

December 27, 2010

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Office of the Secretary**

In the Matter of:) Docket No. 50-346
FirstEnergy Nuclear Operating Company)
Davis-Besse Nuclear Power Station, Unit 1)
(Regarding the Renewal of Facility)
Operating License NPF-003 for a 20-Year)
Period))
)

**DECLARATION AND *CURRICULUM VITAE* OF ALVIN COMPAAN,
INTERVENORS' EXPERT WITNESS ON CONTENTION #2**

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Facility Operating License)
NPF-003 for a 20-Year Period)

**DECLARATION OF ALVIN COMPAAN,
INTERVENORS' EXPERT WITNESS ON CONTENTION #2**

Now comes Alvin Compaan, Ph.D., Declarant herein, who hereby declares as follows under penalty of perjury:

1. I am a professor of physics at the University of Toledo, Toledo, Ohio, and hold a Ph.D. degree from the University of Chicago. My *curriculum vitae* as of August 2010 is attached hereto and made a part of this Declaration.

2. I have read and reviewed the entirety of Contention #2 of the "Request for Public Hearing and Petition for Leave to Intervene" brought by Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario, Don't Waste Michigan, and the Green Party of Ohio." In particular, I have read and considered paragraphs 123 through 151 of Contention #2, which are its factual allegations.

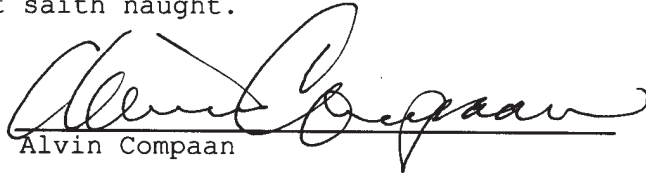
3. Respecting paragraphs 123 through 151, I am familiar with and have personally researched literature in the field of solar energy and solar photovoltaic electricity which is therein referenced. Further, I personally authored those paragraphs.

4. All scientific conclusions stated in Contention #2 are mine, and are proffered as expert conclusions based upon my training, background, scientific experience and specific expertise in the field of solar energy and photovoltaic energy.

5. I have stated the scientific and expert conclusions in Contention #2 to a reasonable degree of scientific certainty in the discipline and study of physics.

6. Further Declarant saith naught.

Dec 27, 2010
Date


Alvin Compaan

CURRICULUM VITAE

NAME: Alvin Compaan

DEGREES: A.B., Calvin College, 1965
M.S., University of Chicago, 1966
Ph.D., University of Chicago, 1971

EXPERIENCE:

Teaching Assistant, University of Chicago, 1965-66
NDEA Title IV Fellow, University of Chicago, 1968-69
NSF Trainee, University of Chicago, 1969-1971
Research Associate, New York University, 1971-1973
Assistant Professor, Kansas State University, 1973-1977
Associate Professor, Kansas State University, 1977-1981
Professor, Kansas State University 1981-1987
Alexander von Humboldt Fellow, (Guest Scientist Max Planck Institute für Festkörperforschung - Stuttgart) 1982-1983
Professor of Physics, The Univ. of Toledo 1987-
Director, Thin Films Research Inst., 1991-96
TUBITAK Distinguished Senior Visitor, Bilkent U., Ankara, July-Aug. 1994
Guest Scientist: National Research Council--Ottawa (with J.J. Dubowski), Oct-Dec. 1994
Director, Center for Materials Science and Engineering, 1996-
Chair, Dept. of Physics and Astronomy, July 2004-2008

HONORARY AND PROFESSIONAL SOCIETIES:

American Physical Society, A.A.A.S., International Society for Optical Engineering (SPIE), Union of Concerned Scientists, Materials Research Society, Sigma Xi, Sigma Pi Sigma

FIELDS OF RESEARCH COMPETENCE:

Resonant Raman Scattering, Semiconductor Physics, Laser Annealing of Semiconductors, Ion Implantation Studies, Thin Film Solar Cells, Laser Scribing, RF Sputtering, Pulsed Laser Deposition

REFEREE FOR:

Physical Review, Physical Review Letters, Journal of Applied Physics, Applied Physics Letters, J. Vacuum Science & Technology, Surface Science, Physica Scripta, NSF, ARO, DOE, Research Corp

PATENTS AWARDED/FILED:

"Process for RF Sputtering of Cadmium Telluride Photovoltaic Cell," patent no. 5,393,675 awarded on Feb. 28, 1995, to Alvin D. Compaan, assigned to The Univ. of Toledo.
"Method of manufacturing semiconductor having group II-group VI compounds doped with nitrogen," inventors: Alvin D. Compaan, Kent J. Price, Xianda Ma, and Konstantin Makhrtchev, patent no. 6,852,614 awarded on Feb. 8, 2005, assigned to The Univ. of Toledo.
"Method of making diode structures," inventors: Alvin D. Compaan and Akhlesh Gupta, utility patent 7,141,863 issued Nov. 28, 2006, assigned to The Univ. of Toledo
"Photovoltaic healing of non-uniformities in semiconductor structures," inventors: V. G. Karpov, Y. Roussillon, D. Shvydka, A.D. Compaan, D. Giolando, utility patent 7,098,058 issued Aug. 29, 2006, to the U. of Toledo.

EXTRAMURAL FUNDING:

- Research Corporation - "Spectroscopic Studies of Pure and Implanted Cuprous Oxide Using Tunable Lasers" (\$10,000) 6/75 - 6/76.
- NSF - "Raman and Photoluminescence Studies of Pure and Implanted Cuprous Oxide" (\$48,000) 12/76 - 5/79
- NSF - "Laser Light Scattering Studies of Exciton and Free Carrier Relaxation in Pure and Implanted Semiconductors" (\$27,700) 2/79 - 7/80.
- IBM - "Design, Construction and Test of a Pupillary Response Visibility Meter (PRVM)" (\$28,194) 3/80 - 9/80 (with C. Bennett, P.I.).
- ONR - "Raman Studies of Surface Temperature in Laser-Heated Semiconductors" (\$360,759) 4/80 - 9/84.
- NSF (Science in Developing Countries) - "Pulsed Laser Annealing of Some Elementary and Compound Semiconductors" (\$9,625) 3/83 - 2/85.
- NSF (Chemical Instrumentation) - "A Tunable Pulsed Dye Laser Facility" (\$101,700) 2/84 - 1/85 (with K. Klabunde, P.I., and five others).
- USAF - UES "Summer Faculty Research" (\$9,052) 5/85-7/85.
- USAF - UES "Below-Melt-Threshold Excimer-Laser-Annealing of GaAs" (\$20,000) 10/85-9/86.
- USARO-BATTELLE "Excimer Laser Processing of HgCdTe", (\$14,389), 4/87-8/87.
- NSF - International Travel Grant to attend "Workshop on Advanced Raman Spectroscopy" in Kanpur, India, 7-11 Dec. 1987 (\$1,641).
- OBOR Grant - Research Challenge Program - "Central Materials Facility," 7/88 - 12/89 (\$10,000) (with S. A. Lee, R. G. Bohn and C. Y. Tai).
- Ohio's Thomas Edison Program and Glasstech, Inc., "Advanced Processing for Thin Film Solar Cells", 6/89 - 6/91 (\$500,000) (with C.Y. Tai, co-investigator).
- Ohio's Thomas Edison Program and Solar Cells, Inc., "Laser Processing for CdTe Solar Cells", 6/89 - 6/90 (\$100,000) (with R.G. Bohn, co-investigator).
- Solar Energy Research Institute (with collaborative efforts from Glasstech, Solar Cells, and Glasstech Solar), "Cadmium Telluride Solar Submodules Using Laser-Driven Vapor Deposition," 07/90-12/93 (\$475,407) with R. G. Bohn as Co-Investigator.
- Co-Investigator on SBIR grant with Principal Investigator from AVCA Corp. (Vaughn Baltzly). (Funded for \$50,000, 6 months, starting September 1990).
- Ford Motor Company - "Solar Photovoltaics," 10/91 - 9/92 (\$30,000).
- NASA, "Photophysics and Hydrogen Processing of Interstellar Carbon Solids," with A. N. Witt as Principal Investigator and C. Y. Tai, (\$66,877), 8/92-.
- National Renewable Energy Laboratory (NREL) "High Efficiency Thin Film CdTe-Based Solar Cells" (1/21/94-1/20/97) \$374,848 (with R.G. Bohn and Y. Rajakarunanayake as co-investigators).
- NSF, "High Resolution Spectroscopy for Undergraduates," 9/94-9/96, (\$23,566 with UT match of \$23,566) (with A.N. Witt and L.J. Curtis as co-PIs)
- OBOR Research Challenge Program, "Semiconductor Thin Films for Large-Area Photo-Assisted Field Emission," \$30,300 (6/94-6/95) with B.G. Bagley as co-PI.
- NREL, "Optimization of Laser Scribing for Thin-Film PV Modules," (\$255,000; 4/95 - 10/97), three lower-tier subcontractors: Solar Cells Inc., (Toledo, OH), International Solar Electric Technologies (ISET), (Los Angeles, CA), and C J Laser Corp., (Dayton, OH).
- NREL, "High Efficiency Thin Film CdTe-Based Solar Cells" (extension) (\$124,000; 1/21/97-3/31/98) (with R.G. Bohn as co-I)
- NSF, "U.S.-Mexico Cooperative Research: Thin-Film Materials for Photovoltaics," INT-9901383, (\$28,500 6/99-6/02)
- NREL, "High Efficiency Thin-Film Cadmium Telluride and Amorphous Silicon Based Solar Cells," (\$870,000; 2/1/98 - 1/30/01) (with X. Deng as Co-P.I. and R.G. Bohn as co-I)
- NREL, "Acquisition of Hot-wire Deposition Chamber and In Situ Optical Absorption measurement for Thin Film Solar Cell Fabrication," \$98,450 (funded 50/50 NREL and UT) 7/1/98--6/30-00.
- NREL, "High Efficiency Thin-Film Cadmium Telluride and Amorphous Silicon Based Solar Cells," (2/1/98 - 1/30/01) [addition of \$54,000), (with X. Deng as Co-P.I. and R.G. Bohn as co-I).
- Solar Cells Inc., "Electrical and Optical Characterization of Photovoltaic Materials," 1/20/97 - 7/31/98 (\$66,936).
- Solar Cells Inc., "Laser Scribing and Optical Characterization of Photovoltaic materials," (\$15,214.50 to date).
- Electro Plasma Inc., "Collaborative Research on Color Plasma Displays with Enhanced Brightness," 1/1/99—8/25/00 (\$109,274) (with X. Deng as Co-I)
- Electro Plasma Inc., "Collaborative Research on Color Plasma Displays with Enhanced Brightness," 4/01 – 3/02 (\$112,990) (Compaan, P.I.)

NREL, "High Efficiency Thin-Film Cadmium Telluride and Amorphous Silicon Based Solar Cells," funded extension 3/5/01 to 10/15/01, \$115,000.(*Compaan and Deng co-P.I.s, Bohn, co-I*)

NREL High Performance Photovoltaics Program, "Polycrystalline Thin-Film II-VI top cells for tandem photovoltaics,"(\$768,749 for 24 months, 4/3/01 – 6/3/03) (with V. Karpov and X. Deng as co-investigators and with First Solar, LLC, as a lower-tier subcontractor)

NREL "The fabrication and physics of high efficiency CdTe thin-film solar cells," (\$770,265, 9/01-8/04) (Compaan and Karpov, co-P.I.s, Deng, Bohn, & Giolando as co-Is)

NSF "Partnership for Innovation "Northwest Ohio Partnership on Alternative Energy Systems" (Frank J. Calzonetti, P.I., Coleman, Compaan, Deng, Stuart, co-Is)[\$600,000, 10/1/02—9/30/05]

First Solar "Development of On-line diagnostics," (\$15,805, 10/31/03—12/31/03) Compaan, P.I.

Air Force Research Lab-Kirtland, "Light-weight and flexible thin-film solar cells based on a-Si and CdTe," \$1,647,545 11/20/02 – 12/31/06 (Compaan, P.I., Deng co-P.I., co-Is: Collins, Giolando, Marsillac, Karpov)

NREL "Sputtered II-VI alloys and structures for tandem PV," (\$780,000, 11/1/03—2/28/07)(Compaan, P.I., co-investigators: Karpov, Collins, Giolando)

NSF-STTR-through ITN Energy Systems, "P-type CdSe for thin-film top cells enabling high-efficiency monolithic tandem photovoltaics," \$50,000, 8/1/03--7/31/04 (Compaan, UT P.I.)

Air Force Research Lab-Wright Patterson (via Universal Technologies Corp), "Photovoltaic hydrogen for portable, on-demand power," \$1,620,000, 8/1/03—7/31/06 (Deng, P.I., co-Is: Compaan, Coleman, Giolando, Lipscomb)

Ohio Department of Development—"Center for Photovoltaic Electricity and Hydrogen," \$2,000,000 for capital equipment (1/1/04—6/30/07), Compaan, P.I., with co-Is: Giolando, Deng, Karpov

Air Force Research Lab-Kirtland, "Light-weight and flexible thin-film solar cells based on a-Si, CdTe, and CIGS" \$2,517,932, 11/20/02-11/17/07 (Compaan, P.I., Deng co-P.I., co-Is: Collins, Giolando, Marsillac, Karpov)

Ohio Department of Development—"Center for Photovoltaic Electricity and Hydrogen-Enhanced Activities," \$99,920 (7/1/05—6/30/07) Compaan, P.I., with co-Is: Giolando, Deng, Collins, Karpov

NREL "The fabrication and physics of CdTe devices by sputtering," (\$1,155,546, 3/1/05-4/30/08) (Compaan and Karpov, co-P.I.s, Collins & Giolando as co-Is)

Ohio Department of Development-- "Wright Center of Innovation: Photovoltaics Innovation and Commercialization" (6/1/07-5/30/10, \$18.6 M, R. Collins, P.I.; Compaan one of 15 co-investigators) [UT is the lead institution (\$9.3M) with Ohio State University (\$6.8M) and Bowling Green State U (\$2.5M)]

U.S. Dept. of Energy, University Photovoltaic Process and Product Development Support program, "Improved CdTe PV Modules by APVD," R. Collins, P.I., Compaan, co-P.I., with co-Is Giolando, Marsillac and two industrial partners, Calyxo, USA, and Pilkington. \$1,164,175 (05/15/08 – 5/14/11)

Xunlight 26 Solar/Ohio Dept. of Development-Advanced Energy Program—"Flexible Thin-Film CdTe PV Modules," Collins, P.I., \$360,000 (06/01/08 – 05/30/10)

Garland/Ohio Dept. of Development-Advanced Energy Program—"Garland BIPV Systems," Compaan, P.I., \$300,000 (6/01/08 – 5/30/10)

Ascent Solar/SBIR Phase II—"CdSe top cells for CdSe/CIGS Tandems," K. Wieland, P.I., Compaan co-I, \$200,000 (7/1/09 - 6/30/10)

Triton, Inc/SBIR phase II—"Laser Scribing Studies—Phase II," \$31,593 (6/1/08 - 12/30/09)

Air Force Research Lab-Kirtland, "Rapidly Deployable Solar Electricity and Fuel Sources," \$3,343,571, 4/8/08-10/1/09 (Marsillac, P.I., Deng co-P.I., Collins, co-PI, Compaan, co-PI, Giolando, Bigioni, Amar, Khare)[Additional 12 month funded extension to 10/1/2010, \$2,980,860.]

INTRAMURAL FUNDING

Dean Arts & Sciences (UT): Support for New Frontiers Symposium, "Alternative Energy Strategies," \$3,000 (1990-91)

UT Office of Research - Undergraduate Summer Research Participation Program - "Annealing of Solar Cells for Enhanced Efficiency," (Summer 1991), \$1,250.

Department and College Research Excellence Incentive Program, "Quadrupole Mass Analyzer," \$5,000 with Department match of \$8,000 (6/94-6/95).

PUBLICATIONS:

1. A. Compaan, L. Q. Lambert and I. D. Abella, Phys. Rev. Lett. 20, 1089 (1968) "Photon-Echo Dependence on Intensity."
2. L. Q. Lambert, A. Compaan and I. D. Abella, Phys. Ltrs. 30A, 153 (1969) "Modulation and Fast Decay of Photon-Echoes in Ruby."
3. A. Compaan, L. Q. Lambert and I. D. Abella, Optics Communications 3, 236 (1971) "Level Crossing Effects and Spin-Dependent Decay of Circularly Polarized Photon Echoes in Ruby."
4. A. Compaan and I. D. Abella, Phys. Rev. Ltrs. 27, 23 (1971) "Evidence of Strong Optical Super-radiant Damping in Ruby."
5. L. Q. Lambert, A. Compaan and I. D. Abella, Phys. Rev. A4, 2022 (1971) "Effects of Nearly Degenerate States on Photon-Echo Behavior."
6. A. Compaan, Phys. Rev. B5, 4450 (1972) "Concentration-Dependent Photo-Echo Decay in Ruby."
7. A. Compaan and H. Z. Cummins, Phys. Rev. B6, 4753 (1972) "Raman Scattering, Luminescence and Exciton-Phonon Coupling in Cu_2O ."
8. A. Compaan and H. Z. Cummins, Phys. Rev. Ltrs. 31, 41 (1973) "Resonant Quadrupole-Dipole Raman Scattering at the 1S Yellow Exciton in Cu_2O ."
9. A. Compaan, W. D. Langer, D. Eden and H. L. Swinney, Astrophysical Journ. 185, L105 (1973) "Collisional Excitation of CO by H_2 ."
10. A. Compaan, L. Q. Lambert and I. D. Abella, Phys. Rev. A8, 1641 (1973) "Short Time-Interval Behavior of Photon Echoes in Ruby Near Level Crossings."
11. A. Compaan, Solid State Commun. 16, 293 (1975) "Surface Damage Effects on Allowed and Forbidden Phonon Raman Scattering in Cuprous Oxide."
12. I. D. Abella, A. Compaan and L. Q. Lambert, Laser Spectroscopy, R. G. Brewer, ed., Plenum, p. 457 (1974) "Observation of Superhyperfine Modulation and Quantum Beats in Photon-Echo Spectroscopy in Ruby."
13. D. Powell, A. Compaan, J. R. Macdonald and R. A. Forman, Phys. Rev. B12, 20 (1975) "Raman Scattering Study of Ion-Implantation- Produced Damage in Cu_2O ."
14. A. Z. Genack, H. Z. Cummins, M. A. Washington, R. A. Forman and A. Compaan, Phys. Rev. B12, 2478 (1975) "Quadrupole-Dipole Raman Scattering at the 1S Yellow Exciton in Cu_2O ."
15. M. A. Washington, A. Z. Genack, H. Z. Cummins and A. Compaan, in Proceedings of the Third International Conference on Light Scattering in Solids, edited by M. Balkanski, R. C. C. Leite, and S. P. S. Porto, Flammarion Sciences, Paris, p. 29 (1976) "First Order Resonant Raman Scattering in the Yellow Exciton Series of Cu_2O ."
16. A. Z. Genack, H. Z. Cummins, M. A. Washington and A. Compaan in Proceedings of the Third International Conference on Light Scattering in Solids, edited by M. Balkanski, R. C. C. Leite, and S. P. S. Porto, Flammarion Sciences, Paris, p. 34 (1976) "Symmetry - Forbidden Resonant Raman Scattering from Polar Phonons in Cu_2O ."
17. A. Compaan, A. Z. Genack, H. Z. Cummins and M. Washington in Proceedings of the Third International Conference on Light Scattering in Solids, edited by M. Balkanski, R. C. C. Leite, and S. P. S. Porto, Flammarion Sciences, Paris, p. 39 (1976) "Experimental Tests of the Quadrupole - Dipole Raman Scattering Tensor in Cu_2O ."
18. A. Compaan and J. R. Macdonald in Proceedings of the Third International Conference on Light Scattering in Solids, edited by M. Balkanski, R. C. C. Leite and S. P. S. Porto, Flammarion Sciences, Paris p. 612 (1976) "Resonance Raman Study of Ion- Implantation Produced Damage in Cu_2O ."
19. R. M. Habiger and A. Compaan, Solid State Commun. 18, 1531 (1976) "Photoluminescence at High Exciton Densities in Cuprous Oxide."
20. J. F. Hesse, S. C. Abbi and A. Compaan, J. Appl. Phys. 47, 5467 (1976) "Resonance Raman Study of Annealing in Cadmium-Implanted Cuprous Oxide."
21. M. A. Washington, A. Z. Genack, H. Z. Cummins, R. H. Bruce, A. Compaan and R. A. Forman, Phys. Rev. B15, 2145 (1977) "Spectroscopy of Excited Yellow Exciton States in Cu_2O by Resonant Raman Scattering."
22. A. Compaan, Applied Spectroscopy Reviews, 13, 295-369 (1977) "Resonance Raman Scattering with Tunable Lasers."
23. R. M. Habiger and A. Compaan, Solid State Commun. 26, 533 (1977) "Lineshape Studies of the 1S Yellow Exciton in Cu_2O by Resonance Raman Scattering."

24. S. Chandra, A. Compaan and E. Wiener-Avneer, "Coherence and Quantum Optics IV" (1978), L. Mandel and E. Wolf eds. Plenum Press, New York, p. 27 "Higher Order Coherent Raman Scattering."
25. A. Compaan, E. Wiener-Avneer and S. Chandra, Phys. Rev. A17, 1083 (1978) "Second Order Coherent Raman Scattering."
26. E. Wiener-Avneer, S. Chandra and A. Compaan, Appl. Phys. Lett. 32, 268 (1978) "Third Order Nonlinear Susceptibility Ratios by CARS of Mixtures: CS₂ in C₆H₆."
27. A. Compaan and R. M. Habiger, 14th International Conf. on the Physics of Semiconductors, Edinburgh, Inst. Phys. Conf. Ser. No. 43 (c) 1979, p. 489 "Resonance Raman Measurements of Exciton- Phonon Dynamics in Cu₂O."
28. R. M. Habiger and A. Compaan, Phys. Rev. B18, 2907 (1978) "Width of Resonance Raman Enhancement Profiles in Cu₂O: The Phonon- Lifetime Contribution."
29. A. Compaan and S. Chandra, Optics Letters 4, 1970 (1978) "CARS with Counterpropagating Laser Beams."
30. S. Chandra, A. Compaan and E. Wiener-Avneer, Appl. Phys. Lett. 33, 867 (1978) "Coherent Raman Scattering with Three Lasers."
31. J. F. Hesse and A. Compaan, J. Appl. Phys. 50, 206 (1979) "Resonance Raman Studies of Annealing in He-, Na-, and Cd- Implanted Cuprous Oxide."
32. S. Chandra and A. Compaan, Optics Communications 31, 73 (1979) "Double Frequency Dye Lasers with a Continuously Variable Power Ratio."
33. H. W. Lo and A. Compaan, J. Appl. Phys. 51, 1565 (1980) "Raman Measurements of Temperature During CW Laser Heating of Silicon."
34. H. W. Lo and A. Compaan, Phys. Rev. Lett. 44, 1064 (1980) "Raman Measurement of Temperature During Pulsed Laser Heating of Silicon."
35. S. Chandra, A. Compaan and E. Wiener-Avneer, J. Raman Spectroscopy 10, 103 (1981) "Phase Matching in Coherent Anti- Stokes Raman Scattering."
36. A. Compaan and H. W. Lo in Laser and Electron Beam Processing of Materials, edited by C. W. White and P. S. Peercy, Academic Press, New York (1980) p. 71, "Raman Temperature Measurements During Laser Heating of Silicon."
37. A. Compaan and H. W. Lo in 11th Int. Conf. on Defects and Radiation Effects in Semiconductors, Proceedings (Sept. 8-11, 1980, Oiso, Japan), Inst. of Phys. Conference Series (London) (1981) p. 467, "Pulsed Raman Measurements of Laser-Heated Silicon."
38. H. W. Lo and A. Compaan, Appl. Phys. Lett. 38, 179 (1981) "Pulsed Raman Measurement of the Onset of Recrystallization in Laser Annealing."
39. A. Compaan, H. W. Lo, A. Aydinli and M. C. Lee, in Laser and Electron-Beam Solid Interactions and Materials Processing, Gibbons, Hess and Sigmon, eds. (North Holland, 1981) p. 15, "Time-Resolved Raman Scattering and Transmission Measurements During Pulsed Laser Annealing."
40. M. C. Lee, H. W. Lo, A. Aydinli and A. Compaan, Appl. Phys. Lett. 38, 499 (1981) "Time-Resolved Optical Transmission of Pulsed Laser-Irradiated Silicon."
41. A. Aydinli, H. W. Lo, M. C. Lee and A. Compaan, Phys. Rev. Lett. 46, 1640 (1981) "Induced Absorption in Silicon Under Intense Laser Excitation: Evidence for a Self-Confined Plasma."
42. J. A. Van Vechten and A. D. Compaan, Sol. State Commun. 39, 867 (1981) "Plasma Annealing State of Semiconductors; Plasmon Condensation to a Superconductivity-Like State at 1000K?"
43. A. Aydinli, A. Compaan, H. W. Lo and M. C. Lee, Phys. Lett. 86A, 199 (1981) "Time Resolved Transmission of GaAs Under Intense Laser Excitation."
44. A. Aydinli, H. W. Lo, M. C. Lee and A. Compaan, Phys. Rev. Lett. 47, 1565 (1981) "Aydinli et al. Respond" (response to comment on "Induced Absorption ...").
45. A. Aydinli, M. C. Lee, H. W. Lo and A. Compaan, Phys. Rev. Lett. 47, 1676 (1981) "Comment on 'Lattice Temperature During Pulsed Laser Annealing'."
46. A. Compaan, H.W. Lo, M.C. Lee & A. Aydinli, J. de Phys. (Paris) 42, C6-453 (1981), "Pulsed Raman Measurements of Inhibited Electron-Phonon Coupling at High Plasma Densities in Silicon."
47. M. C. Lee, A. Aydinli, H. W. Lo and A. Compaan, J. Appl. Phys. 53, 1262 (1982) "Validity of Raman and Transmission Data Reaffirmed." (comment)
48. A. Compaan, A. Aydinli, M. C. Lee and H. W. Lo in Laser and Electron Beam Interactions with Solids, B. R. Appleton and G. K. Celler, eds. (Elsevier North Holland, New York, 1982) p. 43, "Raman and Optical Properties of the Pulsed Laser Annealing Phase of Si."
49. A. Compaan, H. W. Lo, M. C. Lee and A. Aydinli, Phys. Rev. B26, 1079 (1982) "Time Reversal Invariance and Raman Measurements of Phonon Populations Under Non Equilibrium Conditions."
50. A. Compaan, H. W. Lo, A. Aydinli and M. C. Lee in Laser-Solid Interactions and Transient Thermal

- Processing of Materials, Narayan, Brown, Lemon, eds. (Elsevier, New York) p. 23, "Pulsed Raman Measurements of Phonon Populations: Time Reversal, Correction Factors and All That."
51. A. Compaan, M. C. Lee, H. W. Lo, G. J. Trott and A. Aydinli, *J. Appl. Phys.* 54, 4950 (1983) "Pulsed Raman Measurements of Lattice Temperature-Validity Tests."
 52. M. C. Lee, H. W. Lo, A. Aydinli, G. J. Trott and A. Compaan, *Sol. St. Comm.* 46, 677 (1983) "Nanosecond Optical Transmission Studies of Laser Annealing in Ion-Implanted Silicon-on-Sapphire."
 53. J. Wagner, A. Compaan and A. Axmann, *J. de Physique* 44, C5-61 (1983), "Photoluminescence in Heavily Doped Si and Ge."
 54. G. Contreras, A. Compaan and A. Axmann, *J. de Physique* 44, C5-193 (1983), "Raman Studies of the P Local-Mode-Vibration in P- Implanted, Laser-Annealed Ge."
 55. G. Contreras, A. Compaan, J. Wagner, M. Cardona and A. Axmann, *J. de Physique* 44, C5-55 (1983), "The E_1 - E_1+D_1 Transitions in Bulk Grown and in Implanted, Laser-Annealed Heavily Doped Germanium: Luminescence."
 56. A. Compaan, G. Contreras, M. Cardona and A. Axmann, *J. de Physique* 44, C5-197 (1983), "Phonon Softening in Ultra-Heavily Doped Si and Ge."
 57. L. Vina, C. Umbach, A. Compaan, M. Cardona and A. Axmann, *J. de Physique* 44, C5-203 (1983), "The Electronic Structure of Heavily Doped, Ion-Implanted, Laser-Annealed Silicon: Ellipsometric Measurements."
 58. L. Vina, C. Umbach, M. Cardona, A. Compaan and A. Axmann, *Sol. State Commun.* 48, 457 (1983) "Absorption Edge of Ultraheavily Doped Si."
 59. D. von der Linde, G. Wartmann and A. Compaan, *Appl. Phys. Lett.* 43, 613 (1983) "Comment on 'Raman Scattering with Nanosecond Resolution during Pulsed Laser Annealing of Silicon'."
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INVITED TALKS AND COLLOQUIA

- "Photon-Echo Decay," Yeshiva University, 19 December 1972.
- "Raman Scattering and Luminescence in Cu_2O ," Kansas State University, 12 February 1973.
- "Photon-Echo Decay in Ruby," Bell Telephone Labs, 15 March 1973.
- "Excitons and Raman Scattering," University of Kansas, 11 February 1974.
- "Resonance Raman Scattering with Continuously Tunable Lasers," 26th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Cleveland, March 3-7, 1975.
- "Symmetry-Forbidden Resonant Raman Scattering from Polar Phonons in Cu_2O ," 3rd International Conference on Light Scattering in Solids, Campinas, Brazil, July 1975 (with A. Z. Genack, M.A. Washington and H. Z. Cummins).
- "Coherent Anti-Stokes Raman Scattering," University of Kansas, Department of Physics, 7 November 1977.
- "Exciton-Phonon Scattering and Thermalization of Excitons in Semiconductors," University of Nebraska, Department of Physics, 13 April 1978.
- "Laser Annealing of Semiconductors," Kansas State University, Department of Electrical Engineering, 8 March 1979.
- "Laser Annealing of Semiconductors," Kansas State University, Department of Physics, 3 March 1980.
- "Raman Temperature Measurements During Pulsed Laser Heating of Silicon," IBM Watson Research Center, 15 April 1980; and Bell Telephone Labs (Murray Hill, N.J.), 16 April 1980.
- "Physical Mechanisms of Laser Annealing in Semiconductors," University of Missouri, Dept. of Physics Colloquium, 29 October 1980.
- "The Physics of Laser Annealing in Semiconductors," University of Illinois (Urbana), Solid State Physics Seminar, 31 October 1980.
- "Optical Properties of Silicon and GaAs Under Intense Laser Excitation: Evidence for a Self-Confined Plasma," U.S. Naval Research Lab, June 9; Bell Telephone Lab (Holmdel) June 15; IBM Watson Res. Ctr., June 17, 1981.
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 - J. Drayton, C. Taylor, A. Gupta, R.G. Bohn, A.D. Compaan, B.E. McCandless, and D. Rose, “Optical, structural and transport properties of reactively sputtered ZnTe:N,” National Center for Photovoltaics Program Review Meeting, Denver, Oct. 14-17, 2001.
 - A.D. Compaan, Diana Shvydka, K.J. Price, A. Vasko, V.G. Karpov, “Bias-dependent Luminescence in CdS/CdTe Cells,” National Center for Photovoltaics Program Review Meeting, Denver, Oct. 14-17, 2001.
 - Diana Shvydka, A.D. Compaan, and V.G. Karpov, “Nonlocal Optical Response in CdTe Photovoltaics,” National Center for Photovoltaics Program Review Meeting, Denver, Oct. 14-17, 2001.
 - Xiangxin Liu, Akhlesh Gupta, Alvin D. Compaan (Dept. of Physics and Astronomy, University of Toledo), Nadia Leyarovska (Biological, Chemical, and Physical Sciences, Illinois Institute of Technology), Jeff Terry (Dept. of Physics, University of Notre Dame), The Materials Research Collaborative Access Team “K-edge EXAFS and XANES studies of Cu in CdTe thin-film solar cells” (Presentation B28.015, Am. Phys. Soc. Mtg, March 2002, Indianapolis, IN)
 - Jennifer A. Drayton, Alvin D. Compaan (The University of Toledo, Department of Physics and Astronomy) “Spectroscopy of molecular nitrogen during reactive sputtering of ZnTe:N” (Presentation C33.156, Am. Phys. Soc. Mtg, March 2002, Indianapolis, IN)
 - Ilvydas Matulionis (Dept. of Physics and Astronomy, The University of Toledo, Toledo, Ohio 43606, USA), Akhlesh Gupta, Jennifer A. Drayton, Alvin D. Compaan “Substrate Configuration Cadmium Telluride Solar Cells” (Presentation H33.106, Am. Phys. Soc. Mtg, March 2002, Indianapolis, IN)
 - Brian Sunderland (Colorado College, Colorado Springs, Colorado 80903-3298), Akhlesh Gupta, Alvin D. Compaan (University of Toledo, Department of Physics and Astronomy, Toledo, Ohio 43606-3390) “Nickel Phosphide as a Copper Free Back Contact for CdTe-Based Solar Cells” (Presentation S17.013, Am. Phys. Soc. Mtg, March 2002, Indianapolis, IN)
 - Kathleen Hinko (University of Toledo) “Photoluminescence of magnetron sputtered CdTe films: dependence on target purity, substrate, and annealing conditions,” (Presentation D31.013, Am. Phys. Soc. Mtg, March 2002, Indianapolis, IN)
 - D. Shvydka, V.G. Karpov, and A.D. Compaan, “Low Light Diagnostics in Thin-Film Photovoltaics,” March 2003 meeting of the American Physical Society, Austin, TX.
 - V.G. Karpov, A.D. Compaan, D. Shvydka, “A new class of disordered systems: larg-area electronics,” March 2003 meeting of the American Physical Society, Austin, TX.

GRADUATE STUDENTS DIRECTED

Robert M. Habiger

M.S. December 1975 "Photoluminescence Studies of the Yellow Series Free Exciton in Cuprous Oxide Using Pulsed and Continuous Wave Tunable Dye Lasers"

Ph.D. August 1978 "A Study of Exciton Lifetimes in Cuprous Oxide Using Tunable Dye Lasers"

Joseph F. Hesse

M.S. August 1977 "Resonance Raman Scattering and Optical Reflectivity Studies of Ion-Implantation-Produced Damage in Cuprous Oxide"

Ho Wai Lo

M.S. December 1979 "Raman Measurements of Temperature During Continuous Wave Laser--Induced Heating of Silicon"

Ph.D. August 1982 "Raman Measurements of Lattice Temperature in Silicon Under Intense Pulsed Laser Excitation"

Ming Chih Lee

M.S. May 1982 "Time Resolved Transmission and Reflectivity Studies of Pulsed-Laser Irradiated Silicon-on-Sapphire"

Ph.D. September 1984 "Transient Raman Studies of Intense Laser-Irradiated Silicon Under Pulsed Laser Annealing Conditions"

Huade Yao

M.S. May 1986 "Raman Measurements of Dye-Laser-Annealed, Ion-Implanted GaAs"

Ph.D. May 1989 "Optical Studies of Extremely Heavily Doped n-GaAs Produced by Pulsed Laser Annealing"

Ajit Bhat

M.S. August 1987 "Time-Resolved Reflectivity Study of Pulsed-Laser-Irradiated, Si₃N₄ Capped GaAs"

Ph.D. December 1991 "Thin Film Preparation Using Pulsed Laser Deposition"

Brijesh Aggarwal

M.S. August 1988 "Laser Annealing Studies of HgCdTe and Surface Profiling Using Raman Spectroscopy"

Mai Nguyen

M.S. April 1991 "Photoluminescence and Raman Scattering from CdTe and CdS Films Grown by Laser-Driven Physical Vapor Deposition"

Shu Zhen Liu

M.S. Feb. 1991 "Spectral Quantum Efficiency Measurements in CdTe/CdS Solar Cells"

Marc Savage

M.S. Dec. 1992 "Raman Studies of Heavily Doped Polycrystalline Si-Films Prepared by Excimer-Laser Annealing of Doped a-Si:H."

Yuxin Li

M.S. June 1993 "Photoluminescence Studies of CdS and CdTe Films Grown by LDPVD and RF Sputtering."

Zhirong Feng

M.S. June 1994 "Photoreflectance and Electoreflectance Studies of CdTe Films and CdTe/CdS Heterostructures"

Faming Shen

M.S. Aug. 1994 "Frequency Dependent C-V Measurements on CdTe Solar Cells"

Meilun Shao
Ph.D. June 1995 "CdTe and CdS Thin Film Preparation Using RF Plenum Magnetron Sputtering"

Andreas Fischer
Ph.D. Oct. 1996 "Photoluminescence and Raman Studies of CdTe, CdS_xTe_{1-x} Alloys and CdS/CdTe Thin-Film Solar Cells"

Eugene Bykov
M.S. Mar. 1997 "Capacitance Measurements for Quantitative Analysis of Sputtered CdTe Solar Cells"

David Zuo
M.S. Dec. 1997 "Optical Absorption of CdS_xTe_{1-x} Alloy Films at 10K"

Chitra Narayanswamy
M.S., Dec. 1998 "SIMS Analysis of Cu in ZnTe-Based Back Contacts for CdTe/CdS Solar Cells"

Ilydas Matulionis
M.S. 1998
Ph.D., December 2002, "Superstrate and Substrate Type CdTe Solar Cells and Monolithic Integration of Photovoltaic Materials"

Dan Grecu
M.S. 1997
Ph.D. August 1999, "Photoluminescence Study of Cu-doped CdTe and Related Stability Issues for CdS/CdTe Solar-Cell Devices"

Shogo Nakade
M.S., May 1999 "Time-Resolved Reflectivity Measurements on Thin-Film Photovoltaic Materials"

Diana Shvydka
M.S.
Ph.D., August 2002, "Physical Characterization of CdTe/CdS Photovoltaics: Defects, Fields, and Micrononuniformities"

Konstantin Makhratchev
M.S. June 2000

Jeff Gottschalk
M.S.

Xianda Ma
M.S., June 1999 "ZnTe:N Film as a Back Contact Material for Solar Cells"

Jennifer Drayton
M.S. December 2003
Ph.D. December 2005, "Studies of rf sputtered ZnTe:N and CdS for photovoltaic applications"

Viral Parikh
M.S. 2005
Ph.D. December 2007, "Studies of two-terminal and four-terminal polycrystalline thin-film tandem solar cells based on II-VI materials."

Xiangxin Liu
M.S. May 2005
Ph.D. December 2005, "Extended X-ray Absorption Fine Structure (EXAFS) and Photoluminescence Studies of CdTe Material"

Anthony Vasko
M.S. in progress
Ph.D. in progress

Karthikeya Allada
M.S. in progress

Victor Plotnikov
M.S. in progress
Ph.D. in progress

Aaron Korostyshevsky
M.S. in progress

DoHyoung Kwon
Ph.D. in progress

Amruta Nawarange
Ph.D. in progress

Naba Paudel
Ph.D. in progress

POSTDOCTORAL FELLOWS and VISITING SCHOLARS DIRECTED

Atilla Aydinli	1980-1983
Gary J. Trott	1982-1984
Upali J. Jayamaha	1995-1996
Andreas Fischer	1/97-6/97
Ralf Wendt	3/97-6/97
Kent Price	10/98-7/00
WooGeun Lee	3/00-1/01
Akhlesh Gupta	4/01-7/05
Sunghyun Lee	3/02-2/04
Diana Shvydka	9/02-10/06
Shanli Wang	7/02-6/05
Xavier Mathew	7/05-7/06
Jennifer Drayton	1/06-1/07
Xiangxin Liu	6/07--
Snigdha Gupta	3/07—3/08
James Walker	3/07-8/07
Kristopher Wieland	7/07--