

## Robert W. Hellwarth

### List of Publications

1. Thesis: "An Investigation of Hyperfine Structure Using the Atomic Beam Magnetic Resonance Method," submitted for the degree of Doctor of Philosophy by Robert W. Hellwarth, St. John's College, Oxford University, June, 1955.
2. "Nuclear Spin and Hyperfine Structure of Radioactive Silver<sub>47</sub>AG<sup>222</sup>," R.W. Hellwarth and G.K. Woodgate, *Nature*, Vol.176, pp.395-396, 1955.
3. "Hyperfine Structure of Radioactive Silver<sub>47</sub>AG<sup>222</sup>," R.W. Hellwarth and G.K. Woodgate, *Proc. Phys. Soc. A*, Vol.LXIX, pp.581-587, 1956.
4. "Shape of Resonance Curves in Atomic Beam Experiments," R.W. Hellwarth and G.K. Woodgate, *Proc. Roy. Soc. A*, Vol.LXIX, pp.588-592.
5. "Geometrical Representation of the Schrodinger Equation for Solving Laser Problems," R.P. Feynman, R.W. Hellwarth, and F.L. Vernon, *Journal of Appl. Phys.*, Vol.28, pp.49-52, January, 1957; reprinted in *Selected Papers in Physics*, Phys. Soc. of Japan, 1958.
6. "Theory of the Pulsation of Fluorescent Light from Ruby," R.W. Hellwarth, *Phys. Rev. Letters*, Vol.6, pp.9-11, December, 1961.
7. "Control of Fluorescent Pulsations," R.W. Hellwarth in Advances in Quantum Electronics, pp.334-341, Edited by Jay R. Singer (Columbia University Press, New York, 1961).
8. "Giant Pulsations from Ruby," R.W. Hellwarth and F.J. McClung, *J. Appl. Phys.*, Vol.33, pp.838-841, March, 1962; and *Bull. Am. Phys. Soc.*, Vol.6, p.414, 1962.
9. "Double Pumping of Ruby Optical Laser," J.L. Emmett and R.W. Hellwarth, *Bull. Am. Phys. Soc.*, Vol.7, p.615, 1962.
10. "Mobility of Slow Electrons in a Polar Crystal," R.P. Feynman, R.W. Hellwarth, C. Iddings, and P.M. Platzman, *Physical Review*, Vol.127, pp.1004-1017, August, 1962.
11. "Magnetization of Slow Electrons in a Polar Crystal," R.W. Hellwarth and P.M. Platzman, *Physical Review*, Vol.128, pp.1599-2604, November, 1962.
12. "Stimulated Raman Scattering from Organic Liquids," G. Eckhardt, R.W. Hellwarth, F.H. McClung, S.E. Schwarz, D. Weiner, and E. Woodbury, *Physical Review Letters*, Vol.9, pp.455-457, December, 1962.

13. "Characteristics of Giant Optical Pulsations from Ruby," R.W. Hellwarth and F.J. McClung, Proc. IEEE, Vol.51, pp.46-53, January, 1963.
14. "Theory of Stimulated Raman Scattering," R.W. Hellwarth, Physical Review, Vol.130, pp.1850-1852, June, 1963; reprinted in Series of Selected Papers in Physics, Quantum Electronics I, Physical Society of Japan, 1965.
15. "Q-Modulation of Lasers and Stimulated Raman Scattering," R.W. Hellwarth, in Lectures On Quantum Electronics, Edited by M.L. Stich (UCLA Press, 1963).
16. "Analysis of Stimulated Raman Scattering of a Giant Laser Pulse," R.W. Hellwarth, Applied Optics, Vol.2, pp.847-854, August 1963.
17. "Structure of Giant Induced Optical Pulses from Ruby," R.W. Hellwarth, Advances in Quantum Electronics III, pp.1203-1210, Edited by P. Grivet and N. Bloembergen (Columbia Univ. Press, New York, 1964).
18. "Quantum Noise in a Parametric Amplifier with Lossy Modes," R.W. Hellwarth and W.G. Wagner, Physical Review, Vol.133, pp.915-920, February, 1964.
19. "Stimulated Raman Scattering and Related Parametric Effects," R.W. Hellwarth, Current Science, Vol.33, pp. 129-137, March, 1964.
20. "Anomalies in the Angles of the Emission Accompanying Stimulated Raman Scattering from Nitrobenzene," R.W. Hellwarth, F.J. McClung, W.G. Wagner, and D. Weiner, Bull. Am Phys. Soc., Vol.9, pp. 490, 1964.
21. "Giant Pulse Lasers and Stimulated Raman Scattering," R.W. Hellwarth, F.J. McClung, W.G. Wagner, and D. Weiner, Journal of Applied Math. and Physics, Vol.16, pp.27-32, 1965.
22. "Nonlinear Optics of Many-Particle Systems," Gordon Baym and R.W. Hellwarth, IEEE Journal of Quantum Electronics, Vol.1, pp.309-320, October, 1965.
23. "Q-Modulation of Lasers," R.W. Hellwarth, Chapter IV, in Advances in Lasers, pp.253-294, Edited by A.K. Levine (Marcel Dekker, New York, 1966).
24. "Nonlinear Interactions of Radiation in Plasmas," R.W. Hellwarth and Gordon Baym, in Physics of Quantum Electronics, pp.105-111, Edited by P.L. Kelley, B. Lax and P.E. Tannenwald (McGraw-Hill, New York, 1966).
25. "The Self-focusing of Light of Different Polarizations," D.H. Close, C.R. Guiliano, R.W. Hellwarth, L.D. Hess, F.J. McClung, and W.G. Wagner, IEEE Journal of Quantum Electronics, Vol.QE-2, pp.553-557, September, 1966.

26. "Effect of Molecular Redistribution on the Nonlinear Refractive Index of Liquids," R.W. Hellwarth, Phys. Rev., Vol.152, pp.156-165, December, 1966; Vol.163, pp.205-206, November, 1967.
27. "Kerr Effect and Intermolecular Correlations in Liquids," C. Cooke, N. George, and R.W. Hellwarth, IEEE Journal of Quantum Electronics, Vol.QE-4, p.36, May, 1968.
28. "Operating Characteristics of a High-Brightness Hydrogen Stokes Source," D.H. Close, R.W. Hellwarth, F.J. McClung, and W.G. Wagner, IEEE Journal of Quantum Electronics, Vol.QE-4, p.66, May, 1968.
29. "Kerr Effect in Symmetric-Molecule Liquids," R.W. Hellwarth, Proceedings of the International School of Physics-Enrico Fermi, XLII Course, Edited by R.J. Glauber (Academic Press, New York, 1969).
30. "Kerr Constant Measurements Using a Laser Polarimeter," C.R. Cooke, N. George, and R.W. Hellwarth, Electron Technology, Vol.2, pp.229-236, 1969.
31. "Nonlinear Refractive Indices of CS<sub>2</sub>-CCl<sub>4</sub> Mixtures," N. George and R.W. Hellwarth, Journal of Opto-Electronics, Vol.1, pp.213-217, 1969.
32. "Theory of Molecular Light Scattering Spectra Using the Linear Dipole Approximation," R.W. Hellwarth, Journal of Chemical Physics, Vol.52, pp.2128-2138, February, 1970.
33. "Role of Photo-Electrons in Optical Damage," R.W. Hellwarth in Damage in Laser Materials, Edited by A.J. Glass, NBS Special Publication 341, December, 1970.
34. "Origin of the Nonlinear Refractive Index of Liquid CCl<sub>4</sub>," N. George, R.W. Hellwarth, and A. Owyong, Phys. Rev. A, Vol.4, pp.2342-2347, December, 1971.
35. "Intensity-Induced Changes in Optical Polarizations in Glasses," N. George, R.W. Hellwarth, and A. Owyong, Phys. Rev. B, Vol.5, pp.628-633, January, 1972.
36. "Nonlinear Propagation of Monochromatic Radiation Near Medium Resonance," R.W. Hellwarth and J.I. Cotrim Vasconcellos, Bulletin of American Physics Society, Vol.17, p.1197, December, 1972.
37. "High-Power Infrared-Laser Windows," with committee, National Materials Advisory Board, Publ. 292, National Academy of Science, July, 1972.
38. "Fundamental Absorption Mechanisms in High-Power Laser Window Materials," R.W. Hellwarth, in Laser Induced Damage in Optical Materials, pp.165-171, Edited by A.J. Glass and A. Guenther, NBS Special Publication 372, 1972.

39. "Checks of Multi-Phonon Absorption Theory," R.W. Hellwarth in Laser Induced Damage in Optical Materials, Edited by A.J. Glass and A. Guenther, NBS Special Publication 387, 1973.
40. "Infrared Absorption in Ionic Insulators Due to Multi-phonon Processes," R.W. Hellwarth, T.C. McGill, M. Mangir, and H.V. Winston, *J. Phys. Chem. Solids*, Vol.34, pp.2015-2115, December, 1973.
41. "A Method for Measuring the Contribution of the Nonlinear Dipole Moment to Multi-phonon Absorption," R.W. Hellwarth in *Proceedings of the Third Conference on High Power Laser Window Materials*, November 12, 1973, Edited by Carl Pitha, A. Armington, and H. Posen, Air Force Cambridge Research Laboratories, Special Report 174, February, 1974.
42. "Method for Measuring the Contribution of the Nonlinear Dipole Moment to Multi-phonon Absorption," R.W. Hellwarth and M. Mangir, *Phys. Rev. B*, Vol.15, pp.1635-1641, August, 1974.
43. "Frequency Dependence of the Nonlinear Optical Susceptibility of Five Glasses," J. Cherlow, R.W. Hellwarth, and Tien-Tsai Yang, in *Laser-Induced Damage in Optical Materials*, pp.207-209, Edited by A.J. Glass and A. Guenther, NBS Special Publication 414, 1974.
44. "Nonlinear Optical Microscopic Examination of Structure in Polycrystalline ZnSe," P. Christensen and R.W. Hellwarth, *Applied Optics*, Vol.14, p.247, 1974.
45. "Nonlinear Optical Microscope Using Second Harmonic Generation," P. Christensen and R.W. Hellwarth, *Applied Optics*, Vol. 14, p.247, 1974.
46. "Origin and Frequency Dependence of Nonlinear Optical Susceptibilities of Glasses," J. Cherlow, R.W. Hellwarth, and Tien-Tsai Yang, *Phys. Rev. B*, pp.964-967, January, 1975.
47. "Determination of Multi-Phonon Absorption Mechanism by Refractive Index Measurements," R.W. Hellwarth and M. Mangir, in *Proceedings of the Fourth Annual conference on Infrared Laser Window Materials*, Edited by C.R. Andrews and C.L. Strecker, Air Force Materials Laboratory, January, 1975.
48. "Observation of Dynamical Central Peak in the Light Scattering Spectrum of a Glass," J. Cherlow, L. Firstein, and R.W. Hellwarth, *Journal of Applied Physics*, Vol.28, p.25, 1976.
49. "Relation Between Light-Scattering Cross-Sections and the Nonlinear Optical Susceptibilities of Liquids and Solids," R.W. Hellwarth, *Proceedings of the First USA-USSR Seminar-Symposium of Theory of Light Scattering in Condensed Matter*, pp.270-283 (Publishing House "Nauka", Moscow, 1976).

50. "Nonlinear Susceptibilities and Light Scattering," R.W. Hellwarth in Theory of Light Scattering in Condensed Matter, pp.225-234, Edited by Bendow, Birman and Agranovich (Plenum Press, New York, 1976).
51. "Raman-Induced Kerr Effect: A Nonlinear Spectroscopic Tool," Proceedings to II International Conference on Interaction of Electrons with Strong Electro-magnetic Field (Central Research Institute, Budapest, Hungary, 1976).
52. "Experimentation Determination of Mutiphonon Absorption Mechanism and Parameters in CVD Zinc Selenide," R.W. Hellwarth and M. Mangir, Proceedings of the Fifth Annual Conference on Infrared Laser Window Materials, pp.839-848, Edited by C.R. Andrews and C.L. Strecker (University of Dayton Research Institute, Ohio, 1976).
53. "Raman-Induced Kerr Effect," D. Heiman, R.W. Hellwarth, M.D. Levenson, and G. Martin, Phys. Rev. Lett., Vol.36, pp.189-192, 1976.
54. "Nonlinear Optical Effects for Plasma Diagnostics," R.W. Hellwarth, Applied Physics, Vol. 11, pp.147-151, 1976.
55. "Nonlinear Optical Susceptibilities of Solvents," J.M. Cherlow, R.W. Hellwarth, and T.T. Yang, IEEE Journal of Quantum Electronics, Vol.QE-12, p.644, 1976.
56. Energy and Social Change, co-author with James O'Toole and Twenty-Year Forecast Staff (MIT Press, Cambridge, 1976).
57. "Third-Order Susceptibilities of Liquids and Solids," R.W. Hellwarth, Part I of Vol.5 of Monographs: Progress in Quantum Electronics, Edited by J.H. Sanders and S. Stenholm (Pergamon Press, New York, 1977).
58. "Refractive Index Measurements and Nonlinear Moment Parameters for Polycrystalline ZnSe," R.W. Hellwarth and M. Mangir, Physical Review, Vol.16, pp.856-862, July, 1977.
59. "Generation of Time-Reversed Wavefront by Nonlinear Refraction," R.W. Hellwarth, Journ. Optical Soc. Am., Vol.67, pp.1-3, January, 1977.
60. "Observation of the Time-Reversed Replica of a Monochromatic Optical Wave," R.W. Hellwarth and S.M. Jenson, Appl. Phys. Lett. Vol. 32, pp.166-168, February, 1978.
61. "Measurements of the Electronic and Nuclear Contributions to the Nonlinear Index of Beryllium Fluoride Glass," C. Cline, D. Heiman, R.W. Hellwarth, D. Milam, W.L. Smith, and M. Weber, Appl. Phys. Lett., Vol.32, pp.403-405, April, 1978.
62. "Theory of Phase Conjugation by Stimulated Scattering in a Waveguide," R.W. Hellwarth, J. Opt. Soc. Am., Vol.68, pp.1050-1056, August, 1978.

63. "Generation of Time-Reversed Waves by Nonlinear Refraction in a Waveguide," R.W. Hellwarth and S.M. Jensen, *Appl. Phys. Lett.*, Vol.33, pp.404-405, September, 1978.
64. "Theory of Phase-Conjugation by Four-Wave Mixing in a Waveguide," (invited) R.W. Hellwarth, *IEEE Journal of Quantum Electronics*, Vol.QE-15, pp.101-109, February, 1979.
65. "Spatial-Diffusion Measurements in Impurity-Doped Solids by Degenerate Four-Wave Mixing," J. Feinberg, D.S. Hamilton, D. Heiman, and R.W. Hellwarth, *Optics Lett.*, Vol.4, pp.124-125, April, 1979.
66. "Raman Scattering and Nonlinear Refractive Index Measurements of Optical Glasses," D.S. Hamilton, D. Heiman and R.W. Hellwarth, *Journ. of Non-Crystalline Solids*, Vol. 34, pp.63-79, 1979.
67. "Brillouin Scattering Measurements on Optical Glasses," D.S. Hamilton, D. Heiman, and R. W. Hellwarth, *Phys. Rev. B*, Vol.19, pp.6584-6592, June, 1979.
68. "Infrared-To-Optical Image Conversion by Bragg Reflection From Thermally Induced Index Gratings," R.W. Hellwarth and G. Martin, *Appl. Phys. Lett.*, Vol.34, pp.371-373, March, 1979.
69. "Conjecture on the Effect of Small Anharmonicity on Vibration Modes of Glass," R.W. Hellwarth, *Solid State Comm.*, Vol.32, pp.85-88, October, 1979.
70. "Photorefractive Effects and Light-Induced Charge Migration in Barium Titanate," J. Feinberg, D. Heiman, R.W. Hellwarth and A. Tanguay, *J. Appl. Phys.*, Vol.51, pp.1297-1305, March, 1980.
71. "Generation of a Time-Reversed Replica of a Non-Uniformly Polarized Image-Bearing Optical Beam," R.W. Hellwarth, L.K. Lam, and G. Martin, *Optics Lett.*, Vol.5, pp.185-187, May, 1980.
72. "Phase-Conjugating Mirror with Continuous-Wave Gain," J. Feinberg and R.W. Hellwarth, *Optics Letters*, Vol.5, pp.519-521, December, 1980.
73. "Photorefractive-Index Gratings Formed by Nanosecond Optical Pulses in BaTiO<sub>3</sub>," T.Y. Chang, J. Feinberg, R.W. Hellwarth, and L.K. Lam, *Optics Letters*, Vol.6, pp.475-477, October, 1981.
74. "New Component in Degenerate Four-Wave Mixing of Optical Pulses in Sodium Vapor," R.W. Hellwarth, S.N. Jabr, and L.K. Lam, *Phys. Rev. A*, Vol.24, pp.3264-3267, December, 1981.

75. "Recent Developments in Laser Physics and Applications," R.W. Hellwarth, Proceedings of the Sixth International Nathiagalhi Summer College, June 15 to July 2, 1981 (Editor, M.M. Qazi, Pakistan Atomic Energy Commission, Islamabad).
76. "High-Resolution Resonance Raman Spectroscopy in the B-X Band of I<sub>2</sub><sup>227</sup> Vapor," R.W. Hellwarth, D. Kirillov, and L.K. Lam, Journal of Molecular Spectroscopy, Vol.91, pp.269-272, January, 1982.
77. "Optical Beam Phase Conjugation by Stimulated Backscattering," R.W. Hellwarth, Optical Engineering, Vol.21, pp.257-262, March/April, 1982.
78. "Optical Beam Phase Conjugation by Four-Wave Mixing in a Waveguide," R.W. Hellwarth, Optical Engineering, Vol.21, pp.262-263, March/April, 1982.
79. "Intensity-Induced Non-Reciprocity in a Fiberoptic Gyroscope," S. Ezekial, J.L. Davis and R.W. Hellwarth, Proceedings of the International Conference on Fiberoptic Rotation Sensors, M.I.T., November 9-11, Edited by S. Ezekial (Springer-Verlag, New York, 1982).
80. "Observation of Intensity-Induced Nonreciprocity in a Fiberoptic Gyroscope," S. Ezekial, J.L. Davis and R.W. Hellwarth, Optics Lett., Vol.7, pp.457-459, September, 1982.
81. "Phase Conjugation by Four-Wave Mixing in a Waveguide," R.W. Hellwarth, Chapter 5 of Optical Phase Conjugation, Edited by R.A. Fisher (Academic Press, New York, 1983).
82. "Phase Conjugation by Stimulated Backscattering," R.W. Hellwarth, Chapter 7 of Optical Phase Conjugation, Edited by R.A. Fisher (Academic Press, New York, 1983).
83. "Raman-Induced Phase Conjugation Spectroscopy," R.W. Hellwarth and S.K. Saha, Phys. Rev. A, Vol.27, pp.919-922, February, 1983.
84. "Optical Beam Phase Conjugation by Stimulated Backscattering in Multi-Mode Optical Waveguides," R.W. Hellwarth in New Directions in Guided Waves and Coherent Optics, Vol.11, pp.335-337, Edited by D.B. Ostrowski and E. Spitz (Martinus Nijhoff Publishing, Boston, 1984).
85. "Minimum Power Requirements for Efficient Four-Wave Mixing and Self-Focusing of Electromagnetic Beams in Glasses and Fluids," R.W. Hellwarth, Phys. Rev. A, Vol.31, pp.533-536, January, 1985.
86. "Optical Measurement of the Photorefractive Parameters of Bi<sub>12</sub>SiO<sub>20</sub>," R.W. Hellwarth and R.A. Mullen, Journ. Appl. Phys., Vol.58, pp.40-44, July, 1985.
87. "Optical Phase Conjugation by Backscattering in Barium Titanate," T.Y. Chang and R.W. Hellwarth, Optics Lett., Vol.10, pp.408-410, August, 1985.

88. "Hole-Electron Competition in Photorefractive Gratings," R.W. Hellwarth, J.M.C. Jonathan, and F.P. Strohkendl, *Optics Lett.*, Vol. 11, pp.312-314, May, 1986.
89. "Effect of Applied Electric Field on the Buildup and Decay of Photorefractive Gratings," R.W. Hellwarth, J.M.C. Jonathan, and G. Roosen, *IEEE Journal of Quantum Electronics*, Vol.QE-22, No.10, pp.1936-1941, October, 1986.
90. "Image Processing Using Nonlinear Optical Effects," R.W. Hellwarth, pp.67-69, in "Optical Nonlinearities, Fast Phenomena and Signal Processing," edited by Peyghambarian (National Science Foundation, Washington, DC, 1986).
91. "Contribution of Holes to the Photorefractive Effect in n-type  $\text{Bi}_{12}\text{SiO}_{20}$ ," F.P. Strohkendl and R.W. Hellwarth, *J. Appl. Phys.*, Vol.62, pp.2450-2455, September, 1987.
92. "Photorefractive and liquid crystal materials," P. Brody, U. Efron, J. Feinberg, A. Glass, R.W. Hellwarth, R. Neurogaonkar, G. Rakuljic, G. Valley, and C. Woods, *Appl. Opt.*, Vol.26, pp.220-224, January, 1987.
93. "Theory and observation of electron-hole competition in the photorefractive effect," R.W. Hellwarth, in *Laser Optics of Condensed Matter*, Edited by J.L. Birman, H.Z. Cummins, and A.A. Kaplyanskii (Plenum Press, New York, 1988).
94. "Nonlinear index of air at  $1.053\mu\text{m}$ ," D.M. Pennington, M.A. Henesian, and R.W. Hellwarth, *Phys. Rev. A*, Vol.39, pp.3003-3009, March, 1989.
95. "Picosecond nonlinear optical response of three rugged polyquinoxaline-based aromatic conjugated ladder-polymer thin films," X.F. Cao, J.P. Jiang, D.P. Bloch, R.W. Hellwarth, L.P. Yu, and L. Dalton, *J. Appl. Phys.*, Vol.65, pp.5012-5018, June, 1989.
96. "Comment on 'Reflected phase-conjugate wave in plasma'," R.W. Hellwarth, D. Lininger, and M.V. Goldman, *Phys. Rev. Lett.*, Vol.62, p.3011, June, 1989.
97. "Recent advances in the synthesis of new nonlinear optical polymers," L.P. Yu, R. Vac, L.R. Dalton and R.W. Hellwarth, *Proc. S.P.I.E.*, Vol.1147, pp.142-148, 1989.
98. "Comparative study of photorefractive  $\text{Bi}_{12}\text{SiO}_{20}$ ," F.P. Strohkendl, P. Tayabati, and R.W. Hellwarth, *J. Appl. Phys.*, Vol.65, pp.3773-3779, December, 1989.
99. "Bipolaronic enhanced third-order nonlinearity in organic ladder polymers," X.F. Cao, J.P. Jiang, R.W. Hellwarth, L.P. Yu, M. Chen, and L.R. Dalton, *Proc. S.P.I.E.*, Vol.1337, pp.114-124, 1990.
100. "Synthesis and characterization of third order nonlinear optical materials," L.P. Yu, M. Chen, L.R. Dalton, X.F. Cao, J.P. Jiang and R.W. Hellwarth, *Materials Res. Soc. Symp. Proc.*, Vol.173, pp.607-612, December, 1990.



101. "Indices governing optical self-focusing and self-induced changes in the state of polarization of N<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>, and Ar Gases," T.W. Hellwarth, D.M. Pennington, and M.A. Henesian, *Phys. Rev. A*, Vol.41, pp.2766-2777, 1990.
102. "Direct determination of electron mobility in photorefractive Bi<sub>12</sub>SiO<sub>20</sub> by a holographic time-of-flight technique," J.P. Partanen, J.M.C. Jonathan, and R.W. Hellwarth, *Appl. Phys. Lett.*, Vol.57, pp.2404-2406, December, 1990.
103. "Charge transport and holographic determination of the mobility of charge carriers in photorefractive BSO," J.P. Partanen, P. Nouchi, J.M.C. Jonathan, and R.W. Hellwarth, *Annales De Physique, Colloque no 1, Suppl. no 1*, Vol.16, pp.135-142, February, 1991.
104. "Anomalous optical transmission in homogenous latex suspensions," P. Tam and R.W. Hellwarth, *Phys. Rev. B*, Vol.43, pp.13314-13319, June, 1991.
105. "Comparison between holographic and transient photocurrent measurements of electron mobility in photorefractive Bi<sub>12</sub>SiO<sub>20</sub>," J.P. Partanen, P. Nouchi, J.M.C. Jonathan, and R.W. Hellwarth, *Phys. Rev. B*, Vol.44, pp.1487-1491, July, 1991.
106. "Spatial harmonics of photorefractive gratings in a barium titanite crystal," Y.H. Lee and R.W. Hellwarth, *J. Appl. Phys.*, Vol.71, pp.916-923, January, 1992.
107. "Temperature dependence of electron mobility in photorefractive Bi<sub>12</sub>SiO<sub>20</sub>," P. Nouchi, J.P. Partanen, and R.W. Hellwarth, *J. Opt. Soc. Am. B*, Vol.9, pp.1428-1431, August, 1992.
108. "Technique for characterization of laser-induced dielectric gratings: application to non-photoreactive cubic KTaO<sub>3</sub>:Cu," P. Xia, J.P. Partanen, and R.W. Hellwarth, Nonlinear Optics: Materials, Fundamentals, and Applications Technical Digest, 1992 (Optical Society of America, Washington, DC, 1992) Vol.18, pp.266-269.
109. "Fidelity of optical phase conjugation by photorefractive degenerate four-wave mixing in barium titanite," D.L. Naylor, P.W. Tam, and R.W. Hellwarth, *J. Appl. Phys.*, Vol.72, pp.5840-5847, December, 1992.
110. "Simple transient solutions for photoconduction and space charge field in a photorefractive material with shallow traps," P. Nouchi, J.P. Partanen, and R.W. Hellwarth, *Phys. Rev. B*, Vol.47, pp.15581-15587, June, 1993.
111. "Third-order optical nonlinearity of C<sub>60</sub>, C<sub>70</sub>, and CS<sub>2</sub> in Benzene at 1.06μm," N. Tang, J.P. Partanen, R. Knize, and R.W. Hellwarth, *Phys. Rev. B*, Vol.48, pp.8404-8408, September, 1993.

112. "Measurement of the complex polarizability of electron traps in  $\text{Bi}_{12}\text{SiO}_{20}$  by a moving grating technique," P. Xia, J.M.C. Jonathan, J.P. Partanen, and R.W. Hellwarth, *Optics Lett.*, Vol.18, pp.1780-1782, November, 1993.
113. "Excited-state dynamic studies of resonant enhanced optical nonlinearity in ladder chromophores by degenerate four-wave mixing," L.S. Sapochak, F. Strohkendl, L.R. Dalton, N. Tang, J.P. Partanen, R.W. Hellwarth, T.Y. Chang, C.W. Spangler, and Q. Ling, in "Organic materials for Nonlinear Optics III," edited by R.A. Hann and D. Bloor (Royal Society of Chemistry, Cambridge, UK, 1993).
114. "Third order nonlinearity in polymer models and composites containing stabilized bipolarons," E.G. Nickel, C.W. Spangler, N. Tang, R.W. Hellwarth, and L. Dalton, in "Organic materials for Nonlinear Optics III," edited by R.A. Hann and D. Bloor (Royal Society of Chemistry, Cambridge, UK, 1993).
115. "Third order nonlinearity in bis-ferrocenyl polyenes," M.L. Sachtleben, C.W. Spangler, N. Tang, R.W. Hellwarth, and L. Dalton in "Organic materials for Nonlinear Optics III," edited by R.A. Hann and D. Bloor (Royal Society of Chemistry, Cambridge, UK, 1993).
116. "Substituent effects in the design of new organic NLO materials," C.W. Spangler, T.A. Kelleher, P.-K. Liu, L.-T. Cheng, N. Tang, and R.W. Hellwarth, in "Organic materials for Nonlinear Optics III," edited by R.A. Hann and D. Bloor (Royal Society of Chemistry, Cambridge, UK, 1993).
117. "Bipolaron formation and nonlinear optical properties in bis-thienyl polyenes," C.W. Spangler, M.Q. He, J. Laquindanum, N. Tang, J.P. Partanen, and R.W. Hellwarth, in Electrical, optical and magnetic properties of organic solid state materials, Vol.138, of the *Mat. Res. Soc. Symp. Proc. Ser.*, October, 1993.
118. "Excited-state absorption cross-section of  $\text{C}_{60}$ ," N. Tang, H. Guan, J.P. Partanen, and R.W. Hellwarth, *Proc. S.P.I.E.*, Vol.2143, pp.272-280, January, 1994.
119. "Studies of optical nonlinearity in bis-thienyl polyenes," N. Tang, J.P. Partanen, R.W. Hellwarth, J. Laquindanum, L. Dalton, M.Q. He and C.W. Spangler, *S.P.I.W. Symposium Proceedings Series*, Vol.2285, Nonlinear Optical Properties of Organic Materials VII, pp.186-195, July, 1994.
120. "Optical image processing by an atomic vapor," I. Biaggio, J.P. Partanen, B. Ai, R.J. Knize, and R.W. Hellwarth, *Nature*, Vol.371, pp.318-320, September, 1994.
121. "Nonlinear optical properties of  $\text{C}_{60}$  films between 740 and 880 nm," F.P. Strohkendl, R.J. Larsen, L.R. Dalton, R.W. Hellwarth and Z.H. Kafafi, *S.P.I.E. Proceedings*, Vol.2285, pp.186-195, September, 1994.

122. "Optical correlator that uses cesium vapor," I. Biaggio, B. Ai, R.J. Knize, J.P. Partanen, and R.W. Hellwarth, *Optics Lett.*, Vol.19, pp.1765-1767, November, 1994.
123. "The design of new organic materials with enhanced nonlinear optical properties," C.W. Spangler, M. He, E.G. Nickel, J. Laquindanum, L.T. Dalton, N. Tang, and R.W. Hellwarth, *Mol. Cryst. Liq. Cryst.*, Vol.240, pp.17-23, November, 1994.
124. "Measurement of the excited-state molecular polarizability of C<sub>60</sub>," N. Tang, R.W. Hellwarth, J.P. Partanen, *Mat. Res. Soc. Proc.* 359, pp.511-516, 1996.
125. "Optical limiting in protonic doped bis-benzothiazole," N. Tang, R.W. Hellwarth, J. Partanen, S. Sun and L. Dalton, *Mat. Res. Symp. Proc.* 374, pp.225-230, 1996.
126. "Focused one-cycle electromagnetic pulses," R.W. Hellwarth and P. Nouchi, *Phys. Rev.*, Vol.E-54, pp.889-895, July, 1996.
127. "Phase-mismatched degenerate four-wave mixing: complex third-order susceptibility tensor elements of C<sub>60</sub> at 768 nm," F.P. Strohkendl, L. Dalton, R.W. Hellwarth, H. Sarkas and Z. Kafafi, *Journ. Optical Soc. Am. B*, Vol.14, pp.92-98, January, 1997.
128. "Band mobility of Photo-excited Electrons in Bi<sub>12</sub>SiO<sub>20</sub>," I. Biaggio, R.W. Hellwarth and J.P. Partanen, *Phys. Rev. Letters*, Vol. 78, pp.891-894, February, 1997.
129. "Observation of the lowest-lying electric-dipole-allowed two-photon resonance in C<sub>60</sub>," F.P. Strohkendl, T. Axenson, R. Larsen, L. Dalton, R.W. Hellwarth, and Z. Kafafi, *The Journal of Physical Chemistry B*, Vol.101, pp.8802-8807, 1997.
130. "Stimulated Raman backscattering from the stratosphere: a useful guide star for blue starlight?" by R.W. Hellwarth in "Laser Technology for Laser Guide Star Adaptive Optics Astronomy," Proceedings No.55, edited by N. Hubin (Publ: European Southern Observatory, Garching, Germany, 1997).
131. "Guoy shift and temporal reshaping of focused single-cycle electromagnetic pulses", Simin Feng, H.G. Winful and R.w. Hellwarth. *Optics Letters* Vol. 23: pp. 385-387. March 1998.
132. "Stimulated backscattering from the stratosphere: a useful guide star?", R.W. Hellwarth, J.P. Partanen, and Nansheng Tang in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, Washington DC, 1999), p.95.
133. "Spatiotemporal evolution of focused single-cycle electromagnetic pulses", S. Feng, H. Winful and R.W. Hellwarth. *Phys. Rev. E* Vol. 59: pp. 4630-4649, April 1999.
134. "Mobility of an electron in a multimode polar lattice", R.W. Hellwarth and I. Biaggio. *Phys. Rev. B*, Vol. 60: pp. 299-307, July 1999.

135. "Nonlinear optical spectra of C70", F. Strohkendl, T. Axenson, R. Larsen, L. Dalton, R. Hellwarth, and Z. Kafafi, Chem. Phys. Vol. 245: pp. 285-295 (1999).
136. "Raman line locking in air", R.W. Hellwarth, to be published in Phys. Rev. B.