swept-Current Electron Spectrometer for On Line Internal Conversion Spectroscopy," with J. E. Pinkerton and J. H. Trueblood, Nucl. Inst. and Meth. 107, 453 (1973).
19. "Internal Source Method of Measuring Absolute Pair Production Cross Sections," with S.M. Blankenship, Nucl. Instr. and Meth. 116, 515 (1974).
20. "L-Subshell Internal Conversion Ratios of the Ninety-nine keV Transition in  $^{195}\text{Pt}$ ," with S. J. Morgan, Phys. Rev. C9, 432 (1974).
21. "Internal Conversion Measurements in  $^{207}\text{Pb}$  Using a Combination Magnetic-Si(li) Spectrometer," Nucl. Inst. and Meth. 116, 521 (1974).
22. "Low Energy Pair Production Cross Section Measurements for  $Z = 50$ ," with S. M. Blankenship, Phys. Rev. A10, 793 (1974).

23. "Initial UNISOR Research. New Isotopes  $^{186}\text{Tl}$ ,  $^{188}\text{Tl}$ ,  $^{116}\text{Tl}$ ; Decays of  $^{189,190}\text{Tl}$ ,  $^{117}\text{I}$ ; and Off-Line Atomic and Nuclear Studies," (published with the UNISOR consortium). Proceedings of the XXIV Annual National Conference of the Academy of Sciences U.S.S.R. on Nuclear Spectroscopy, Kharkov, U.S.S.R., Jan. 1974. (Presented by E. H. Spejewski).
24. "Recent Improvements in the Experiment to Demonstrate the Creation of Positron-Electron Pairs," with S. M. Blankenship, Amer. J. of Phys. 42, 698 (1974).
25. "Improved Projected Hartree-Fock Description of the Low-Lying Quasirootational States in Nuclei," with S. K. Sharma, Phys. Rev. C10, 2106 (1974).
26. "Internal Conversion Studies in  $^{144}\text{Nd}$ ," with S. Raman, Phys. Rev. C12, 963 (1975).
27. A Modern Nuclear Laboratory Course (Text Book), University of South Carolina Press, Sept. 1975.
28. "Multipole Mixing Ratios of the Single Neutron Hole Transitions in  $^{207}\text{Pb}$ ," with T. A. Girard, Phys. Rev. C13, 2067 (1976).
29. "Experimental and Theoretical Multipole Mixing Ratios in Transitions of  $^{208}\text{Pb}$ ," with S. M. Blankenship and W. W. True, Phys. Rev. C14, 267, (1976).
30. "Behavior of Excited Deformed Band and Search for Shape Isomerism," with J. D. Cole, et al., Phys. Rev. Lett. 37, 1185 (1976).
31. "Recent Work at UNISOR on Neutron Deficient Au, Hg and Tl Nuclei in the Mass Range  $184 \leq A \leq 197$ " with J. Wood, et al., Proceedings of the Third International Conference on Nuclei Far from Stability, Cargese, Corsica, France, May (1976).
32. "The UNISOR Isol Data Acquisition System," with H. K. Carter, et al., Nucl. Instrum. and Meth. 139, 349 (1976).
33. "New Isomers of  $^{185,187}\text{Tl}$  and the Departure of the  $h\ 9/2$  Intruder State," with A. G. Schmidt, et al., Phys. Lett. 66B, 133 (1977); Phys. Rev. C16 2010 (1977).
34. "The Interpretation of  $n\ e^-$  Scattering with Reactor Anti-neutrinos," with Z. D. Greenwood, Phys. Rev. D16, 2383 (1977).
35. " $\gamma$ -Ray and Internal Conversion Intensity Studies of Transitions in the Decay of  $^{228}\text{Th}$ " with A. G. Schmidt, Phys. Rev. C17, 380 (1978).
36. "The Weak Neutral Disintegration of the Deuteron," with Z. D. Greenwood, Phys. Rev. D17, 154 (1978).
37. "Low Energy Absolute Pair Production Cross section Measurements in Targets of  $Z = 13, 26, 29, 50,$  and  $82$ ," with T. A. Girard and S. M. Blankenship, Phys. Rev. A17, 218 (1978).
38. "The Weak Neutral Current: A Low Energy Experiment," with T. P. Lang, et al., Proceedings of the International Conference on Neutrino Physics and Neutrino Astrophysics, Purdue University, C68, April 1978.
39. "Interpretation of Experiments with Reactor Antineutrinos," with L. P. Hopkins, Proceedings of the International Conference on Neutrino Physics and Neutrino Astrophysics, Purdue University, C42, April 1978.

40. "Beta End-Point-Energy Measurements with a Hyperpure Germanium Detector," with T.A. Girard, Nucl. Inst. and Meth, 154, 199 (1978).
41. "A Monte-Carlo Evaluation of an Improved-Sensitivity, <sup>76</sup>Ge Double-Beta-Decay Experiment," with Z. D. Greenwood, Nucl. Inst. and Meth., 160 (1979) 493-497.
42. "Absolute Pair Production Cross Section Measurements in Z = 92 at Energies Near Threshold," with T. A. Girard and T. L. Huntsberger, Phys. Lett. 71A, (1979) 33.
43. "Theoretical Beta Spectrum from Uranium-235 Fission Fragments in Secular Equilibrium," with L. P. Hopkins and Z. D. Greenwood, Nucl. Sci, and Eng. 72 (1979) 216.
44. "Phenomenological Coulomb Interaction for Microscopic Nuclear Structure Calculations," with T. L. Huntsberger, Phys. Rev. C20 (1979) 1580.
45. "High Resolution Measurements of the Anisotropic Directional Correlation Between  $\gamma$  Rays and KX Rays," with Ali E. Khalil, Phys. Lett. 75A (1980) 201.
46. "Subnanosecond Lifetime Measurements of Excited States in Nuclei Far from Stability," Proceedings of the International Symposium on Future Directions in Studies of Nuclei Far From Stability," Ed. J. H. Hamilton et al., 77 (1980).
47. "A Monte Carlo Code for Predicting the Response for A Ge-NaI (TI) Compton Supression Spectrometer," Nucl. Instr. and Meth. 174 555 (1980).
48. "Calculated Spectra of Antineutrinos From the Fission Products of <sup>235</sup>U, <sup>238</sup>U, and <sup>239</sup>Pu, and Antineutrino Interactions," with Z. D. Greenwood, Phys. Rev. C22 594 (1980).
49. "A Computer Study of the Experimental Feasibility of Observing the Nuclear Excitation of <sup>7</sup>Li by Reactor Antineutrinos," with T.W. Donnelly, Nucl. Instr. and Meth. 179 (1981) 163.
50. "Empirical Polynomials for Computing Gamma Ray Interaction Cross Sections and Coefficients," with J. A. Jeffreys, Nucl. Instr. and Meth. 179 (1981) 159.
51. "Anisotropic Directional Correlations Between  $\gamma$ -rays and KX rays Emitted from Atoms with Deformed Nuclei," with Ali E. Khalil (Phys. Rev. A24 (1981) 1198).
52. "Low Energy Proton and Electron Responses of an N-Octane Liquid Scintillator," with M. H. Wood et al., Nucl. Inst. & Meth, 188 (1981) 75.
53. "Proposed Ultrasensitive Investigation of Neutrinoless and Two Neutrino Double Beta Decay of Ge, A Progress Report," with R. L. Brodzinski and N. A. Wogman, in "Weak Interactions as Probes of Unification", AIP Conference Proceedings, ed. G. B. Collins, L. N. Chang, J. R. Ficenc and R. E. Marshak, No. 72, 134 (1981).
54. "A Computational Study of the Response of Ge and NaI (TI) Detectors to the Inner Bremsstrahlung of <sup>90</sup>Y," Nucl. Instr. and Meth. 184 (1981) 521.
55. "Electron Capture and Positron Decay of <sup>206</sup>Fr and <sup>208</sup>Fr," with B. G. Ritchie, H. K. Carter, R. L. Mlekodaj and E. H. Spejewski, Phys. Rev. C23 (1981) 1717.
56. "Isospin Dependence of Nucleon-Nucleon Interactions and its Effect of the Cross Section  $\sigma(\nu_e^- + d \rightarrow n + n + e^+)$ ," Phys Rev. D24 (1981) 778.

57. "Calculations of the Interference of Annihilation Radiations with Positron Spectra in Ge Detectors," with H. Noma, D. M. Moltz, and K. S. Toth, Nucl. Instr. and Meth. 189 (1981) 453.
58. "Cross Sections for the Production of Electron-Positron Pairs by 1.064 MeV Photons on Germanium," with Ali E. Khalil, Phys. Rev. A 24, (1981) 2920.
59. "Precision Mass Measurements Utilizing Beta End Points," with D. M. Moltz, K. S. Toth, H. Noma and B. D. Kern, Proc. 4th. Int. Conf. on Nuclei Far from Stability, Helsingør Denmark, June 1981. CERN 81-09, 20 July 1981, pp. 141.
60. "Improved Low-Energy Absolute Pair Production Cross-Section Measurements in Targets of Z = 26, 29, 50, 82, and 92," with Ali E. Khalil Phys. Rev. A26, 825 (1982).
61. "Precision Mass Difference Measurements in Light Rubidium and Krypton Isotopes Utilizing Beta-End Points," with D. M. Moltz, K. S. Toth, H. Noma, B. G. Ritchie, and B. D. Kern, Phys. Lett. 113 B 16 (1982).
62. "Absolute Pair-Production Cross Section Measurements in Targets of Z = 26, 29, 50, 82, and 92 with 1.119 MeV Photons," with A. E. Khalil, Phys. Rev. A26, 770 (1982).
63. "A Monte Carlo Study of the Response of a Germanium Detector to Electrons and Positrons," with H. Noma, D. M. Moltz, and K. S. Toth, Nucl. Instr. and Meth. 211, 391 (1983).
64. "Inner Bremsstrahlung Spectrum of  $^{90}\text{Sr}$  and  $^{90}\text{Y}$  in Equilibrium," with W. C. Barker, Phys. Rev. C26, 2658 (1982).
65. "Early Results from the Battelle-Carolina  $^{76}\text{Ge}$  Double Beta Decay Project," with R. L. Brodzinski, D. P. Brown, J. C. Evans, Jr., W. K. Hensley, J. H. Reeves and N. A. Wogman, Proc. of the Int. Workshop on Science Underground, AIP Conference Proceedings 96, 419 (1983).
66. "New Limits on Neutrino Mass, Lepton Conservation and No-Neutrino Double Beta Decay of  $^{76}\text{Ge}$ ," with R. L. Brodzinski, D. P. Brown, J. C. Evans, Jr., W. K. Hensley, J. H. Reeves and N. A. Wogman, Phys. Rev. Lett. 50 (1983) 721.
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68. "Study of the Performance Characteristics of a High Resolution Multi-Detector Array for Gamma Ray Spectroscopy," with J. X. Saladin, R. S. Moore, C. Baktash and I. Y. Lee, Proceedings of the Conference on Bismuth Germanate, Princeton, N. J., Nov. 1982.
69. "The Beta Decay of  $^{76}\text{Rb}$  and the Level Structure of  $^{76}\text{Kr}$ ," with D.M. Moltz, K.S. Toth, H. Noma, B.D. Kern, R.E. Tribble, R.E. Neese, J.P. Sullivan, and J. Lin, Nucl. Phys. A427 p. 317 (1984).
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71. "Double Beta Decay: Recent Developments and Projections," with R.L. Brodzinski, D.P. Brown, J.C. Evans, Jr., W.K. Hensley, J.H. Reeves and N.A. Wogman, Proc. Fourth Workshop on Grand Unification, Phila. PA., April 1983, Progress in Physics 9 (1983) 174, Birkhouser Press.
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76. " $\beta$ -Delayed Proton Activities:  $^{147}\text{Dy}$  and  $^{149}\text{Er}$ ," with K. S. Toth, D. M. Moltz, E. C. Schloemer, M. D. Cable and Y. A. Ellis-Akovali, Phys. Rev. 30, 712, (1984).
77. " $^{76}\text{Ge}$  Double Beta Decay Experiments at Homestake" with R. L. Brodzinski, D. P. Brown, J. C. Evans, Jr., W. K. Hensley, J. H. Reeves, N. A. Wogman, and H. S. Miley, AIP Conference Proceedings of the Homestake Conference on Neutrino Physics and Astrophysics, No. 126, 50 (1985).
78. "Single-Particle States in  $^{149}\text{Er}$  and  $^{149}\text{Ho}$  and the Effect of the  $Z = 64$  Closure," K.S. Toth, Y.A. Ellis-Akovali, F.T. Avignone, III, R.S. Moore, and D.M. Moltz, J.M. Nitschke, P.A. Wilmarth, P.K. Lemmertz, D.C. Sousa, and A.L. Goodman Phys. Rev. C32, 342 (1985).
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81. "An Experimental Test of Computed Responses of Bismuth Germanate to Gamma Rays," R. S. Moore, and F. T. Avignone, III, Nucl. Instrum. and Meth. A242, 134 (1985).
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83. "Neutron Deficient Mass Surface Between the  $1f_{7/2}$  and  $1g_{9/2}$  Shells: The Mass of  $^{77}\text{Kr}$  and  $^{75}\text{Kr}$ ," D.M. Moltz, J.D. Sullivan, R.E. Tribble and C.A. Gagliardi, K.S. Toth and F.T. Avignone, III, Proc. 7th Int. Conf. on Atomic Masses and Fundamental Constants (AMCO-7) Sept. 84 Darmstadt, FRG 7, 277 (1985).
84. "Structure in  $\beta$ -Delayed Proton Spectra of  $N=81$  Precursors," K.S. Toth, Y.A. Ellis-Akovali, F.T. Avignone, III, J.M. Nitschke, P.A. Wilmarth, P.K. Lemmertz and D.M. Moltz, Phys. Lett. 178B, 150 (1986).
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