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C. Jerald Buchenauer
Research Professor
Electrical and Computer Engineering Department
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Education:

Cornell University, Ithaca, NY, 1962-69. PhD in Experimental Solid State Physics.
Thesis: "Resonant Raman Spectra of F Centers"

Franklin & Marshall College, Lancaster, PA, 1958-62. A.B. in Physics
Thesis: "Development of a Recording Interference Dilatometer for Thermal Expansion Measurements"

Qualifications: Qualified by 50 years of R&D experience in the physical sciences and engineering. Professional activities included ultra-wideband sensor and antenna design; rf remote sensing; radio frequency field measurements of particle beam tests, beam target interactions, HPM generators, weapons tests, and electrical breakdown phenomena; pulsed power systems, high-voltage plasma machines, and EMP generators; electromagnetic plasma feedback control systems, electro-optical feedback control systems, electro-optical system design, and digital and analog electronic circuit design; fusion plasma electrical and optical diagnostic measurements; fission reactor diagnostic measurements; quadrature, heterodyne, and two-wavelength interferometry and holography; inelastic light scattering spectroscopy, Raman spectroscopy, and Thomson scattering; optics and optical properties of solids, and experimental solid state physics.

Employment History:

Research Professor: University of New Mexico, Albuquerque NM.
Electrical and Computer Engineering Department, 2002-present.
Contributed to the Compact Pulsed Power Multidisciplinary University Research Initiative program. Activities included research in electrical breakdown, arc switch scaling, antenna design, pulsed power circuit design, and high power microwave generation.

Laboratory Associate: Los Alamos National Lab, Los Alamos NM, 2006-2013.
IT Division Office; member of the Intel Reserve Core.

Technical Staff Member: Los Alamos National Lab, Los Alamos NM, 1975-2006.
Nonproliferation and International Security Division;
ISR-5, NIS-9, NIS-12, IT-12, IT-6, IT-4, HRD; 1991-2006.
Contributed to numerous R&D activities in remote sensing, radio frequency field measurements of particle beam tests, beam target interactions, HPM generators, weapons tests, and electrical breakdown phenomena.
IPA, Philips Laboratory/WSR, Kirtland AFB, NM, 1991-1998. Research Physicist:

Conducted experimental research in ultra-wideband time-domain electromagnetic field sensors, high-power antennas, and microwave sources.

Controlled Thermonuclear Research Division, CTR-7/2/1, 1975-1991.
Participated in high-temperature fusion plasma research programs on the staged theta-pinch, STP; the field reversed pinch, ZT40; and the compact torus experiment, CTX. Developed and performed plasma diagnostic measurements including, quadrature, heterodyne, and two-wavelength interferometry, holography, Tomson scattering, and magnetic field distribution measurements. Implemented plasma equilibrium control systems. Designed electro-optical feedback control systems, multi-wavelength Bragg cells and optical coatings, polar coordinate digitizers, and numerous analog electronic circuits.

Senior Research Engineer: Aerojet Nuclear Company, Idaho Falls, ID, 1974-1975.
Contributed to programs supporting nuclear reactor safety research. Participated in the development of ultrasonic thermometers, and flow meters and densitometers for two-phase flow.

Research Associate/Associate Instructor: University of Utah, Department of Physics, Salt Lake City, Utah, 1971-1974. Activities involved teaching and establishing a departmental inelastic light scattering facility with argon and dye lasers and a high gain optical spectroscopy system. Investigated resonant Raman and hot luminescence spectra of impurity systems in solids.

Reaearch Associate: Brown University, Department of Physics, Providence RI, 1969-71.
Responsible for constructing a Raman spectroscopy facility and a 10 kbar pressure system for optical studies. Raman spectra of opaque semiconductors under hydrostatic pressure and uniaxial stress were investigated.

Graduate Research Assistant: Cornell University, Department of Physics, Ithaca, NY, 1962-69.
Research involved the investigation of the optical properties of pure metal surfaces under ultra-high vacuum conditions;
measurement of the low-temperature pressure shift of absorption spectra of F centers in alkali halides using a 10 kbar high-pressure gas system, and construction of a Raman spectroscopy apparatus employing a pulsed argon laser and gated photon counting electronics. Absolute Raman and hot luminescence cross sections of F centers in alkali halides at low temperatures were measured for various excitation wavelengths.

Undergraduate Research Assistant and Technician: Department of Physics, Franklin & Marshall College, Lancaster, PA, 1960-62. Constructed electronic equipment for undergraduate teaching laboratories. Developed instrumentation which interferometrically measured the thermal expansion of materials up to their melting points using a recording interference dilatometer.

Technician and Summer Student: Photo and Image Tube Development Division of RCA, Lancaster, PA. Investigated space charge effects in phototubes exposed to intense light pulses, and the dynamics of phototube performance exposed to external magnetic fields. Developed circuit designs for scintillation radiation detectors.

Professional Societies: IEEE and American Physical Society

PUBLICATIONS:

Journal Articles

C.J. Buchenauer, "Optimizing Compact Marx Generator Networks," *IEEE Transactions on Plasma Science: Special Issue on Pulsed Power*, 2010.

P. Kumar, S. Altunc, C.E. Baum, C.J. Buchenhauer, C.G. Chrisotdoulou, E. Schamiloglu, "Radially Inhomogeneous Spherical Dielectric Lens for Matching 100 ps Pulses into Biological Targets," *Special Issue - IEEE Transactions on Nonthermal Medical/ Biological Applications Using Ionized Gases and Electromagnetic Fields*, 2010.

S. Altunc, C.E. Baum, C.J. Buchenauer, C.G. Christodoulou, and E. Schamiloglu, "Design of a Special Dielectric Lens for Concentrating a Subnanosecond Electromagnetic Pulse on a Biological Target," *IEEE Transactions on Dielectrics and Electrical Insulation*, Vol. 16, No. 5, October 2009.

S. Altunc, C.E. Baum, C.G. Christodoulou, E. Schamiloglu, and C.J. Buchenauer, "Focal Waveforms for Various Source Waveforms Driving a Prolate-Spheroidal Impulse Radiating Antenna (IRA)," *IEEE Transactions on Radio Science*, Vol. 43, RS4S13, 2008.

M. Dogan, J.S. Tyo, and C.J Buchenauer, "Increasing Prompt Response of Impulse Radiating Antennas through Polarization Control of Aperture Fields," *IEEE Transactions on Antennas Propagation*, 54, pp. 586–594 (2006)

J.S. Tyo, and C.J. Buchenauer, "Experimental Verification of the Effect of Aperture Shape on Prompt IRA Response," *IEEE Transactions on Antennas and Propagation*, Vol. 50, No. 7, July 2002.

C.J. Buchenauer, J.S. Tyo, and J.S.H. Schoenberg, "Prompt Aperture Efficiencies of Impulse Radiating Antennas with Arrays as an Application," *IEEE Transactions on Antennas and Propagation*, Vol. 49, No. 8, August 2001.

Z.H. Wang, et al, "Density and H-Alpha Diagnostics and Results for a Sustained Spheromak Physics Experiment," *Review of Scientific Instruments*, Vol. 72, No. 8, Pt. 2, pp. 1059–1062, January 2001.

J.S. Tyo, C.J. Buchenauer, and J.S.H. Schoenberg, "Use of Isorefractive Media to Improve Prompt Aperture Efficiency in a Lens IRA," *IEEE Transactions on Antennas and Propagation*, pp. 1114–1115, Vol. 46, No. 7, July, 1998.

W.B. Maier, A. Kadish, C.J. Buchenauer, and R.T. Robiscoe, "Electrical Discharge Initiation and a Macroscopic Model for Formative Time Lags," *IEEE Trans. on Plasma Science*, pp. 676–683, Vol. 21 No. 6, December 1993.

R.B. Howell, et al, "Asymmetric Magnetic-Flux Generation, m=1 Activity, and Edge Phenomena on a Reversed Field Pinch," *Physics of Fluids*, Vol. 30, No. 6, pp. 1828–1838, (1987)

E.W. Newman, C.J. Buchenauer, and H.W. Hoida, "Multichord Near-Infrared Interferometers for the CTX and ZT-40M Experiments," *Review of Scientific Instruments*, Vol. 57, No. 3, pp. 1992–1993, (1986)

R.S. Massey, et al, "Status of the ZT-40M RFP Experimental Program," *Fusion Technology*, Vol. 8, No. 1, pp. 1571–1580, (1985)

K.F. Schoenberg, C.J. Buchenauer, et al, "F Theta Pumping and Field Modulation Experiments on a Reversed Field Pinch Discharge," *Physics of Fluids*, Vol. 27, No. 3, pp. 548–551, (1984)

J.N. Downing, C.J. Buchenauer, et al, "An Evaluation of Limiter Configurations in ZT-40M," *J. Nuclear Materials*, Vol. 128, pp. 517–523**,** (1984)

C.J. Buchenauer and A.R. Jacobson, "Quadrature Interferometer for Plasma Density Measurements," *Review of Scientific Instruments*, Vol. 48, No. 7, pp. 769–774, July 1977

A.R. Jacobson, C.J. Buchenauer, J.N. Downing, and K.S. Thomas, "Auxiliary Heating of a Theta-Pinch Plasma by Radial Magnetoacoustic Standing Waves," *Physical Review Letters*, Vol. 37, No. 14, pp. 897–899, (1976)

F. Cerdeira, C.J. Buchenauer, and F.H. Pollak, Stress-Induced Shifts of First-Order Raman Frequencies of Diamond and Zink-Blend-Type Seniconductors," *Phys. Rev.* B 5, 580 (1972)

C.J. Buchenauer, M. Cardona, and F.H. Pollak, "Raman Scattering in Gray Tin," *Phys. Rev.* 3, 1243 (1971)

C.J. Buchenauer and D.B. Fitchen, "Pressure Shift of the F Band; Ion Size Effects," *Phys. Rev.* 167, 846 (1968)

Technical Reports

C.J. Buchanauer, "Detection of Weak Signals from Moving Platforms: Antenna Size, Area Coverage, and Dwell-Time Considerations," LANL report LA-14063, July 2003.

J.S. Tyo and C.J. Buchenauer, "Measurement of Prompt IRA Response under Different Focused Aperture Configurations," AFRL report SSN 454, March 2001.

C.J. Buchanauer, "Narrow-Band Weak-Signal Detection Limits Due to Multi-path Effects from Ground Reflections," LANL report NIS-9 (S)-00-079, July 2000.

C.J. Buchenauer, J.S. Tyo, and J.S.H. Schoenberg, "Aperture Efficiencies of Impulse Radiating Antennas," AFRL report SSN 421, November 1998.

E.G. Farr and C.J. Buchenauer, "Validation of IRA Models," AFRL report SSN 364, January 1994.

E.G. Farr, G.D. Sower, and C.J. Buchenauer, "Design Considerations for Ultra-Wideband High-Voltage Baluns, AFRL report SSN 371, October 1994.

A. Haberstich, D.A. Baker, C.J. Buchenauer, et al, "Scaling of Sustained ZT-40M Reversed-Field Pinches," LANL report LA-12567-MS, December 1993.

M.I. Buchwald, C.J. Buchenauer, R.F. Holland, and W.B. Maier, "RF and Optical Emissions for Hit Assessment and Other Uses, LANL report LA-CP-90-85, May 1990.

C.J. Buchenauer, "Observations of Radio-Frequency Emissions from Arcs in Relativistic H-Beam Irradiated Targets and Their Relation to Neutral Particle Beam Hit Assessment," LANL report LA-11644-MS, December 1989.

C.J. Buchenauer, "Observation of Relativistic Proton Beam Radio-Frequency Emissions and Their Relation to Neutral Particle Beam Hit Assessment," LANL report LA-11307-MS. March 1989.

E.W. Newman, C.J. Buchenauer, and H.W. Hoida, "Multi-Chord Near Infrared Interferometers for the CTX and ZT-40M Experiments," LANL report LA-UR-86-848, April 1986

K.F. Schoenberg, et al, "ZT-P: an Advanced Air Core Reversed Field Pinch Prototype," LANL report LA-10593-MS (1986)

C.J. Buchenauer, "Acoustically Compensated Two-Wavelength Interferometry for Plasma Density Measurements: One-Dimensional Theory and Applications," LANL report LA-9880-MS, February 1984.

J.N. Downing, C.J. Buchenauer, et al, “An Evaluation of Limiter Configurations in ZT-40M,” LANL report LA-UR-84-1500, May 1984.

R.S. Massey, C.J. Buchenauer, G. Miller, and G. Barnes, "Preliminary Equilibrium and Field Error Studies on ZT-40M," LANL report LA-9567-MS, February 1983.

R.S. Massey, C.J. Buchenauer, et al, "Preliminary Results from ZT-40M Using Active Feedback for Equilibrium Control," LANL report LA-9809-MS, July 1983.

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C.J. Buchenauer, "Quadrature Flash Digitizers and Synchronous Counters for Conversion of Analog Quadrature Signals to Phase Angle Data," LANL report LA-8381, July 1981

D.A. Baker, C.J. Buchenauer, et al, "Initial Reversed-Field Pinch Experiments on ZT-40M with a Metallic Vacuum Liner," LANL report LA-UR-81-1413, 10th European Conference on Controlled Fusion and Plasma Physics, Sept. 14-19, 1981 - Moscow

A.R. Jacobson and C.J. Buchenauer, "Transient Phenomena on ZT-40," LANL report LA=UR-80-1875, June 1980. Submitted to: Proceedings of the RFP Workshop, Los Alamos, NM.

D.A. Baker, C.J. Buchenauer, et al, "Initial Reversed-Field Pinch Experiments on ZT-40 and Recent Advances in RFP Theory," LANL report LA-UR-80-1834, April 1980. Proceedings of the IAEA Eighth International Conference on Plasma Physics and Controlled Nuclear Fusion Research.

D.A. Baker, et al, "Reversed Field Pinch Experiments in ZT-40," LANL report LA-UR-79-2978, Submitted to: IAEA Eighth International Conference on Plasma Physics and Controlled Nuclear Fusion Research, Brussels, Belgium, July 1–10, 1980.

F.C. Jahoda, C.J. Buchenauer, R. Kristal, and P.R. Forman, Advanced Plasma Diagnostics Development Proposal, LA-UR-77-1526, 1977.

There are about 15 additional reports not listed here of which some are sensitive, restricted, or classified.

Conference Proceedings

C.J. Buchenauer, “Dispersionless Charge Transfer on Lumped-Element Transmission Lines Synthesized Via Resonant Frequency Assignment,” Proceedings of the 19th IEEE International Pulsed Power Conference, 2013 (to be published).

C.J. Buchenauer, “Optimizing Compact Marx Generator Networks,” Proceedings of the 17th IEEE International Pulsed Power Conference, 2009, pp. 357–362.

L. Zaccarian, S. Galeani,1 M. Francaviglia, C.T. Abdallah, E. Schamiloglu, and C.J. Buchenauer, “A Control Theory Approach on the Design of a Marx Generator Network,” Proceedings of the 17th IEEE International Pulsed Power Conference, 2009, pp. 363–366.

S. Prasad, M. Roybal, C.J. Buchenauer, K. Prestwich, M. Fuks, and E. Schamiloglu, “Experimental Verification of the Theory of the Transparent Cathode”, Proceedings of the 17th IEEE International Pulsed Power Conference, 2009, pp. 81–85.

S. Prasad, M. Roybal, K. Prestwich, M.I. Fuks, C.J. Buchenauer, and E. Schamiloglu, “Magnetron Experiments on the Short-Pulse ”SINUS-6” Accelerator,” Proceedings 2008 IEEE International Vacuum Electronics Conference, 2008, pp. 441–442.

E. Schamiloglu, C. J. Buchenauer, M.I. Fuks, M. Roybal, and S. Prasad, “Recent Progress on Relativistic Magnetrons Using a Transparent Cathode for HPM Generation,” Proceedings of BEAMS 2008.

P. Castro, C.J. Buchenauer, J. Gaudet, and E. Schamiloglu, “Studies of Dielectic Breakdown under Pulsed Power Conditions,” Proceedings of the 15th IEEE International Pulsed Power Conference, 2005, pp. 978–981.

J. H. Chen, C. J. Buchenauer, J. S. Tyo. “Numerical and Experimental Modeling of Subnanosecond Plasma Closing Switches in Gases,” Proceedings of the 14th IEEE International Pulsed Power Conference, 2003, pp. 59–62.

J.S. Tyo, M.J. Baretala, C.J. Buchenauer, H.L. Bowen, and E.G. Farr, "Increase in the Prompt Radiated Field from an IRA by Aperture Design," *Intense Microwave Pulses VIII*, H.E. Brandt Editor, pp. 19–29, Proc. SPIE 4371, (SPIE, Bellingham, WA, 2001)

J.M. Lehr, et al, "Marx Generator Triggering with Photoconductive Switches," *Intense Microwave Pulses VII*, Howard E. Brandt, Editor, pp. 175, Proceedings of SPIE, Vol. 4031 (2000)

C.J. Buchenauer, J.S. Tyo, and J.S.H. Schoenberg, "Aperture Efficiencies of Impulse Radiating Antennas," *Ultra-Wideband Short-Pulse Electromagnetics 4*, E. Heyman, B. Mandelbaum, and J. Shiloh Editors, pp. 91–108, Kluwer Academic/Plenum Plublishers, New York, 1999

J.S. Tyo, C.J. Buchenauer, and J.S.H. Schoenberg, "Improving Power Concentration In IRA's using Conformal Isorefractive Media," *Proceedings of the 16th URSI Comission B International Symposium*, Thessaloniki, Greece, pp. 784–786, 1998

C.J. Buchenauer, J.S. Tyo, and J.S.H. Schoenberg, "Antennas and Electric Field Sensors for Ultra-Wideband Transient Time-Domain Measurements: Applications and Methods," *Ultra-Wideband, Short-Pulse Electromagnetics 3*, C.E. Baum, L. Carin, and A.P. Stone, Editors, pp. 405–420, Plenum Press, New York, 1997

E.W. Newman, C.J. Buchenauer, and H.W. Hoida, "Multichord Near-Infrared Interferometers for the CTX and ZT-40M Experiments," Sixth Topical Conference on High Temperature Plasma Diagnostics, Hilton Head, SC, March 9–13, 1986.

C.J. Buchenauer and J.R. Marek, "Hybrid Antenna Sources for Radiating High-Power Impulsive Fields," *Intense Microwave Pulses III*, H.E. Brandt Editor, pp. 209–213, Proc. SPIE 2557, (SPIE, Bellingham, WA, 1995)

C.J. Buchenauer, "Time-Domain Concepts and Experiments," *Proceedings of the Tri-Service Ultra-Wideband Antenna Design Workshop*, N.J. Chesser Editor, Directed Technologies Inc., Arlington, VA, 1995

E.G. Farr, C.E. Baum, and C.J. Buchenauer, "Impulse Radiating Antennas, Part II," *Ultra-Wideband Short-Pulse Electromagnetics 2*, L. Carin, and L.B. Felsen, Editors, pp. 159–170, Plenum Press, New York, 1995

C.J. Buchenauer and J.R. Marek, "Antennas and Electric Field Sensors for Time Domain Measurements: an Experimental Investigation," *Ultra-Wideband Short-Pulse Electromagnetics 2*, L. Carin, and L.B. Felsen, Editors, pp. 197–208, Plenum Press, New York, 1995

C.J. Buchenauer, "Spark Gap Generated Electromagnetic Pulses for Time Domain Measurements," *Ultra-Wideband Radar: Proceedings of the First Los Alamos Symposium*, pp. 529–536, CRC Press, Boco Raton, Florida, 1991

D.A. Baker, C.J. Buchenauer, et al, "Experimental and Theoretical Studies of the ZT-40M Reversed-Field Pinch," *Plasma Physics and Controlled Nuclear Fusion Research*, 1984 (Proc. 10th Int. Conv. London, 1984), Vol. 2 IAEA, Vienna (1985) pp. 439

C.J. Buchenauer, F. Cerdeira, and M. Cardona, "Influence of Hydrostatic Pressure on the First-Order Raman Frequencies of Opaque Semiconductors," *Proceedings of the Second International Conference on Light Scattering in Solids*, edited by M. Balkanski (Flammarion Sciences, Paris, 1972)

D.B. Fitchen and C.J. Buchenauer, "Experimental Study of Resonant Raman Scattering by Impurities," *Physics of Impurity Centers in Crystals* (Academy of Sciences of the Estonian S. S. R., 1972)

C.J. Buchenauer, D.B. Fitchen, and J.B. Page, Jr., "Raman Spectra of F Centers," *Proceedings of the International Conference on Light Scattering Spectra of Solids*, edited by G.W. Wright (Springer-Verlag Inc., New York, 1969)

Conference Abstracts

Chris Leach et al, "Experimental Plan for 70% Efficient Relativistic Magnetron with Diffraction Output MDO," AMERAM 2014, University of New Mexico, Albuquerque, NM, July, 2014.

C.J. Buchenauer, "Dispersionless Charge Transfer on Lumped-Element Transmission Lines Synthesized via Resonant Frequency Assignment," 19th IEEE International Pulsed Power Conference, San Francisco, CA, June, 2013.

C.J. Buchenauer, "Optimizing Compact Marx Generator Networks for Driving Capacitive Loads," 37th International Conference on Plasma Science, Norfolk, VA, June 2010

C.J. Buchenauer, "Optimizing Compact Marx Generator Networks," 17th IEEE International Pulsed Power Conference, Washington, DC, June, 2009.

L. Zaccarian, S. Galeani,1 M. Francaviglia, C.T. Abdallah, E. Schamiloglu, and C.J. Buchenauer, "A Control Theory Approach on the Design of a Marx Generator Network," 17th IEEE International Pulsed Power Conference, Washington, DC, 2009.

S. Prasad, C. J. Buchenauer, M.I Fuks, E. Schamiloglu, " Experimental Verification of the Theory of the Transparent Cathode," 17th International Pulse Power Conference, Washington, DC, July 2009.

S. Prasad, C.J. Buchenauer, M.I. Fuks, C.J. Leach, M. Roybal, E. Schamiloglu, and W. White, "X-Band Relativistic BWO with Frequency Tuning" IEEE International Conference on Plasma Science, San Diego, CA, June 2009.

S. Prasad , M. Roybal , C.J. Buchenauer , K. Prestwich , M.I. Fuks , and E. Schamiloglu, "Effect of Cathode Alignment on Magnetron Operation," Am. Phys. Soc. DPP05, UP1 5 (2009).

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E. Schamiloglu, M.I. Fuks, C. J. Buchenauer, S. Prasad, and M. Roybal, "Recent Progress on Relativistic Magnetrons Driven by Transparent Cathodes," EUROEM 2008, Lausanne, Switzerland, July 21–25, 2008.

E. Schamiloglu, M.I. Fuks, C.J. Buchenauer, S. Prasad, and M. Roybal, "Initial Experimental Results from a Relativistic Magnetron Driven by Transparent Cathodes," IEEE International Conference on Plasma Science, Karlsruhe, Germany, June 15–19, 2008.

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C.J. Buchenauer, "Arc Switch Modeling with Complex-Impedance Loads," 31st IEEE International Conference on Plasma Science, Baltimore, MD, June 28 – July 1, 2004.

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G.A. Wurden, et al, "Scaling Results for ZT-40M," *Bulletin of the American Physical Society*, Vol. 30, pp. 1402–1402, (1985)

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C.J. Buchenauer, A.R. Jacobson, E.M. Little, and K.S. Thomas, "Electron Temperature Measurements in the Staged Theta-Pinch Experiment," *Bulletin of the American Physical Society*, Vol. 22, No. 9, pp. 1210–1210, (1977)

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C.J. Buchenauer, and A.R. Jacobson, "Quadrature Interferometer for Plasma Density Measurements," *Bulletin of the American Physical Society*, Vol. 21, No. 9, pp. 1041-1042, (1976)

A.R. Jacobson, C.J. Buchenauer, E.M. Little, and M.L. McKinstry, "Magnetic-Field and Plasma-Density Measurements in the Staged Theta-Pinch Experiment," *Bulletin of the American Physical Society*, Vol. 20, No. 10, pp. 1371–1371, (1975)

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