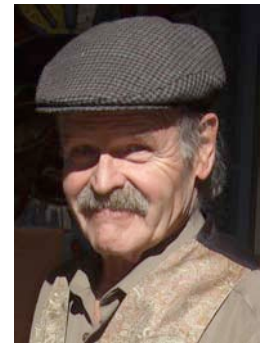


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- EDUCATION:**
- Ph.D. Stanford University - 1972 (Plasma Physics)
 - M.S. Massachusetts Institute of Technology - 1963 (Electrical Engineering, Honors)
 - B.S. Massachusetts Institute of Technology - 1961 (Electrical Engineering, Honors)
- BIRTH:** March 15, 1940, Ponca City, Oklahoma, U.S.A.
- EXPERTISE:**
- Laser interaction with surfaces, modeling and measurements
 - Design of high-energy laser systems for fusion and propulsion
 - Optical diagnostics of plasmas, and general plasma physics
 - Chemistry of the global environment
 - Nonlinear optics of materials, theory and application
 - Magneto-optics in semiconductors
- LANGUAGES:** Reading and some conversational ability in German, Japanese and French
- PROFESSIONAL EXPERIENCE:**
- Current: Managing Partner, Photonic Associates, LLC:
- Initiated, obtained sponsorship for, organized and chaired International Symposia on High Power Laser Ablation Symposia: Santa Fe, Osaka and Taos 1998 – present, meetings which typically draw 160 international attendees.
 - Invented L'ADROIT UV laser space debris clearing and nudging system
 - Developed PALLC's laser plasma thruster (LPT) (1998-2007)
 - Participated as SME in studies of pulsed laser momentum transfer and other effects
- 1995-2002:
- Initiated and participated in a \$650k NASA validation study of "Orion" laser space debris removal concept (1995-6).
 - Laser-surface interaction studies for Northeast Science and Technology, East Sandwich, MA; NASA Marshall Spaceflight Center; Data Technology, Inc., Woburn, MA; Bekey Designs, Inc., Annandale VA; Redcone Research, Conifer, CO; and Lawrence Livermore National Laboratory, CA.
- 1994-1995: Associate Director, Alliance for Photonic Technology/Los Alamos:
- During two years, created cooperative R&D agreements worth \$18M between Los Alamos and private industry, especially the USCAR Low Emissions Partnership (Distinguished Performance Award Nomination). USCAR is the "Big 3" automotive R&D consortium. Initiated several new R&D projects in photonics involving small private industry and New Mexico National Laboratories. Highlight: a "smart wheel bearing" with optical rotation output for anti-lock brake systems developed by Los Alamos and NTN Technical Associates, Ann Arbor, MI, used in Ford Taurus, Mercury Sable and Lincoln Continental.
- 1987-1995: Senior Research Staff Member, Advanced Optical Systems Group, Los Alamos:
- Developed theory of laser-materials interactions, with applications to space propulsion and semiconductor manufacture.
 - Lecture series in Berlin, Antwerp, Marseille, St. Louis (France) and Sydney.
 - Worked with internationally recognized scientists for extended periods, including Prof. H. Hora, head, Theoretical Physics Dept., University of New South Wales, Sydney, Prof. T. Fujioka, head, Industrial Research Institute of Japan [high power iodine laser transmission in glass fibers], and Prof. P. Harper, Heriot-Watt University, Edinburgh.
- 1983-1987: Project Leader, Laser Effects, Los Alamos National Laboratory:
- Invented a novel method of obtaining laser fusion at large scale using the pulsed hydrogen fluoride (HF) laser (Distinguished Performance Award nomination).
 - Conducted basic theoretical and experimental research programs in mechanical and thermal coupling of pulsed lasers to targets in vacuum using the reconstructed Gemini (CO₂) laser at LANL, the Sprite (KrF) laser at Rutherford Laboratory (U.K.) and the Mjöllnir (HF) laser at Kirtland AFB.

- Designed and managed \$2.3M Aurora high power KrF laser-target interaction for SDIO.
 - Design of sky to ground communication system employing phase conjugation
- 1974 -1983: Section Leader, Infrared Physics Los Alamos National Laboratory :
- Principal investigator for studies of nonlinear optics at infrared wavelengths, in germanium and other materials.
 - First observation of bulk laser-induced photoionization in germanium and its application to obtaining phase conjugation via 4-wave mixing with gain in the infrared.
 - Directed top-quality Ph.D. thesis of Los Alamos group leader David E. Watkins
- 1972 -1974: Physics Staff Member Lawrence Livermore National Laboratory:
- Independently and synchronously with KMS Industries, invented and published theory and design of “clamshell optics”. Developed mathematical model for radial intensity profile of one or two cylindrically symmetric laser beams which, after injection into the clamshell, create uniform spherically converging irradiation of a laser fusion target.
 - Invented, constructed and successfully tested the first Faraday rotation laser isolator for 10 μ m pulsed lasers using the interband Faraday effect in germanium.
 - Designed the target-interaction laser diagnostic subsystem for the Valkyrie CO₂ laser
- 1965 -1972: Research Assistant, Stanford University, Institute for Plasma Research:
- Designed, obtained independent funding from NASA for, built and executed the first laser-plasma interaction experiment at Stanford [Ph.D. thesis under Prof. Oscar Buneman, discoverer of the well-known “Buneman” or two-stream instability]. Via laser Thomson scattering in a Penning discharge plasma, measured nonthermal components of the axial and radial velocity distribution. Involved individual photon counting and routinely measured signal-to-pump intensity ratio of order 10⁻¹⁹.
- 1963 -1965: Radar Program Officer, LT, USN (1405/EDO), US Navy Electronics Lab, San Diego:
- Coordinated USNEL input to Bureau of Ships in response to USN Operational Requirements in the area of electromagnetic radiation (radar, ECM, IFF, etc.)
 - Frequently interacted with BuShips personnel
 - Independently created and gave graduate-level course “Statistical theory of Communication” to employees of the USNEL IFF section.
 - Completed a technical report on the theory of random walks as applied to the OMEGA global navigation system.
- 1961 -1963: Staff Member, MIT Instrumentation Laboratory:
- Completed technical evaluation of the state of integrated circuit technology and assessed future developments, based on company visits.

PROFESSIONAL ACTIVITIES AND HONORS:

- Co-organizer, Workshop on Laser Solutions for Orbital Space Debris, Université Paris Diderot (2015)
- Organizer and Chair, Santa Fe High Power Laser Ablation Symposia, 1998 to present
- Advisory committee, COLA 09
- Lifetime Achievement Award , 4th International Symposium on Beamed Energy Propulsion, Nara, Japan, 2005
- Plenary Speaker, 3rd International Symposium on Beamed Energy Propulsion, Troy, New York, 2004
- Member, International Program Committee, International Symposia on Beamed Energy Propulsion
- Chair, American Subcommittee, SPIE's Conferences on Laser Optics, St. Petersburg, 2003-2008
- Keynote speaker, International Congress on Laser Advanced Materials Processing 2002, Osaka
- Member, International Organizing Committee, Atomic and Molecular Pulsed Lasers Conf., Tomsk, 2001
- Member, International Advisory Committee, LPM 2001, Singapore
- Listing, Who's Who in the World, 1996-2005
- Technical Coordinator, NASA Near-Earth-Object Interception Workshop, Los Alamos, Jan. 1992
- Invited Lecturer on Laser-target Interactions: Free University of Berlin 1989 & 1990; Sydney, Marseille, Antwerp & St. Louis, 1988-90
- LANL IR&D Committee Member 1990-92; Distinguished Performance Award Nominee, 1988
- Director, Santa Fe Investment Conference 1987
- W. Alton Jones graduate fellowship 1961-2, Tau Beta Pi, Sigma Xi, Eta Kappa Nu, undergraduate honors

PATENTS:

No. 7,460,243 December 2, 2008: Precise Rotational Motion Sensor

No. 6,530,212 B1 March 11, 2003: Laser Plasma Thruster

PUBLICATIONS: Over 280 journal publications and conference presentations, including 43 invited presentations, a keynote paper, a technical book chapter, a book covering a broad range of subjects in theory and applications of high power laser ablation, optical design and plasma physics, and a book popularizing science and technology for young adults.

BOOKS:

C. Phipps, ed., *Laser Ablation and its Applications*, Springer Series in Optical Sciences, **129**, Springer, New York (2007), pp. 407-434

C. Phipps, with Friedelwolf Wicke (Illustrator), *No Wonder You Wonder! Great Inventions and Scientific Mysteries*, Springer International Publishing, Cham (2016)

JOURNAL PUBLICATIONS:

1. C. R. Phipps, Jr., *M.I.T. Instrumentation Laboratory Report E-1338*, "Three Approaches to Extreme Miniaturization of Electronic Systems," October 1963.
2. C. R. Phipps, Jr., *Navy Electronics Laboratory R&D Report 1544*, "OMEGA System Synchronization in the Absolute Mode of Operation," March 1968.
3. C. R. Phipps, Jr., *Stanford University Institute for Plasma Research Report 277*, "A Study of Optical Scattering Methods in Laboratory Plasma Diagnostics," January 1969.
4. C. R. Phipps, Jr., *Stanford University Institute for Plasma Research Report 281*, "A Study of Optical Scattering Methods in Laboratory Plasma Diagnostics," February 1969.
5. C. R. Phipps, Jr., *Stanford University Institute for Plasma Research Report 426*, "A Study of Optical Scattering Methods in Laboratory Plasma Diagnostics," March 1972.
6. C. R. Phipps, Jr. and D. Bershader, "Measurement of Nonisotropic Electron Velocity Distributions by Laser Scattering" in *Dynamics of Ionized Gases*, M. J. Lighthill, I. Imai, and H. Sato, Eds., University of Tokyo Press, 1973.
7. C. R. Phipps, Jr. and S. J. Thomas, "Observation of Interband Faraday Rotation at 10.59- μm Wavelength in Room-Temperature Ge, CdTe, and GaAs," *Appl. Phys. Lett.* **25**, 313 (1974).
8. C. R. Phipps, Jr., *Lawrence Livermore Laboratory Report UCRL - 51706*, "Spherical Irradiation Systems Employing Multiple Beams and Hemireflectors," December 1974.
9. C. R. Phipps, Jr., S. E. Bodner, and J. W. Shearer, "Reflective Optics System for Uniform Spherical Illumination," *Appl. Opt.* **14**, 985 (1975).
10. C. R. Phipps, Jr. and S. J. Thomas, "High-Power Isolator for the 10- μm Region Employing Interband Faraday Rotation in Germanium," *J. Appl. Phys.* **47**, 204 (1976).
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14. R. K. Ahrenkiel, J. F. Figueira, C. R. Phipps, Jr., D. J. Dunlavy, S. J. Thomas, and A. J. Sievers, "A New Saturable Absorber for the CO₂ Laser Using Doped KCl," *Appl. Phys. Lett.* **33**, 705 (1978).
15. J. E. Sollid, C. R. Phipps, Jr., S. J. Thomas, and E. J. McLellan, "Lensless Method of Measuring Gaussian Laser Beam Divergence," *Appl. Opt.* **17**, 3527 (1978).
16. R. K. Ahrenkiel, D. Dunlavy, J. F. Figueira, C. R. Phipps, Jr., S. J. Thomas, and A. J. Sievers, "A New 10.6- μm Saturable Absorber: KCl Doped with KReO₄," in *Proceedings of the International Conference on Lasers - '78*, 1979.
17. J. E. Sollid, S. J. Thomas, and C. R. Phipps, Jr., "Damage Threshold Variation with Spot Size at 10.6 μm for Kalvar and Polaroid Films," *Appl. Opt.* **18**, 424 (1979).
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28. C. R. Phipps, R. F. Harrison, H. S. Steele, T. R. King, and W. Z. Osborne, "Measurements of Laser Impulse Coupling in Vacuum at 3 Wavelengths with kJ-level Laser Systems", in *Technical Digest, International Conference on Lasers* (Chinese Journal of Lasers, Applied Laser and Oversea Laser, China, 1987)
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38. C. R. Phipps, "Astrodynamics of Interception," in *Report of the NASA Near-Earth-Object Interception Workshop, January 14-16, 1992*, Los Alamos, NM, John D. G. Rather, Chair (workshop summary), Los Alamos National Laboratory Report LA-12476-C

39. C. R. Phipps, "Laser Deflection of NEO's," *Report of the NASA Near-Earth-Object Interception Workshop, January 14-16, 1992*, Los Alamos, NM, John D. G. Rather, Chair, Los Alamos National Laboratory Report LA-12476-C
40. C. R. Phipps and M. M. Michaelis, "Space Propulsion Concept using High Energy, Pulsed Laser Ablation", *Proceedings of the Physics of Nuclear Induced Plasmas and Problems of Nuclear Pumped Lasers Conference, Obninsk, Russia, 26-29 May, 1992*
41. C. R. Phipps, "Modification of Earth-satellite orbits using medium-energy pulsed lasers," in *Proceedings of the Ninth International Symposium on Gas Flow and Chemical Lasers, Crete, Greece*, C. Fotakis, C. Kalpouzou and T. Papazoglou, eds., SPIE volume **1810**, SPIE, Bellingham, WA, 1993
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44. C. R. Phipps and R. W. Dreyfus, "Laser ablation and plasma formation" in *Laser Ionization Mass Analysis*, Akos Vertes, Renaat Gijbels and Fred Adams, eds., Chemical Physics Monographs **124**, pp. 369-441 (1993)
45. C. R. Phipps and M. M. Michaelis, "LISP," *Laser and Particle Beams*, **12** (1), 23-54 (1994)
46. C. R. Phipps, "LISK-BROOM: A laser concept for clearing space junk," in *AIP Conference Proceedings 318*, Laser Interaction and Related Plasma Phenomena, 11th International Workshop, Monterey, CA October, 1993, George Miley, ed. American Institute of Physics, New York (1994) pp. 466-8
47. C. R. Phipps, "LISK-BROOM: A laser concept for clearing space junk," *Proceedings of the 11th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, October 25-29, 1993*, *Laser and Particle Beams*, **13**(1) (1995) pp. 33-41.
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Experimental Analysis of Laser-Driven Rocket and Micro-Airplane", *Proc. 2nd International Conference on inertial Fusion Sciences and Applications, Kyoto Japan, Elsevier, Paris (2002)*

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2. C. R. Phipps, Jr. and D. Bershader, "Measurement of Nonisotropic Electron Velocity Distributions by Laser Scattering," I.U.T.A.M. Symposium, Tokyo, 1971.
3. C. R. Phipps, Jr., "Measurement of Nonisotropic Electron Temperature by Laser Scattering," 12th Annual Industrial Affiliates Meeting, Stanford University, April 1971.
4. C. R. Phipps, Jr., S. E. Bodner, and J. W. Shearer, "Reflecting Optics System for Uniform Spherical Illumination," Optical Society of America Spring Meeting, Washington, April 1974.
5. C. R. Phipps, Jr. and S. J. Thomas, "A High Power Isolator for the 10 Micron Region Employing Interband Faraday Rotation in Germanium," I.E.E.E./O.S.A. Conference on Laser Engineering and Applications, Washington, May 1975.
6. C. R. Phipps, Jr. and D. Bershader, "Measurement of Non-Maxwellian Electron Velocity Distributions in a Reflex Discharge," American Physical Society Fall Meeting, St. Petersburg, November 1975.
7. C. R. Phipps, Jr., S. J. Thomas, and J. F. Figueira, "Broadband Passive Isolator for High-Power 10- μ m Laser Systems," O.S.A./I.E.E.E. Conference on Laser and Electro-optical Systems, San Diego, May 1976.
8. C. R. Phipps, Jr., S. J. Thomas, J. S. Ladish, S. J. Czuchlewski, and J. F. Figueira, "Saturation Behavior of P-type Ge over the CO₂ Laser Spectrum, I.E.E.E./O.S.A. Conference on Laser Engineering and Applications, Washington, June 1977.
9. C. R. Phipps, Jr., and S. J. Thomas, "Characterization of P-Type Germanium for 10- μ m Passive Isolation and Pulse-Shaping," I.E.E.E./O.S.A. Topical Meeting on Inertial Confinement Fusion, San Diego, February 1978.
10. C. R. Phipps, Jr. and S. Thomas, "Observation of Absorption and Wavefront Distortion due to Plasma Formation in Ge at 10.6 μ m," Stanford University Quantum Electronics Seminar, February 1978. **(Invited)**
11. R. K. Ahrenkiel, D. Dunlavy, J. F. Figueira, C. R. Phipps, Jr., S. J. Thomas and A. J. Sievers, "A New 10.6- μ m Saturable Absorber: KCl Doped with KReO₄," International Conference on Lasers, Orlando, December 1978.
12. D. E. Watkins, C. R. Phipps, Jr., and S. J. Thomas, "Ellipse Rotation in Germanium," I.E.E.E./O.S.A. Conference on Laser Engineering and Applications, Washington, June 1979.
13. C. R. Phipps, Jr., J. F. Figueira, S. J. Czuchlewski, and S. J. Thomas, "Efficient Plasma Isolator for High-Power 10- μ m Lasers," 21st Annual Meeting, American Physical Society, Boston, November 1979.
14. C. R. Phipps, Jr., S. J. Thomas, and D. E. Watkins, "Effect of Nonlinear Refraction on Beam Brightness in Laser Fusion Applications," International Conference on Lasers '79, Orlando, December 1979.
15. S. J. Czuchlewski, C. R. Phipps, Jr., J. F. Figueira, and S. J. Thomas, "Plasma Breakdown Isolators for CO₂ Laser Fusion Systems," I.E.E.E./O.S.A. Topical Meeting on Inertial Confinement Fusion, San Diego, February 1980.
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24. D. E. Watkins, C. R. Phipps, Jr., and S. J. Thomas, "Amplified Reflection via Degenerate Four-Wave Mixing in a Laser-Induced Free-Carrier Plasma in Germanium," International Conference on Excited States and Multiresonant Nonlinear Optical Processes in Solids, Aussois, France, March 1981.
25. C. R. Phipps, Jr., "DFWM with Net Gain via Plasma Gratings in Germanium," Rutherford Laboratory, Chilton, Didcot, England, March 1981.
26. B. J. Feldman, R. A. Fisher, and C. R. Phipps, Jr., "Optical Phase Conjugation at Los Alamos," S.P.I.E. 25th Annual International Technical Symposium, San Diego, August 1981.
27. C. R. Phipps, Jr., "Modern Applications of Nonlinear Optics," Department of Physics, University of Washington, Seattle, October 12, 1981 **(Invited)**.
28. D. E. Watkins and C. R. Phipps, Jr., "Theory and Measurement of Degenerate Four-Wave Mixing in a Resonant Three-Level Absorber," Conference on Lasers and Electro-optics '82, Phoenix, April 14, 1982.
29. C. R. Phipps, Jr., "Phase Conjugation by Degenerate Four-Wave Mixing: Principles and Applications," Quantum Electronics and Applications Society seminar, University of Texas at Dallas, April 26, 1982 **(Invited)**.
30. C. R. Phipps, Jr., "Status of CO₂ Lasers for Materials Processing," NATO Advanced Workshop on Laser Processing in Materials Science, Mons, Belgium, January 29, 1983 **(Invited)**.
31. C. R. Phipps, Jr., "Measurements of Pulsed Laser Mechanical Coupling Phenomena at Los Alamos," New Mexico State University, Physics Department colloquium, November 1983 **(Invited)**.
32. C. R. Phipps, Jr., "A Study of Plasma Formation ...", AFOSR Workshop on Spacecraft Survivability, Aberdeen, Maryland, June 29, 1984.
33. R. S. Dingus, R. Green, T. King, W. Osborne, and C. Phipps, "Single-Pulse Laser Effects Measurements at 248 nm," AIAA Laser Effects Meeting, Stanford Research Institute, Menlo Park, California, November 7, 1984.
34. P. L. Mascheroni, M. M. Mueller, J. Norton, G. Pollack, E. Lindman, and C. R. Phipps, Jr., "Different Turbulent Regimes in Antares Long-Pulse Experiments and Broadband Effects," Fall Meeting, American Physical Society (Plasma Physics), Baltimore, Maryland, November 3-7, 1984.
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36. P. L. Mascheroni and C. R. Phipps, Jr., "Conceptual Design of a 100-MJ Hydrogen Fluoride Driver for Fusion Research," 1986 Topical Conference on the Physics of Radiatively Driven ICF Targets, Albuquerque, NM, December 8-11, 1986.
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39. C. R. Phipps, R. F. Harrison, H. S. Steele, T. R. King, W. Z. Osborne, "Measurements of Laser Impulse Coupling in Vacuum at 3 Wavelengths with kJ-level Laser Systems", 1987 International Conference on Lasers, Xiamen, China, November 15-19, 1987.

40. C. R. Phipps, Jr., "Conceptual Design for a 100-MJ Hydrogen Fluoride Laser Driver for Fusion Research", Dept. of Electrical Engineering, Keio University, Yokohama, Japan, November 9, 1987 **(Invited)**
41. C. R. Phipps, Jr., "Impulse Coupling to Targets in Vacuum by KrF, HF and CO₂ Single-pulse Lasers", Institute of Applied Physics, Beijing, China, November 30, 1987 **(Invited)**
42. C. R. Phipps, Jr., R. F. Harrison, T. P. Turner, G. K. Anderson, and L. C. Haynes, "Impulse Coupling to Targets in Vacuum by KrF, HF and CO₂ Single-Pulse Lasers", CLEO 88, San Diego, California, April 25-29, 1988
43. C. R. Phipps, Jr., "Mirror, Mirror off the Wall: the Lasermakers' Dream", M.I.T. Workshop on Novel Applications of High-Temperature Superconductors, Salem, Massachusetts, June 22-24, 1988, Wednesday evening session **(Invited)**
44. C. R. Phipps, Jr., "Observation of Anomalously Large Infrared Laser Impulse Coupling Coefficients in Vacuum", 19th European Conference on Laser Interaction with Matter (ECLIM), Madrid, October 3-7, 1988, paper P1-10
45. C. R. Phipps, "Feasibility of 100-MJ Hydrogen Fluoride Lasers for Fusion", International Meeting on Laser-Plasma Interactions, University of New South Wales, November 1, 1988
46. C. R. Phipps, "Conceptual Design of a 100-MJ Pulsed HF Laser for Fusion", Laser Physics Centre, Research School of Physical Sciences, Australian National University, Canberra, November 21, 1988 **(Invited)**
47. C. R. Phipps, "New Hope for Laser Fusion", Physics Department Colloquium, University of New South Wales, Sydney, December 8, 1988 **(Invited)**
48. J. E. Sollid, D. W. Feldman, C. R. Phipps and R. W. Warren, "Observation of Induced Absorption in Zinc Selenide", S. O. Q. U. E. Lasers '88, Lake Tahoe, Nevada, December 5-9, 1988, paper TD.7.
49. H. Hora, L. Cicchitelli, G. Kasotakis, C. Phipps, G. H. Miley and R. J. Stening, "Fusion Gain Calculations for Ideal Adiabatic Volume Compression and Ignition at 100-MJ HF-laser Driving Energies", 16th European Conference on Controlled Fusion and Plasma Physics, Venice, March 13-17, 1989
50. C. R. Phipps, "Implications of a Plasma-physics-dominated Laser Coupling Theory for Materials Processing by Pulsed Lasers from the UV to the IR", March Meeting of the American Physical Society, St. Louis, March 20-24, 1989 **(Invited)**
51. C. R. Phipps, "Understanding Pulsed Laser Ablation of Planar Solid Targets in the Low and High-Intensity Limits", Euromech 257, Mechanical Effects Induced by Lasers, Marseille, September 6-8, 1989, keynote address **(Invited)**
52. C. R. Phipps, "Laser-induced Plasma Generation and Interactions with Planar Solid Targets in Vacuum", 3-Lecture Series, Physics Department, Free University of Berlin, October 9 - 21, 1989 **(Invited)**
53. C. R. Phipps, "Understanding Pulsed Laser Ablation of Planar Solid Targets in the Low and High-Intensity Limits", CEL-Valenton, France, October 25, 1989
54. C. R. Phipps, "Dynamics of Laser-Plasma Interactions", 3-Lecture Series, Physics Department, Free University of Berlin, November 9 - 16, 1990 **(Invited)**
55. C. R. Phipps, "Impulsive Laser-Target Interactions in Vacuum, in the High-Intensity Limit", Chemistry Department, University of Antwerp, Belgium, November 21, 1990
56. C. R. Phipps, "High Power Laser Research at Los Alamos", Institut St. Louis, St. Louis, France, November, 1990
57. C. R. Phipps, "Laser deflection of the Death Asteroid", Los Alamos Innovative Concepts Forum, October 25, 1991 **(Invited)**
58. C. R. Phipps, "Dynamics of NEO Interception", NASA Near Earth Object Interception Workshop, Los Alamos, New Mexico, January 14-16, 1992 **(Invited Tutorial)**
59. C. R. Phipps, "Laser deflection of NEO's", NASA Near Earth Object Interception Workshop, Los Alamos, New Mexico, January 14-16, 1992
60. C. R. Phipps and R. W. Dreyfus, "Extending Laser Fusion Concepts into the Microelectronics Arena," paper A23, 1992 March Meeting of the American Physical Society, March 16-20, Indianapolis

61. C. R. Phipps and M. M. Michaelis, "Space propulsion concept using very high energy pulsed DF laser ablation," Conference on Physics of Nuclear Induced Plasmas and Problems of Nuclear Pumped Lasers, Obninsk, Russia, 29 May, 1992
62. C. R. Phipps, "Modification of Earth-satellite orbits using medium-energy pulsed lasers," 9th International Symposium on Gas Flow and Chemical Lasers 1992, Elounda, Crete, September 21-25, 1992
63. C. R. Phipps, "Estimation of Shock Pressure Induced in Tissue by Pulsed Laser Irradiation," Wellman Laboratories of Photomedicine Lecture Series, Boston, October 6, 1992 **(Invited)**
64. C. R. Phipps, "Laser Deflection of the Death Asteroid," IEEE/LEOS conference, Boston, November 15-20, 1992 **(Invited)**
65. C. R. Phipps, "Novel applications of modest lasers in satellite propulsion," Los Alamos section meeting, Optical Society of America, December 9, 1992 **(invited)**
66. C. R. Phipps, "Efficient Space Propulsion Engines Based on Laser Ablation", LANL/SDIO Workshop on Dynamic Response of Materials to Pulsed Heating, Los Alamos, New Mexico, January 22-25, 1993 **(Invited)**
67. R. W. Dreyfus, C. R. Phipps and A. Vertes, "Extending Laser Fusion Concepts into the Lower Power ($\leq 1\text{GW}/\text{cm}^2$) Microelectronics Arena," Second International Conference on Laser Ablation, Knoxville, April 19-22, 1993
68. C. R. Phipps, "LISP: An Overview of Laser Impulse Space Propulsion concepts at Los Alamos," Physics Department Colloquium, University of Natal, Durban, South Africa **(invited)** August 4, 1993
69. C. R. Phipps, "LISK-BROOM: A laser concept for clearing space junk," 11th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, October 25-29, 1993
70. C. R. Phipps, "Overview of Los Alamos Photonics", Electronic Imaging, Optics and Photonics Workshop sponsored by High Technology of Rochester, Rochester, NY November 9, 1993
71. C. R. Phipps, "LISK-BROOM, A laser concept for clearing near-Earth space junk", Los Alamos Innovative Concepts forum **(invited)** August 26, 1994
72. C. R. Phipps and M. M. Michaelis, "Deflecting Near-Earth Objects Using High Average Power, Repetitively-Pulsed Lasers", 23rd European Conference on Laser Interaction with Matter, Oxford, September 19-23, 1994
73. C. R. Phipps and M. M. Michaelis, "LISK-BROOM: Clearing near-Earth Space Debris in 4 Years using a 20-kW, 530-nm Repetitively Pulsed Lasers", NPL 94 Conference, Arzamas, Russia September 26-30, 1994 **(invited)**
74. C. R. Phipps, "LISP - Laser Impulse Space Propulsion", Optical Society of America Annual Meeting/ILS-X, Dallas, Texas October 2-7, 1994
75. C. R. Phipps, "Lasers can play an Important Role in the Planetary Defense", Lawrence Livermore National Laboratory Planetary Defense Workshop, May 22-6, 1995, Livermore CA
76. C. R. Phipps and J. P. Reilly, "ORION: Clearing near-Earth space debris in two years using a 30-kW repetitively-pulsed laser", paper F1, XI International Symposium on Gas Flow and Chemical Lasers and High Power Laser Conference, Edinburgh, 30 August, 1996
77. M. M. Michaelis and C. R. Phipps, "De-orbiting space Debris. Choice of Laser Site." COSPAR meeting, University of Birmingham, UK 8/96
78. C. R. Phipps, "New Applications for High Average Power, High Peak Power Lasers", University of Pretoria physics department seminar **[invited]**, October 30, 1996
79. C. R. Phipps, J. W. Campbell, C. R. Phipps, I. Bekey, J. Rather, W. Dent, R. Raukp, J. Reilly, D. Spencer, R. Sridharan, C. Taylor and G. Zeiders, "ORION: Orbital Debris Removal Using Ground-Based Sensors and Lasers," NASA TM 108522, October 1996
80. C. R. Phipps, "ORION: Clearing near-Earth space debris in 2 years using a 30-kW repetitively pulsed laser", University of Natal physics department seminar **[invited]**, November 1, 1996
81. C. R. Phipps, "ORION: Clearing near-Earth space debris in 2 years using a 30-kW repetitively pulsed laser", University of Cape Town physics department seminar **[invited]**, November 6, 1996

82. C. R. Phipps, "ORION: Physics Overview", Lasers 96 conference, Portland, OR, Dec.2-6, 1996 **[invited]**
83. C. R. Phipps, "Laser deflection of near-Earth asteroids and comet nuclei", Lasers 96 conference, Portland, OR, Dec.2-6, 1996 **[invited]**
84. C. R. Phipps, "ORION: Clearing Near-Earth Space Debris", Physics of Quantum Electronics meeting, Snowbird, UT, Jan. 13-16, 1997 **[invited plenary]**
85. C. R. Phipps and J. P. Reilly, "Clearing near-Earth space debris in two years using a 20-kW repetitively-pulsed laser", SPIE/LASE '97, San Jose, CA, February 10-14, 1997
86. C. R. Phipps, "Ultrashort Pulses for Impulse Generation in Laser Propulsion Applications", Thirteenth International Conference on Laser Interactions and Related Plasma Phenomena, U.S. Naval Postgraduate School Monterey, California, 17 April, 1997
87. C. R. Phipps, "Requirements for Laser Acquisition of NEO's", Lasers 97 conference, New Orleans, LA, December 15-19, 1997 **[invited]**
88. C. R. Phipps, "Advantages of using ps-pulses in the ORION Space Debris Clearing System", Lasers 97 conference, New Orleans, LA, December 15-19, 1997
89. C. R. Phipps, "Review of Direct-Drive Laser Space Propulsion Concepts", Space Technology and Applications International Forum, Albuquerque, NM, January 25-9, 1998
90. C. R. Phipps, "ORION: Challenges and Benefits", Santa Fe High Power Laser Ablation Conference, April 26-30, 1998
91. K. X. Liu, E. Garmire and C. R. Phipps, "Predicting Laser Coating Removal Rates", Santa Fe High Power Laser Ablation Conference, April 26-30, 1998
92. C. R. Phipps, D. Seibert II, C. Reyerson, R. Royse, M. Lander, J. W. Campbell and J. P. Reilly, "Impulse Coupling Measurements for an ORION Demonstration" Space Technology and Applications International Forum, Albuquerque, NM 1999, paper E19-II.4
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94. C. R. Phipps and J. Luke, "Micro Laser Plasma Thrusters for Small Satellites," Santa Fe High Power Laser Ablation Conference, April 23-28, 2000
95. C. R. Phipps, D. B. Seibert II, R. Royse, G. King and J. W. Campbell, "Very High Coupling Coefficients at Low Laser Fluence with a Structured target," Santa Fe High Power Laser Ablation Conference, April 23-28, 2000
96. C. R. Phipps, "Realistic Laser Ablation Space Propulsion Concepts – Watts to Megawatts," Gordon Research Conference on Laser Interaction with Materials, Andover, NH June 11-15, 2000 **[invited]**
97. C. R. Phipps, J. Luke and J. Marquis, "Diode Laser-based Microthrusters: A New Alternative for High I_{sp} , Long-life Engines," paper AIAA-2000-3477, 36th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Huntsville, AL July 18, 2000
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99. T. Yabe, C. Phipps, R. Nakagawa, M. Yamaguchi K. Aoki, C. Baasandash, H. Abe, N. Yoshida, Y. Ogata, M. Nakagawa, E. Fujiwara, K. Yoshida, A. Nishiguchi, K. Ochi and I. Kajiwara, "Numerical and Experimental Analysis of Laser-Driven Rocket and Micro-Airplane", 2nd International Conference on inertial Fusion Sciences and Applications, Kyoto Japan, September 10-14 2001
100. C. R. Phipps, J. R. Luke and G. G. McDuff, "A Diode-laser-Driven Microthruster", paper IEPC-01-220, 27th International Electric Propulsion Conference, Pasadena October 15-19, 2001
101. C. R. Phipps, J. R. Luke, G.G. McDuff and T. Lippert, "Diode-laser-driven Micro-propulsion Engine", AAAF 6th International Symposium on Propulsion for Space Transportation of the XXIst Century, Palais de Congres, Versailles, France May 14-17, 2002.
102. C. R. Phipps, J. R. Luke and T. Lippert, "A Laser-ablation-based micro-rocket", 33rd AIAA Plasmadynamics and Lasers Conference, Maui, May 20-23, 2002

103. C. R. Phipps, "Overview of Laser Applications: the State of the Art and the Future Trend", International Congress on Laser Advanced Materials Processing 2002, Osaka, May 27-31, 2002 **[invited keynote]**
104. C. R. Phipps and J. R. Luke, "Advantages of a ns-pulse micro-Laser Plasma Thruster", First International Symposium on Beamed Energy Propulsion, Huntsville, November 5-7, 2002
105. C. R. Phipps, J. Luke and T. Lippert, "Laser ablation of organic coatings as a basis for micropropulsion", paper H-VIII.2, European Materials Research Society Spring Meeting, Strasbourg (2003) **[invited]**
106. C. R. Phipps, "Using Laser Ablation for Space Propulsion", DX-2 Seminar, Los Alamos National Laboratory, September 5, 2003
107. C. R. Phipps and J. Luke, "Micropropulsion using Laser Ablation", COLA 03, Hersonissos, Crete, October 6-10, 2003
108. M. Keidar, I. D. Boyd, J. Luke and C. Phipps, "Plasma generation and plume expansion for a transmission-mode micro-laser ablation plasma thruster", paper AIAA-2003-4567, 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 2003
109. C. Phipps, J. Luke, D. Funk, D. Moore, J. Glowina and T. Lippert, "Laser impulse coupling at 130fs," paper J-1221, EMRS Spring meeting, Strasbourg, 2005
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116. C. R. Phipps, "Laser Space Propulsion," Rutherford Appleton Laboratory luncheon talk, Chilton, Didcot, UK, July 5, 2006
117. C. R. Phipps, "Laser-driven Space Engines with High Thrust and High I_{sp} ," Paul Scherrer insitut, Villigen, Switzerland July 3, 2006
118. C. R. Phipps, J. R. Luke and W. D. Helgeson, "Laser Space Propulsion Overview," XVI International Symposium on Gas Flow and Chemical Lasers and High Power Lasers Conference, Gmunden, Austria September 7, 2006
119. C. R. Phipps, J. R. Luke and W. D. Helgeson, "Laser Space Propulsion Overview," XIV Advanced Laser Technologies Conference, Brasov, Romania, September 12, 2006
120. C. R. Phipps, J. R. Luke and W. D. Helgeson, "A $200 < I_{sp} < 3000$ s, Efficient Electrical Propulsion Engine," seminar, Edwards AFB, CA September 20, 2006
121. C. R. Phipps, J. R. Luke and W. D. Helgeson, "Laser-powered thrusters for high efficiency variable specific impulse space missions," 54th JANNAF Propulsion Meeting, Denver CO May 17, 2007
122. C. Phipps, W. Bohn, T. Lippert, A. Sasoh, W. Schall and J. Sinko, "A Review of Laser Ablation Propulsion," Advanced Laser Technologies 2009, Antalya, Turkey Septmber 30, 2009
123. C. Phipps and J. W. Campbell, "A Review of the ORION Concept for Space Debris Mitigation," DARPA International Orbital Debris Removal Conference, Chantilly, VA December 8-10, 2009

124. C. Phipps, K. Baker, S. Libby, D. Liedahl, S. Olivier, L. Pleasance, A. Rubenchik, J. Trebes, E. George, B. Marcovici, J. Reilly and M. Valley, "Removing Orbital Debris with Pulsed Lasers," High Power Laser Ablation 2012, April 30-May3, Santa Fe NM
125. C. Phipps, "Removing Orbital Debris with Pulsed Lasers," Second European Conference on Active Debris Removal, CNES, Paris 18-19 June 2012
126. C. Phipps, "Short-pulse Laser-optical System Requirements for Reducing the Space Debris Threat," High Power Laser Ablation and Beamed Energy Propulsion, Santa Fe NM, 21-25 April, 2014
127. C. Phipps, "Pulsed Laser ADR Strategy," Third European Workshop on Space Debris Modeling and Remediation, CNES, Paris 16-18 June 2014
128. C. Phipps, "Laser Space Debris Removal: Now, not Later," 20th International Symposium on High Power Laser Systems and Applications, Chengdu China 25-29 August 2014 (**invited**)
129. C. Phipps and C. Bonnal, "Pulsed UV Laser System Design for Re-entering or Nudging Debris in LEO and Re-orbiting GEO Debris," Laser Solutions to Orbital Debris workshop, Université Paris Diderot, 27-28 April 2015
130. C. Phipps, "Mysteries of Lasers in Space," Outlook on Wake Field Acceleration: the next Frontier workshop, CERN, 15-16 October, 2015
131. C. Phipps, "Pulsed Lasers for Clearing Debris in LEO and GEO" (**invited**), Laser Solutions for Space and the Earth Conference, Optics and Photonics International Congress, Yokohama, 17-20 May 2016
132. C. Phipps, "Using Pulsed Lasers to Transmit Impulse in Space" (**invited lecture**), RIKEN, Wako-shi, 23 May 2016
133. C. Phipps, "Concerns for Phased Fiber Laser Arrays in Space," Fourth International Workshop on Space Debris Modeling and Remediation, CNES, Paris 6-8 June 2016
134. C. Phipps, "Comparing Electric and Laser Thrusters for the 21st Century," Fourth International Workshop on Space Debris Modeling and Remediation, CNES, Paris 6-8 June 2016
135. C. Phipps, "Asteroids: Very Large and Very Valuable Debris," Fourth International Workshop on Space Debris Modeling and Remediation, CNES, Paris 6-8 June 2016
136. C. Phipps, "High Power Laser Systems for Space Debris Clearing" (**invited lecture**), Fifth International School on Lasers in Materials Science, San Servolo, 10-17 July 2016
137. C. Phipps, C. Bonnal, F. Masson, M. Boustie, S. Baton, E. Brambrink, J.-M. Chevalier, L. Videau, S. Boyer and M. Schneider, "Small Payload transfers from Earth to LEO and LEO to interplanetary space using lasers," paper 679, 7th European Conference for Aeronautics and Space Sciences, Milano 3-6 July (2017)
138. C. Phipps, C. Bonnal and F. Masson, "New 80ps data enable transfers from Earth to LEO and LEO to interplanetary space using lasers," 2nd HiLASE Workshop, Chateau Stirin, Czechia, September 26 (2017) (**invited lecture**)
139. C. Phipps and C. Bonnal, "Pulsed laser rockets for launching small payloads into low Earth orbit and interplanetary space," 20th anniversary High Power Laser Ablation conference, Santa Fe, 26-29 March (2018)
140. S. A. E. Boyer, L. Berthe, M. Boustie, S. Baton, E. Brambrink, L. Videau, J.-M. Chevalier, A. Burr, S. Jacomet, C. Phipps, F. Masson and C. Bonnal, "In-situ and post-mortem damage characterization of short-pulse laser in metals and polymer based materials," 20th anniversary High Power Laser Ablation conference, Santa Fe, 26-29 March (2018)
141. L. Videau, S. Baton, L. Berthe, M. Boustie, S. Boyer, E. Brambrink, J.-M. Chevalier, C. Phipps, C. Rousseaux and M. Schneider, "Temporal characterization of short-pulse absorption in metals," 20th anniversary High Power Laser Ablation conference, Santa Fe, 26-29 March (2018)
142. C. Phipps, "Power beaming applications for high efficiency lasers," Workshop on high efficiency free electron lasers, UCLA, Los Angeles, 11-13 April (2018)
143. C. Phipps and C. Bonnal, "Large Debris Traffic Management (LDTM) using Lasers," 5th workshop on debris modeling and remediation, CNES-HQ, Paris 25-27 June 2018
144. S. Boyer, A. Burr, S. Jacomet, M. Boustie, L. Berthe, S. Baton, E. Brambrink, L. Videau, J.-M. Chevalier, M. Schneider, C. Phipps, F. Masson and C. Bonnal, "400fs and 80ps pulse laser in selected

materials: first in-situ and post-mortem analysis," International Conference on Processing and Manufacturing of Advanced Materials, Paris 9-13 July 2018

TECHNICAL MAGAZINE ARTICLES:

1. C. R. Phipps and M. M. Michaelis, "Renaissance for Laser Space Propulsion," *Photonics Spectra Magazine*, September, 1993
2. "Optical Sensor Enhances Braking Reliability", *Sensor Technology*, **10** no. 12, December, 1994
3. Adam Mann, "Space Junk Crisis: Time to Bring in the Lasers," *Wired Magazine* 26 October, 2011
4. C. R. Phipps, "Clearing Space Debris with Lasers," SPIE Newsroom 30 December 2011, <http://spie.org/x84761.xml?ArticleID=x84761>
5. Debra Werner, "Cleaning up Space", *Aerospace America*, May 2015
6. Kimberly Adams, "What to do about all that space junk? Cue the lasers," *Marketplace* 5 October 2015, <http://www.marketplace.org/topics/tech/what-do-about-all-space-junk-cue-lasers>
7. A. Anzaldua, G. Barnhard, D. Dunlop and C. Phipps, "A path to commercial orbital debris cleanup, power-beaming and communications utility, using technology development missions at ISS," <http://www.thespacereview.com/article/3363/1> (November 6, 2017)