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Educational Degrees

1987 **Ph.D**. Optical Science, University of Arizona, Tucson, AZ
Dissertation: Polarization Aberrations
Advisor: Jim Wyant
1984 **M.S**. Optical Science, University of Arizona, Tucson, AZ
1976 **B.S**. Physics, MIT, Cambridge, MA

Representative Legal Experience

I was retained by Manatt, Phelps & Phillips, LLP, from March 2016 to July 2018, for the case Core Optical Technologies, LLC v. Fujitsu Network Communications, Inc., Case No.: 8:16-CV-00437, United States District Court for the Central District of California, and Fujitsu Network Communications, Inc., Petitioner, v. Core Optical Technologies, LLC, Patent Owner, Case IPR2016-01618, before the Patent Trial and Appeal Board.

I was retained by Quinn Emmanuel Urquhart & Sullivan, from May to July 2014, for the case Reald Inc. v. Volfoni, Inc., et al., Case No. 2:14-cv-2303., United States District Court for the Central District of California.

I was retained by Quinn Emmanuel Urquhart & Sullivan, from August 2010 to December 2012, for the case 3M vs. Avery Dennison, Case No. 0:10-cv-02630-MJD-FLN, United States District Court for the District of Minnesota. I provided measurements, analysis, expert reports, and a deposition on September 28, 2010.

I was retained by Morgan, Lewis & Bockius, from October 2008 to February 2013, on behalf of Fuji Film and Fujinon, in cases against (i) Motorola (Civil Action No. 07-533-GMS-LPS, Fuji prevailed), (ii) HTC (Civil Action No. H.09.4109, I was not informed of the outcome), and (iii) Largan Precision Co. (CV-10-1318(SBA), Fuji prevailed) from October 2008 through February 2013. I provided measurements, analysis, and expert reports.

Chronology of Employment

2002-Present	**Professor**	College of Optical Sciences, University of Arizona Received tenure, July 2006
2016-Present	**Airy Optics, Inc**	Founder and CEO of optical software company
2002-Present	**Axometrics, Inc**	Board of Director and co-founder of polarization test equipment company
2000-2002	**Senior Manager**	Network Appliances Department, JDS Uniphase
1999-2000	**Senior Manager**	Optical Engineering Department, TeraStor Corporation
1997-1998	**Director of Optics R & D**	Innotech, Johnson & Johnson, Inc.
1987-1997	**Full/Associate/Assistant Physics Professor**	University of Alabama in Huntsville
1988-1994	**Consultant**	AT&T Bell Laboratories
1982-1986	**Graduate Research Assistant**	University of Arizona, Optical Sciences Center
1978-1981	**Physicist**	Beckman Instruments Inc.
1977-1978	**Optical Engineer**	Perkin Elmer Corporation

Books

1.   **Polarized Light and Optical Systems,** Russell A. Chipman, Wai Sze Tiffany Lam, and Garam Young, CRC Press, (2018) ISBN13: 798-1-4987-0056-6

Honors and Awards

Joseph Fraunhofer Award/Robert M. Burley Prize, Optical Society of America, 2015, For imaging polarimetry and spectro-polarimetry
G. G. Stokes Award, SPIE, 2007, for fundamental contributions to polarization science
Tenured, College of Optical Sciences, University of Arizona, 2006.
NASA Tech Brief Award for New Technology "High-accuracy multiangle spectropolarimetric imaging concept for aerosol remote sensing from space", 2005.
Elected to Board of Directors of SPIE, 1996-1998.
Fellow, SPIE, 1997.
Researcher of the Year, Sigma Xi, Univ. of Alabama in Huntsville Chapter, 1997.
Fellow, Optical Society of America, 1996.

Patents

1.   R. Chipman, R. Obremski, and C. Brown, "**Multicomponent Quantitative Analytical Method and Apparatus**", U.S. **4,660,151**.
2.   R.A. Chipman and D.B. Chenault, "**Achromatic Infrared Retarder**", U.S. Patent **4,961,634**.
3.   D.G. Goldstein and R.A. Chipman, "**Infrared Spectropolarimeter**", U.S. Patent. **5,045,701**.

4. Matthew H. Smith, Russell A. Chipman, Thomas E. Minnich, Lloyd Hillman, and Kurt R. Denninghoff, "**Method and apparatus for accurately measuring the blood oxygen saturation within a retinal vessel with light having several selected wavelengths**", U.S. Patent **5,776,060**.
5. Smith; Matthew H.; Chipman; Russell A.; Minnich; Thomas E.; Hillman; Lloyd W.; Denninghoff; Kurt R**.**, "**Method and apparatus for accurately measuring the transmittance of blood within a retinal vessel**", US Patent **5,935,076**.
6. Chipman; Russell A.; Reardon; Patrick; Gupta; Amitava**, "Ophthalmic optic devices"**, US Patent **6,000,798**.
7. Chipman; Russell A.; Drewes; Jonathan J.; Hadaway; James B., "**Image quality mapper for progressive eyeglasses"**, US Patent **6,072,570**.
8. Blum; Ronald D.; Chipman; Russell A.; Gupta; Amitava; Menezes; Edgar, **"Progressive addition lenses"**, **6,086,203**.
9. Chipman; Russell A.; Reardon; Patrick, **"Progressive addition lenses"**, **6,183,084**.
10. Smith; Matthew H.; Hillman; Lloyd W.; Denninghoff; Kurt R.; Chipman; Russell A., "**Optical scanning spectroscopic apparatus and associated method"**, **6,244,712**.
11. Chipman; Russell A. and Martinelli; Massimo, **"Polarization controller"**, US Patent **6,947,618**.
12. Waarts; Robert G. and Chipman; Russell A., **"Method and apparatus for polarization mode dispersion monitoring in a multiple wavelength optical system"**, US Patent **7,203,428**.
13. Strauch, III; Lester D., Kreis; Richard J., Chipman; Russell, Crabtree; Karlton, **"Radiation source with self-aligning optics"**, US Patent **7,567,391.**
14. Chipman; Russell, Crabtree; Karlton, **"Polarization Coupling Cube-Corner Retroreflectors"**, Japan Patent **4,482,603.**
15. **Advanced polarization imaging method, apparatus, and computer program product for retinal imaging, liquid crystal testing, active remote sensing, and other applications,** Russell A. Chipman, 7,612,880.
16. **Method and apparatus for measuring near-angle scattering of mirror coatings**, US 8,502,987, *Chipman*; Russell A., Daugherty; Brian J., McClain; Stephen C. , Macenka; Steven A.
17. **Polarization coupling cube-corner retro-reflectors**, US 8,421,711, *Chipman*; Russell A., Crabtree; Karlton
18. **Microgrid imaging polarimeters with frequency domain reconstruction**, U.S. Patent 8,823,848, Chipman, Russell A., Stanley Pau, J. Scott Tyo, and Bradley M. Ratliff, issued September 2, 2014.

Publications, Refereed

1. **Binary classification of Mueller matrix images from an optimization of Poincaré coordinates,** M. Kupinski, J. Bankhead, A. Stohn, and R. Chipman, J. Opt. Soc. Am. A 34, 983-990 (2017)
2. **Polarization Aberrations in Astronomical Telescopes: The Point Spread Function**, James B. Breckinridge, Wai Sze T. Lam and Russell A. Chipman, published online March 31, 2015.
3. **Balancing polarization aberrations in crossed fold mirrors**, Tiffany Lam, Wai Sze, and Russell Chipman, *Applied Optics* 54.11 (2015): 3236-3245.
4. **Relating the statistics of the angle of linear polarization to measurement uncertainty of the Stokes vector**, Kupinski, Meredith, Russell Chipman, and Eric Clarkson, *Optical Engineering* 53.11 (2014): 113108-113108.
5. **The Airborne Multiangle SpectroPolarimetric Imager (AirMSPI): a new tool for aerosol and cloud remote sensing**, D. J. Diner, F. Xu, M. J. Garay, J. V. Martonchik, B. E. Rheingans, S. Geier, A. Davis, B. R. Hancock, V. M. Jovanovic, M. A. Bull,

K. Capraro, R. A. **Chipman**, and S. C. McClain, Atmos. Meas. Tech., **6**, 2007-2025, 2013.

6. **Exploration of a Polarized Surface Bidirectional Reflectance Model Using the Ground-Based Multiangle SpectroPolarimetric Imager**, Diner, D.J.; Xu, F.; Martonchik, J.V.; Rheingans, B.E.; Geier, S.; Jovanovic, V.M.; Davis, A.; Chipman, R.A.; McClain, S.C., *Atmosphere* **2012**, *3*, 591-619.

7. **Liquid crystal polymer full-stokes division of focal plane polarimeter**, G. Myhre, W. Hsu, A. Peinado, C. LaCasse, N. Brock, R. Chipman, and S. Pau, Opt. Express 20, 27393-27409 (2012).

8. **Role of the null space of the DRM in the performance of modulated polarimeters,** C. LaCasse, J. Tyo, and R. Chipman, Opt. Lett. 37, 1097-1099 (2012)**.**

9. **Mueller matrix roots depolarization parameters**, Hannah D. Noble, Stephen C. McClain, and Russell A. Chipman, Appl. Opt. **51**, 735-744 (2012) http://www.opticsinfobase.org/ao/abstract.cfm?URI=ao-51-6-735

10. **Mueller matrix roots algorithm and computational considerations**, H. Noble and R. Chipman, Opt. Express 20, 17-31 (2012).

11. **Retinal oximeter for the blue-green oximetry technique**, Denninghoff KR, Sieluzycka KB, Hendryx JK, Ririe TJ, DeLuca L, Chipman RA;. J. Biomed. Opt. 0001;16(10):107004-107004-7. doi:10.1117/1.3638134.

12. **Rapid development of septic shock in a swine model using cecal ligation and perforation plus fecal inoculation,** DeLuca, Lawrence, Jennifer Hendryx, Tyson Ririe, Russell A. Chipman 4 Curriculum Vitae, July 8, 2016 Kristina Voss, Brendan Munzer, Benjamin Juan, Russell Chipman, and Kurt Denninghoff, *Critical Care Medicine* 40, no. 12 (2012): 1-328.

13. **Measurement of retinal venous oxygen saturation during progressive hypoxia in swine in vivo using the blue-green minima technique**, DeLuca, Lawrence, Tyson Ririe, Jennifer Hendryx, Kristina Voss, Benjamin Juan, Brendan Munzer, Russell Chipman, and Kurt Denninghoff. Critical Care Medicine 40, no. 12 (2012): 1-328.

14. **Skew aberration: a form of polarization aberration,** G. Yun, K. Crabtree, and R. Chipman, Opt. Lett. 36, 4062-4064 (2011).

15. **Formulation of rigorous coupled-wave theory for gratings in bianisotropic media**, M. Onishi, K. Crabtree, and R. Chipman, J. Opt. Soc. Am. A 28, 1747-1758 (2011).

16. **Square-wave retarder for polarization computer-generated holography**, H. Noble, W. Lam, W. Dallas, R. Chipman, I. Matsubara, Y. Unno, S. McClain, P. Khulbe, D. Hansen, and T. Milster, Appl. Opt. 50, 3703-3710 (2011).

17. **Polarization state generator: a polarimeter calibration standard**, A. Mahler and R. Chipman, Appl. Opt. 50, 1726-1734 (2011).

18. **Achromatic athermalized retarder fabrication**, A. Mahler, S. McClain, and R. Chipman, Appl. Opt. 50, 755-765 (2011).

19. **Three-dimensional polarization ray-tracing calculus II: retardance**, G. Yun, S. McClain, and R. Chipman, Appl. Opt. 50, 2866-2874 (2011).

20. **Three-dimensional polarization ray-tracing calculus I: definition and diattenuation**, G. Yun, K. Crabtree, and R. Chipman, Appl. Opt. 50, 2855-2865 (2011).

21. **Analysis of static and time-varying polarization errors in the multiangle spectropolarimetric imager**, A. Mahler, D. Diner, and R. Chipman, Appl. Opt. 50, 2080-2087 (2011).

22. **Band limited data reconstruction in modulated polarimeters**, C. LaCasse, R. Chipman, and J. Tyo, Opt. Express 19, 14976-14989 (2011).

23. **First results from a dual photoelastic-modulator-based polarimetric camera**, Diner, David J; Davis, Ab; Hancock, Bruce; Geier, Sven; Rheingans, Brian; Jovanovic, Veljko; Bull, Michael; Rider, David M; Chipman, Russell A; Mahler, Anna-Britt; McClain, Stephen C, Applied Optics, Vol. 49 Issue 15, pp.2929-2946 (2010)

24. **Polarization synthesis by computer generated holography using orthogonally polarized speckle patterns**, H. Noble, E. Ford, W. Dallas, R.A. Chipman, I. Matsubara, Y. Unno, S. McClain, P. Khulbe,D. Hansen, and T. Milster, Optics Letters 35, 20 (2010).

25. **Polarization conversion cube-corner retroreflector**, Crabtree, Karlton; Chipman, Russell, Applied Optics, Vol. 49 Issue 30, pp.5882-5890 (2010)

26. **Polarization synthesis by computer-generated holography using orthogonally polarized and correlated speckle patterns**, Noble, H; Ford, E; Dallas, W; Chipman, R A; Matsubara, I; Unno, Y; McClain, S; Khulbe, P; Hansen, D; Milster, T D, Optics Letters, Vol. 35 Issue 20, pp.3423-3425 (2010)

27. **Diffuse spectral fundus reflectance measured using subretinally placed spectralon**, David A. Salyer, Kurt R. Denninghoff, Neil Beaudry, Sreenivasa Basavanthappa, Robert I. Park, and Russell A. Chipman, J. Biomed. Opt. 13, 044004 (2008)

28. **Mueller matrix retinal imager with optimized polarization conditions**, K. M. Twietmeyer, R. A. Chipman, Ann E. Elsner, Y. Zhao, and D. VanNasdale, Opt. Express 16, 21339-21354 (2008)

29. **Blue-green spectral minimum correlates with oxyhemoglobin saturation *in vivo***, Kurt R. Denninghoff, David A. Salyer, Sreenivasa Basavanthappa, Robert I. Park, and Russell A. Chipman, J. Biomed. Opt. 13, 054059 (2008)

30. **Optimization of Mueller matrix polarimeters in the presence of error sources**, K. M. Twietmeyer and R. A. Chipman, Opt. Express 16, 11589-11603 (2008)

31. **Vortex retarders produced from photo-aligned liquid crystal polymers**, Scott C. McEldowney, David M. Shemo, and Russell A. Chipman, Opt. Express 16, 7295-7308 (2008)

32. **Creating vortex retarders using photoaligned liquid crystal polymers,** S.C. McEldowney, D.M. Shemo, R.A. Chipman and P.K. Smith, *Optics Letters*, vol. 33, no.2 (January 15, 2008).

33. **Subwavelength-grating-induced wavefront aberrations: a case study,** K. Crabtree and R.A. Chipman, *Applied Optics*, vol. 46, issue 21, pp. 4549-4554, (July 6, 2007).

34. **Dual-photoelastic-modulator-based polarimetric imaging concept for aerosol remote sensing,** D.J. Diner, Ab. Davis, B. Hancock, G. Gutt, R.A. Chipman and B. Cairns, *Applied Optics*, vol. 46, issue 35, pp. 8428-8445 (December 3, 2007).

35. **Dielectric tensor measurement from a single Mueller matrix image**, Neil A. Beaudry, Yanming Zhao, and Russell Chipman *JOSA A*, Vol. 24, no. 3, pp. 814-824 (Mar. 2007).

36. **Retinal oximetry using intravitreal illumination,** D.A. Salyer, N. Beaudry, S. Basavanthappa, K. Twietmeyer, M. Eskandari, K.R. Denninghoff, R.A. Chipman, R.I. Park, *Current Eye Research*, vol. 31, no. 7-8, pp. 617-627 (July-Aug. 2006).

37. **Evanescent imaging ellipsometry based microarray readers,** S. Venkatasubbarao, N. Beaudry, Y. Zhao, R. Chipman, *J Biomedical Optics*, vol. 11, pp. 014-028 (2006).

38. **Blood Oxyhemoglobin Saturation Measurements by Blue-Green Spectral Shift**, K. Denninghoff, R. Chipman, L. Hillman, *Optics Letters*, vol. 31, no. 7, pp. 924-926 (April 2006).

39. **Polarimetric characterization of liquid crystal on silicon panels,** J. Wolfe, R. A. Chipman, *Applied Optics*, vol. 45, issue 8, pp. 1688-1703 (March 2006).

40. **Depolarization of diffusely reflecting manmade objects**, B. DeBoo, J. Sasian, R. Chipman, *Applied Optics*, vol. 44, no. 26, pp. 5434-5445 (Sept. 10, 2005).

41. **The depolarization index and the average degree of polarization**, R. A. Chipman, *Applied Optics*, vol. 44, no.13, pp.2490-2495, (May 2005).

42. **In Vitro multispectral diffuse reflectance measurements of the Porcine fundus,** D. A. Salyer, K. Twietmeyer, N. Beaudry, S. Basavanthappa, R. I. Park, R. A. Chipman, *Invest. Ophthalmology Vis. Sci.* vol. 46, pp. 2120-2124 (Apr. 2005).

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