Christopher M. Spillmann

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Education:

University of Rochester, Rochester, New York, 1997-2003
Ph.D. in Biophysics, Awarded 2004
Committee: Richard E. Waugh, Ph.D. (advisor) Chairman of Biomedical Engineering Dept.
Philip A. Knauf, Ph.D., Professor of Biochemistry and Biophysics
Ingrid Sarelius, Ph.D., Professor of Pharmacology and Physiology
Denise C. Hocking, Ph.D., Assistant Professor of Pharmacology and Physiology
Dissertation: *The Role of Force and Cell Rheology in Neutrophil Adhesion Mediated by β_2-Integrin*
M. S. in Biophysics, Awarded 2000

College of Wooster, Wooster, Ohio, 1993-1997
B.A. in Physics with honors, 1997

Research Experience:

Research Physicist, Navy Civilian, Center for Bio/Molecular Science and Engineering, Naval Research Laboratory, 2006-present

- Principal Investigator: Understand the biochemical composition and mechanism of barnacle cement and secretions
  - Develop and manage efforts to collect and analyze composition of barnacle tissue and cement samples
  - Utilize advanced microscopy/spectroscopy techniques to image barnacle interface and develop an understanding of biomacromolecular profile
- Principle Investigator: Develop, characterize, and mature liquid crystal (LC)-based non-mechanical beam steering in the infrared
  - -Characterize and develop low absorption LCs in the infrared
  - -Coordinate incorporation of infrared transparent glasses and conductive substrates and electrodes with low-loss LC
- Characterization of electrically-actuated liquid crystalline elastomer (LCE)
  - -Develop novel applications for electrically-actuated LCEs
  - -Develop novel technique to demonstrate and characterize mechanical response of elastomer to electrical stimulus
  - -Demonstrate preservation and rotation of ordered molecular domains in response to applied strain
- Characterization of functionally active liquid crystalline nanoparticles for novel applications
  - -Electrically and light-driven nanoactuation

-Tunable fluorescent emission of an organic nanoparticle driven by controlled molecular aggregation, i.e. "organic quantum dot"

-fluorescent tag, cellular drug delivery vehicle

- Develop understanding of directed nanoscale energy transfer

  - Fluorescent resonance energy transfer between inorganic nanoparticle and organic fluorophores

  - Consider performance and design parameters of directed energy transfer on biological scaffolds utilizing DNA nanotechnology

Post-Doctoral Research Associate, Center for Bio/Molecular Science and Engineering, Naval Research Laboratory, 2004-2006

Research Advisor: *Dr. Banahalli R. Ratna*

- Development and mechanical analysis of thermally-driven nematic liquid crystal elastomer for linear actuation applications
- Design and characterization of method for stacking thermally actuated nematic LCEs embedded with heating elements for high force production
- Aid in design and development of prototype deformable fin for unmanned underwater vehicle based on the biological model of the bird wrasse
- Development and characterization of novel electrically-actuated electroclinic LCEs
  - -Tune elastomer material properties to optimize strength of material and mechanical response to electrical stimulus
  - -Develop novel technique to demonstrate and characterize mechanical response of elastomer to electrical stimulus
- Techniques for characterization of macroscopic and molecular actuation include use of dynamic mechanical analyzer, polarized & confocal microscopy, and x-ray scattering

Doctoral Research*:* Department of Biochemistry and Biophysics, University of Rochester, 1997-2003

Research Advisor: *Dr. Richard E. Waugh*

- Development of a technique to investigate homotypic neutrophil adhesion assessed by micropipette manipulation and use of divalent ions to stimulate integrin binding
- Investigation of the influence of force on the neutrophil contact area and the probability of establishing adhesive contacts with ligand-coated surfaces as it relates to inflammation
- Development of models to predict leukocyte deformation under applied force and how this relates to the formation of adhesive contacts with a substrate
- Basic experience with sterile tissue culture techniques, flow cytometry, surface chemistry
- Data and image acquisition/analysis with LabVIEW, NIH Image, MatLab, C++

Undergraduate Research*:* Department of Physics, College of Wooster, 1996-97

Research Advisors: *Dr. John Lindner, Dr. Anna Plopis Andrews*

- Senior Thesis, "The Kinetics of the Self-Assembly of Fatty Acid Aggregates," a continuing study of surface pressure of a self-assembling fatty acid aggregate and its fractal dimensions using a Langmuir balance
- Junior Independent Study, numerical simulations and computer modeling developed to describe the harmonics found in colliding cylinders

Awards:

51st ARPAD Basic Research Publication Award (2019), Frantz J.A., J.D. Myers, R.Y. Bekele, C.M. Spillmann, J. Kolacz, H. Gotjen, V.Q. Nguyen, C.C. McClain, J.S. Sanghera, "Chip-based nonmechanical beam steerer in the midwave infrared," *JOSA B*, 2018, 35(12):C29-37.

48th ARPAD Basic Research Publication Award (2016), So, C.R., K.P. Fears, D.H. Leary, J.M. Scancella, Z. Wang, J.L. Liu, B. Orihuela, D. Rittschof, C.M. Spillmann, K.J. Wahl, "Sequence basis of Barnacle Cement Nanostructure is Defined by Proteins with Silk Homology," *Scientific Reports*, 2016, 6:36219.

2015 Naval Research Laboratory Technology Transfer Award, Transition of liquid crystal (LC)-based steerable electro-evanescent optical refraction (SEEOR) devices for non-mechanical beam steering (NMBS) in the mid-wave infrared (MWIR).

46th ARPAD Basic Research Publication Awards (2014)

i) Spillmann, C.M., M.G. Ancona, S. Buckhout-White, W.R. Algar, M.H. Stewart, K. Susumu, A.L. Huston, E.R. Goldman, I.L. Medintz, "Achieving Effective Terminal Exciton Delivery in Quantum Dot Antenna-Sensitized Multistep DNA Photonic Wires," *ACS Nano*, 2013, 7(8):7101–7118

ii) Boeneman K., J.B. Delehanty, J.B. Blanco-Canosa, K. Susumu, M.H. Stewart, E. Oh, A.L. Huston, G. Dawson, S. Ingale, R. Walters, M. Domowicz, J.R. Deschamps, W.R. Algar, S. DiMaggio, J. Manono, C.M. Spillmann, D. Thompson, T.L. Jennings, P.E. Dawson, I.L. Medintz, "Selecting Improved Peptidyl Motifs for Cytosolic Delivery of Disparate Protein and Nanoparticle Materials," *ACS Nano***,** 2013, 7(5):3778–3796.

44th ARPAD Basic Research Publication Awards (2012)

i) (**cover article**) Burden, D. K., D. E. Barlow, C. M. Spillmann, B. Orihuela, D. Rittschof, R. K. Everett, K. J. Wahl, "Barnacle *Balanus amphitrite* Adheres by a Stepwise Cementing Process," *Langmuir*, 2012, *28*(37):13364–13372.

ii) Shields, A. R., C. M. Spillmann, J. Naciri, P. B. Howell, A. L. Thangawng, F. S. Ligler, "Hydrodynamically directed multiscale assembly of shaped polymer fibers," *Soft Matter*, 2012, 8(24):6656-6660.

42nd ARPAD Basic Research Publication Award (2010), Spillmann, C.M., J. Naciri, G.P. Anderson, M.-S. Chen, B.R. Ratna, "Spectral tuning of organic nanocolloids by controlled molecular interactions," *ACS Nano*, 2009, 3(10):3214-3220.

41st ARPAD Basic Research Publication Award (2009), Spillmann, C.M., J.H. Konnert, J.R. Deschamps, J. Naciri, B.R. Ratna, "Molecular Packing in Electroclinic Liquid Crystal Elastomer Films," *Chemistry of Materials*, 2008, 20(19):6130-6139.

National Research Council Post-Doctoral Associateship, 2004

Peer-reviewed competitive monetary award, funding a 2-year associateship at a national laboratory based on academic accomplishments and quality of proposed research

George V. Metzger Award, 2003

Monetary award for excellence of a Ph.D. thesis and for the research leading to the dissertation in the Program in Biophysics at the University of Rochester

Teaching Assistant Award, 1999

Competitive monetary award, given to one student each semester at the University of Rochester School of Medicine and Dentistry

College Scholar, 1993-97

Competitive and substantial scholarship based on merit

Professional Memberships:

Sigma Xi

Publications:

Myers, J.D., J.A. Frantz, C.M. Spillmann, H.G. Gotjen, J. Kolacz, J. Naciri, C. P. McGinty, A. Clabeau, R.Y. Bekele, J.S. Sanghera, C. Dunay, M. Pauli, D. Burchick, J. Auxier, "High-Speed, Low SWaP Non-mechanical Beam Steering in the Midwave Infrared," *JDR&E*, 2021, 4(2):49-59.

Schultzhaus, Janna N., Chenyue Wang, Shrey Patel, Madeline Smerchansky, Daniel Phillips, Chris R. Taitt, Dagmar H. Leary, Judson Hervey, Gary H. Dickinson, Christopher R. So, Jenifer M. Scancella, Kathryn J. Wahl, and Christopher M. Spillmann, "Distribution of Select Cement Proteins in the Acorn Barnacle *Amphibalanus amphitrite*," *Frontiers in Marine Science*, 2020, doi:10.3389/fmars.2020.586281.

McGinty, C.P., T. Salvato, Z. Salvato, J. Kolacz, H.G. Gotjen, C.M. Spillmann, "Large, Tunable Liquid Crystal Pretilt Achieved by Enhanced Out-of-Plane Reorientation of Azodye Thin Films," *Langmuir*, 2020, 36(29): 8554-8559, doi: 10.1021/acs.langmuir.0c01371

Schultzhaus, J. N., C.R. Taitt, B. Orihuela, M. Smerchansky, Z.S. Schultzhaus, D. Rittschof, K.J. Wahl, C.M. Spillmann, "Comparison of seven methods for DNA extraction from prosomata of the acorn barnacle, *Amphibalanus amphitrite*," *Analytical Biochemistry*, 2019, doi: 10.1016/j.ab.2019.113441.

Kołacz, J., H.G. Gotjen, R.Y. Bekele, J.D. Myers, J.A. Frantz, M. Ziemkiewicz, C.M. Spillmann, "Propagating Transverse Electric and Transverse Magnetic Modes in Liquid Crystal-Clad Planar Waveguides," *Liquid Crystals*, 2019, doi:10.1080/02678292.2019.1662110.

Schultzhaus, J.N., S.N. Dean, D.H. Leary, W.J. Hervey, K.J. Wahl, C.M. Spillmann, "Analysis of the *Amphibalanus amphitrite* adhesive proteome using pressure cycling technology: Method development and the effect of extraction solvents," *Integrative Biology*, 2019, doi:10.1093/intbio/zyz020.

Fears, K.P., A. Barnikel, A. Wassick, H. Ryou, J.N. Schultzhaus, B. Orihuela, J.M. Scancella, C.R. So, K.Z. Hunsucker, D.H. Leary, G. Swain, D. Rittschof, C.M. Spillmann, K.J. Wahl, "Adhesion of Acorn Barnacles on Surface-Active Borate Glasses," *Phil. Trans. R. Soc. B*, 2019, doi: 10.1098/rstb.2019.0203.

Wang C., J.N. Schultzhaus, C.R. Taitt, D.H. Leary, L.C. Shriver-Lake, D. Snellings, S. Sturiale, S.H. North, B. Orihuela, D. Rittschof, K.J. Wahl, C.M. Spillmann, "Characterization of longitudinal canal tissue in the acorn barnacle *Amphibalanus amphitrite*," *PLOS ONE*, 2018, 13(12):e0208352.

Fischer S.A., J. Kołacz, C.M. Spillmann, D. Gunlycke, "Adsorption of the liquid crystal molecule 5CB on graphene," *Physical Review E*, 2018, 98(5):052702.

Frantz J.A., J.D. Myers, R.Y. Bekele, C.M. Spillmann, J. Kolacz, H. Gotjen, V.Q. Nguyen, C.C. McClain, J.S. Sanghera, "Arsenic selenide thin film degradation and its mitigation," *Optical Materials Express*, 2018, 8(12):3659-65.

Frantz J.A., J.D. Myers, R.Y. Bekele, C.M. Spillmann, J. Kolacz, H. Gotjen, V.Q. Nguyen, C.C. McClain, J.S. Sanghera, "Chip-based nonmechanical beam steerer in the midwave infrared," *JOSA B*, 2018, 35(12):C29-37.

So C.R., J.M. Scancella, K.P. Fears, T. Essock-Burns, S.E. Haynes, D.H. Leary, Z. Diana, C. Wang, S. North, C.S. Oh, Z. Wang, B. Orihuela, D. Rittschof, C.M. Spillmann, K.J. Wahl, "Oxidase Activity of the

Barnacle Adhesive Interface Involves Peroxide-Dependent Catechol Oxidase and Lysyl Oxidase Enzymes," *ACS Appl. Mater. Interfaces*, 2017, *9*(13):11493–505.

Nag, O., Naciri, J., E. Oh, C. Spillmann, J. Delehanty, "Targeted Plasma Membrane Delivery of a Hydrophobic Cargo Encapsulated in a Liquid Crystal Nanoparticle Carrier," *Journal of Visualized Experiments*, 2017, 120:e55181.

Essock-Burns, T., N.V. Gohad, B. Orihuela, A.S. Mount, C.M. Spillmann, K.J. Wahl, D. Rittschof, "Barnacle biology before, during and after settlement and metamorphosis: a study of the interface," *Journal of Experimental Biology*, 2017, 220: 194-207.

So, C.R., K.P. Fears, D.H. Leary, J.M. Scancella, Z. Wang, J.L. Liu, B. Orihuela, D. Rittschof, C.M. Spillmann, K.J. Wahl, "Sequence basis of Barnacle Cement Nanostructure is Defined by Proteins with Silk Homology," *Scientific Reports*, 2016, 6:36219.

Hildebrandt, N., C.M. Spillmann, W. Russ Algar, T. Pons, M.H. Stewart, E. Oh, K. Susumu, S.A. Díaz, J.B. Delehanty, I.L. Medintz, "Energy Transfer with Semiconductor Quantum Dot Bioconjugates: A Versatile Platform for Biosensing, Energy Harvesting, and Other Developing Applications," *Chemical Reviews*, 2016, DOI: 10.1021/acs.chemrev.6b00030.

Melinger, J.S., A. Khachatrian, M.G. Ancona, S. Buckhout-White, E.R. Goldman, C.M. Spillmann, I.L. Medintz, P.D. Cunningham, "FRET from Multiple Pathways in Fluorophore-Labeled DNA," *ACS Photonics*, 2016, 3(4):659-669.

Spillmann, C.M., J. Naciri, B.R. Ratna, R.L.B. Selinger, J.V. Selinger, "Electrically Induced Twist in smectic Liquid-Crystalline Elastomers," *Journal of Physical Chemistry B*, 2016, 120(26):6368-6372.

Nag, O.K., J. Naciri, E. Oh, C.M. Spillmann, and J.B. Delehanty, "Lipid Raft-Mediated Membrane Tethering and Delivery of Hydrophobic Cargos from Liquid Crystal-Based Nanocarriers," *Bioconjugate Chemistry*, 2016, 27 (4):982–993.

Golden, J.P., D.K. Burden, K.P. Fears, D.E. Barlow, C.R. So, J. Burns, B. Miltenberg, B. Orihuela, D. Rittschof, C.M. Spillmann, K.J. Wahl, and L.M. Tender, "Imaging Active Surface Processes in Barnacle Adhesive Interfaces," *Langmuir*, 2016, 32(2):541-550.

Díaz, S.A, S. Buckhout-White, M.G. Ancona, C.M. Spillmann, E.R. Goldman, J.S. Melinger and I.L. Medintz, "Extending DNA-Based Molecular Photonic Wires with Homogeneous Förster Resonance Energy Transfer," *Advanced Optical Materials*, 2016, 4(3):399-412.

Wang, Z., D.H. Leary, J. Liu, R.E. Settlage, K.P. Fears, S.H. North, A. Mostaghim, T. Essock-Burns, S.E. Haynes, K.J. Wahl, and C.M. Spillmann, "Molt-dependent transcriptomic analysis of cement proteins in the barnacle *Amphibalanus amphitrite*," *BMC Genomics*, 2015, 16:859.

Spillmann, C.M., Stewart, M.H., Susumu, K., Medintz, I.L., "Combining semiconductor quantum dots and bioscaffolds into nanoscale energy transfer devices," *Applied Optics*, 2015, 54(31): F85-F95.

Spillmann, C.M. and I.L. Medintz, "Use of biomolecular scaffolds for assembling multistep light harvesting and energy transfer devices," *Journal of Photochemistry and Photobiology C: Photochemistry Reviews*, 2015, 23:1-24.

Buckhout-White, S.,* C.M. Spillmann,* W.R. Algar, A. Khachatrian, J.S. Melinger, E.R. Goldman, M.G. Ancona, I.L. Medintz, "Assembling programmable FRET-based photonic networks using designer DNA scaffolds," *Nature Communications*, 2014, 5:5615. (*co-first authors)

Spillmann, C.M., S. Buckhout-White, E. Oh, E. R. Goldman, M. G. Ancona and I. L. Medintz, "Extending FRET cascades on linear DNA photonic wires," *Chem. Commun.*, 2014, 50:7246-7249

Burden, D.K., C.M. Spillmann, R.K. Everett, D.E. Barlow, B. Orihuela, J.R. Deschamps, K.P. Fears, D. Rittschof, K.J. Wahl, "Growth and development of the barnacle Amphibalanus amphitrite: time and spatially resolved structure and chemistry of the base plate," *Biofouling*, 2014, 30(7):799-812.

Spillmann, C.M., J. Naciri, W.R. Algar, Igor L. Medintz, and J.B. Delehanty, "Multifunctional Liquid Crystal Nanoparticles for Intracellular Fluorescent Imaging and Drug Delivery," *ACS Nano*, 2014, 8(7):6986–6997.

Fontana, J., C. Spillmann, J. Naciri, B. Ratna, "A technique to functionalize and self-assemble macroscopic nanoparticle-ligand monolayer films onto template-free substrates," *Journal of Visualized Experiments*, 2014, 87:e51282, doi:10.3791/51282.

Boyd, D.A., J. Naciri, J. Fontana, D.B. Pacardo, A.R. Shields, J. Verbarg, C.M. Spillmann, and F.S. Ligler, "Facile Fabrication of Color Tunable Film and Fiber Nanocomposites via Thiol Click Chemistry," *Macromolecules*, 2014, 47(2):695.

Spillmann, C.M., M.G. Ancona, S. Buckhout-White, W.R. Algar, M.H. Stewart, K. Susumu, A.L. Huston, E.R. Goldman, I.L. Medintz, "Achieving Effective Terminal Exciton Delivery in Quantum Dot Antenna-Sensitized Multistep DNA Photonic Wires," *ACS Nano*, 2013, 7(8):7101–7118.

Tsoi, S., J. Zhou, C. Spillmann, J. Naciri, T. Ikeda, B. Ratna, "Liquid-Crystalline Nano-optomechanical Actuator," *Macromolecular Chemistry and Physics*, 2013, 214(6):734-741.

Boeneman K., J.B. Delehanty, J.B. Blanco-Canosa, K. Susumu, M.H. Stewart, E. Oh, A.L. Huston, G. Dawson, S. Ingale, R. Walters, M. Domowicz, J.R. Deschamps, W.R. Algar, S. DiMaggio, J. Manono, C.M. Spillmann, D. Thompson, T.L. Jennings, P.E. Dawson, I.L. Medintz, "Selecting Improved Peptidyl Motifs for Cytosolic Delivery of Disparate Protein and Nanoparticle Materials," *ACS Nano*, 2013, 7(5):3778–3796.

Delehanty, J.B., C.M. Spillmann, J. Naciri, W.R. Algar, B.R. Ratna, I.L. Medintz, "Fluorescent nanocolloids for differential labeling of the endocytic pathway and drug delivery applications," SPIE Colloidal Nanocrystals for Biomedical Applications VIII, 2013, Proc. SPIE 8595:85951E.

(book chapter contribution) FRET – Förster Resonance Energy Transfer: From Theory to Applications, First Ed, Eds. Igor Medintz and Niko Hildebrandt, 2013 Wiley-VCH Verlag GmbH & Co. KGaA; Ch. 14: FRET Pairs, A.G. Byrne, M.M. Byrne, G. Coker III, K.B. Gemmill, C. Spillmann, I.L. Medintz, S.L. Sloan, and B. Wieb van der Meer.

Burden, D. K., D. E. Barlow, C. M. Spillmann, B. Orihuela, D. Rittschof, R. K. Everett, K. J. Wahl, "Barnacle *Balanus amphitrite* Adheres by a Stepwise Cementing Process," *Langmuir,* 2012, *28*(37):13364–13372.

Shields A. R., C.M. Spillmann, J. Naciri, P.B. Howell, A.L.Thangawng, F.S. Ligler, "Hydrodynamically directed multiscale assembly of shaped polymer fibers" *Soft Matter*, 2012, 8(24):2656-2660.

Montazami, R., C.M. Spillmann, J. Naciri, B.R. Ratna, "Enhanced Mechanical Properties of a Nematic Liquid Crystal Elastomer Doped with Gold Nanoparticles" *Sensors and Actuators A: Physical*, 2012, 178:175-8.

Zhou, J.C., S. Tsoi, C. Spillmann, J. Naciri, B. R. Ratna "Tuning Mechanical Properties of Liquid Crystalline Nanoparticles" *Journal of Colloid and Interface Science*, 2012, 368:152-7.

Thangawng, A.L., P.B. Howell Jr., C.M. Spillmann, J. Naciri, and F.S. Ligler, "UV Polymerization of Hydrodynamically Shaped Fibers," *Lab on a Chip*, 2011, 11(6):1157-1160.

Spillmann, C.M., J.H. Konnert, J.M. Adams, J.R. Deschamps, J. Naciri, B.R. Ratna, "Strain Analysis of an Electroclinic Liquid Crystal Elastomer," *Physical Review E*, 2010, 82(3):031705.

Korlacki, R., V. P. Panov, A. Fukuda, J.K. Vij, C.M. Spillmann, J. Naciri, "Orientational order of a ferroelectric liquid crystal with small layer contraction," *Physical Review E*, 2010, 82(3):031702.

Spillmann, C.M., A.V. Kapur, F. Bentrem, J. Naciri, B.R. Ratna, "Critical Field Strength in an Electroclinic Liquid Crystal Elastomer," *Physical Review Letters*, 2010, 104(22):227802.

Spillmann, C.M., J. Naciri, G.P. Anderson, M.-S. Chen, B.R. Ratna, "Spectral tuning of organic nanocolloids by controlled molecular interactions," *ACS Nano*, 2009, 3(10):3214-3220.

Spillmann, C.M., J. Naciri, K.J. Wahl, Y.H. Garner III, M.-S. Chen, B.R. Ratna, "The Role of Surfactant in the Stability of Liquid Crystal-based Nanocolloids," *Langmuir*, 2009, 25(4):2419-2426.

Spillmann, C.M., J.H. Konnert, J.R. Deschamps, J. Naciri, B.R. Ratna, "Molecular Packing in Electroclinic Liquid Crystal Elastomer Films," *Chemistry of Materials*, 2008, 20(19):6130-6139.

Spillmann C., B. R. Ratna, J. Naciri, "Anisotropic actuation in electroclinic liquid crystal elastomers," *Applied Physics Letters*, 2007, 90(021911):1-3.

Spillmann, C., J. Naciri, B. Martin, B. R. Ratna, "Stacking Nematic Elastomers for Artificial Muscle Applications," *Sensors and Actuators A: Physical*, 2007, 133(2):500-505.

Spillmann C., J. Naciri, M.-S. Chen, A. Srinivasan, B. Ratna "Tuning the Physical Properties of a Nematic Liquid Crystal Elastomer," *Liquid Crystals*, 2006, 33(4):373-80.

Spillmann C., E. Lomakina, R. Waugh, "Neutrophil Adhesive Contact Dependence on Impingement Force," *Biophysical Journal*, 2004, 87(6): 4237-4245.

Lomakina E., C. Spillmann, M. King, R. Waugh, "Rheological Analysis and Measurement of Neutrophil Indentation," *Biophysical Journal*, 2004, 87(6):4246-4258.

Spillmann C., D. Osorio , R. Waugh, "Integrin activation by divalent ions affects neutrophil homotypic adhesion." *Annals of Biomedical Engineering*, 2002, 30(8): 1002-11.

Mascarenhas F., C. Spillmann, J. Lindner, D. Jacobs, "Hearing the Shape of a Rod by the Sound of its Collision." *American Journal of Physics*, 1998, 66: 692-696.

Patents / Patent Applications

H.G. Gotjen, J. Kolacz, C.P. McGinty, C.M. Spillmann, J.D. Myers, J.A. Frantz, R.Y. Bekele, A.R. Clabeau, "Simultaneous Multi-band Feedback for Refractive Non-Mechanical Beam Steering," Navy Case # 112761, IEB approved Aug 2020.

J.D. Myers, J.A. Frantz, C.M. Spillmann, R.Y. Bekele, H.G. Gotjen, J. Kolacz, A.R. Clabeau, C.J. Dunay, D. Burchick, J.S. Sanghera, C.P. McGinty, R.M. Pauli, "Spectroscopic non-mechanical laser transceiver," Navy Case #112004, IEB approved Mar 2020.

J. Kolacz, P. Finkel, J. Pavlova, C.M. Spillmann, "Piezo-Electro-Optic Composite Transduction Devices," Navy Case # 112188, IEB approved Feb 2020.

Kolacz, J., H.G. Gotjen, C.M. Spillmann, J. Naciri, J.D. Myers, J.A. Frantz, R.Y. Bekele, "Bulk Property Feedback for Liquid Crystal-Clad Waveguides," Navy Case # 109924 (IEB Approval 27 Feb 2019).

Naciri, J., C.M. Spillmann, J. Kolacz, H.G. Gotjen, J.D. Myers, J.A. Frantz, R.Y. Bokele, "Liquid Crystal for Longwave Infrared Applications," Navy Case # 109380, (IEB Approval 20 Nov 2018).

J. D. Myers, J. A. Frantz, C. Spillmann, R. Bekele, H. Gotjen, J. Naciri, J. Kolacz, L. B. Shaw, J. S. Sanghera, "Wide Bandwidth Waveguide Coupling Via Multiple Tapered Waveguide Layers," US Provisional Patent Application 107758-US1, filed Jan. 5, 2018 (IEB approval Apr 2018).

Myers, J.D., J.A. Frantz, C.M. Spillmann, R.Y. Bekele, H.G. Gotjen, J. Naciri, J. Kolacz, L.B. Shaw, J.S. Sanghera, "Wavelength-Based Steering of Non-Mechanical Beam-Steering Devices," Navy Case # 108200, *USPTO#: 10,915,004* (2021).

J.A. Frantz, J.D. Myers, C.M. Spillmann, J. Naciri, J. Kolacz, H. Gotjen, J. Auxier, L.B. Shaw, J.S. Sanghera, "Chalcogenide Glass Waveguides for Refractive Non-Mechanical Beam Steerer," Navy Case # 106030, *USPTO#: US 10,690,992* (2020).

R. Basu, D. Kinnamon, J. Kolacz, C.M. Spillmann, J.A. Frantz, J.D. Myers, "Graphene as an alignment layer and electrode for liquid crystal devices." Navy Case # 106008, *USPTO #: US10,564,505* (2020).

J.A. Frantz, J.D. Myers, C.M. Spillmann, J. Naciri, J. Kolacz, H. Gotjen, L.B. Shaw, J.S. Sanghera, "Technique for Dynamically Controlling the Incoupler of a Beam-Steering Device," Navy Case # 107759, *USPTO#: 10,444,595* (2019).

J.A. Frantz, J.D. Myers, C.M. Spillmann, J. Naciri, J. Kolacz, B.R. Ratna, L.B. Shaw, J.S. Sanghera, "Liquid crystal alignment on chalcogenide glasses," Navy Case # 104,163, *USPTO#: 10,168,597* (2018).

Naciri, J., C.M. Spillmann, G. Anderson, B.R. Ratna "Fluorescent Organic Nanoparticles," Navy Case # *99,194, USTPO#: 9,201,010 B* (2015).

Spillmann C., J. Naciri, D. Cylinder, B. Martin, B. R. Ratna, "Method For Stacking Thermal Actuators," *Navy Case # 97,316* (2005), *Patent Cooperation Treaty Application #97,414*; *USTPO#: 7,936,404, 8,040,443* (2011).

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