

## JENNIFER A. HOLLINGSWORTH

Laboratory Fellow

Materials Physics & Applications Division: Center for Integrated Nanotechnologies (CINT)

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### Education

Ph.D. Inorganic Chemistry, Washington University, St. Louis, MO 1999

B.A. Chemistry, *Phi Beta Kappa*, Grinnell College, Grinnell, IA 1992

### Appointments

LANL Laboratory Fellow: 2016 – present

Technical Staff Member, Scientist 5: 2015 – present  
Materials Physics & Applications Division, CINT, LANL

Technical Staff Member, Scientist 4: 2010 – 2015  
Materials Physics & Applications Division, CINT, LANL

Technical Staff Member, Scientist 4: 2006 – 2010  
Chemistry Division and CINT, LANL

Technical Staff Member: 2001 – 2006  
Chemistry Division, LANL

Director's Funded Postdoctoral Fellow: 1999 – 2001  
Chemistry Division, LANL

### Research Interests

'Materials-by-design' approaches to solution-phase synthesis of novel functional nanomaterials. Understanding structure-function relationships in different semiconductor nanomaterials systems to best exploit physical and electronic-structure engineering for controlling fundamental optical and electronic properties. Effects of dimension, geometry, and surface/interface chemistry on properties. Development of new optical nanomaterials and novel synthetic methods (e.g., "flow" solution-liquid-solid nanowire growth and combinatorial hetero-nanomaterials synthesis). Non-blinking nanocrystal quantum dots, semiconductor nanowires, infrared emitting quantum dots, hybrid semiconductor-metal nanostructures.

### Fellowships and Honors

- LANL Laboratory Fellow (2016)
- ACS Councilor, Colloid and Surface Science Division (national elected position) (2016-2018)
- LANL Program Recognition Award and LANL Achievement Award (2014)
- LANL Fellows' Prize for Research (2013)
- LANL Associate Directorate for Chemistry, Life, & Earth Sciences Achievement Award (2009)
- LANL Awards for Outstanding Scientific Achievement (2010, 2006, 2001)
- LANL Women's Career Development Mentoring Award (2005)
- LANL Distinguished Postdoctoral Performance Award (Small Team) (2002)
- LANL Director's Postdoctoral Fellow (1999-2001)
- NASA Graduate Student Researchers Program Center Fellow (1996-1999)

- MRS Graduate Student Award Finalist (Fall, 1997)
- Phi Beta Kappa (1992-present)
- National Merit Scholarship, Grinnell College (1988-1992)
- Three awarded US Patents: 7,935,419 (2011): “Thick-shell Nanocrystal Quantum Dots; 7,261,940 (2007): “Multifunctional Nanocrystals; 6,819,692 (2004): “Optical amplifiers and lasers”

**Journal Publications, Book Chapters and Review Articles (>9000 citations; h-index: 40)**

- [1] Hanson, C. J., Hartmann, N. F., Singh, A., Ma, X. DeBenedetti, W. J. I., Casson, J. L., Grey, J. K., Chabal, Y. J., Malko, A. V., Htoon, H., Hollingsworth, J. A. Giant PbSe/CdSe/CdSe Quantum Dots: Ultrastable Single-Dot Near-infrared Photoluminescence. Submitted **2017**.
- [2] Dawood, F., Schulze, P. A., Sheehan, C. J., Buck, M. R., Dennis, A. M., Karan, N., Staude, I., Dominguez, J., Subramania, G. S., James, A. R., Brener, I., Amro, N. A., Hollingsworth, J. A. Direct Placement of Colloidal Nanocrystal Quantum Dots on Three-Dimensional Nanostructured Dielectric Antenna by Dip-Pen Nanolithography. Submitted **2017**.
- [3] Mishra, N., Wang, F., Orfield, N. J., Hu, Z., Krishnamurthy, S., Malko, A. V., Casson, J. L., Htoon, H., Hollingsworth, J. A. Turning Off Blinking for Two Colors: Using Shape Control to Stabilize Multiexciton Emission in CdSe/CdS Tetrapods. Accepted **2017**
- [4] Matsuzaki, K., Vassant, S., Liu, H.-W., Dutschke, A., Hoffmann, B., Chen, X., Christiansen, S., Buck, Matthew R., Hollingsworth, J. A., Götzinger, S., Sandoghdar, V. Strong plasmonic enhancement of biexciton emission: controlled coupling of a single quantum dot to a gold nanocone antenna. *Scientific Reports* **2017**, 7, 42307 (1-11).
- [5] Hartsfield, T., Gegg, M., Su, P.-H., Buck, M., Hollingsworth, J. A., Shih, C.-K., Richter, M., Htoon, H., Li, X. Semiconductor Quantum Dot Lifetime Near an Atomically Smooth Ag Film Exhibits a Narrow Distribution *ACS Photonics* **2016**, 3, 1085-1089.
- [6] Sampat, S., Guo, T., Zhang, K., Robinson, J. A., Ghosh, Y., Acharya, K. P., Htoon, H., Hollingsworth, J. A., Gartstein, Y. N., Malko, A. V. Exciton and Trion Energy Transfer from Giant Semiconductor Nanocrystals to MoS<sub>2</sub> Monolayers. *ACS Photonics* **2016**, 3, 708-715.
- [7] Orfield, N. J., McBride, J. R., Wang, F.; Buck, M. R., Keene, J. D., Reid, K. R., Htoon, H.,\* Hollingsworth, J. A.,\* Rosenthal, S. J.\* (\*co-corresponding) Quantum Yield Heterogeneity Among Single Nonblinking Quantum Dots Revealed by Atomic Structure-Quantum Optics Correlation. *ACS Nano* **2016**, 10, 1960-1968.
- [8] Sampat, S., Karan, N. S., Guo, T., Htoon, H., Hollingsworth, J. A., Malko, A. V. Multistate Blinking and Scaling of Recombination Rates in Individual Silica-Coated CdSe/CdS Nanocrystals. *ACS Photonics* **2015**, 2, 1505-1512.
- [9] Wang, Z., Li, R., Bian, K., Wang, X., Xu, H., Hollingsworth, J. A.; Hanrath, T.; Fang, J. An Obtuse Rhombohedral Superlattice Assembled by Pt Nanocubes. *Nano Letters* **2015**, 15, 6254-6260.
- [10] Hollingsworth, J. A., Htoon, H., Piryatinski, A., Götzinger, S., Sandoghdar, V. When excitons and plasmons meet: Emerging function through synthesis and assembly. Invited Review *MRS Bull.* **2015**, 40, 768.
- [11] Wang, F., Karan, N. S., Nguyen, H. M., Ghosh, Y., Sheehan, C. J., Hollingsworth, J. A. & Htoon, H., Coupling Single Giant Nanocrystal Quantum Dots to Fundamental Modes of Patch Nanoantennas through Fringe Field. *Sci. Rep.* **2015**, 5, 14313.
- [12] DeVore, M. S., Stich, D. G., Keller, A. M., Cleyrat, C., Phipps, M. E., Hollingsworth J. A., Lidke, D. S., Wilson, B. S., Goodwin, P. M., Werner, J. H. Time-gated 3D single quantum dot tracking with simultaneous spinning disk imaging. *Rev. Sci. Instrum.* **2015**, 86, 126102.
- [13] Wang, F., Karan, N. S., Nguyen, H. M., Ghosh, Y., Sheehan, C. J., Hollingsworth, J. A. & Htoon, H. Quantum Optical Signature of Plasmonically Coupled Nanocrystal Quantum Dots. *Small* **2015**, 11, 5176.
- [14] DeVore, M. S., Stich, D. G., Keller, A. M., Ghosh, Y., Goodwin, P. M., Phipps, M. E., Stewart, M.

- H., Cleyrat, C., Wilson, B. S., Lidke, D. S., Hollingsworth J. A., Werner, J. H. Three dimensional time-gated tracking of non-blinking quantum dots in live cells. *Proc. SPIE 9338: Colloidal Nanoparticles for Biomedical Applications X.*, 933812 **2015** DOI:10.1117/12.2082943.
- [15] Hanson, C. J., Buck, M. R., Acharya, K., Torres, J. A., Kundu, J., Ma, X., Bouquin, S., Hamilton, C. E., Htoon, H. & Hollingsworth, J. A. Giant Quantum Dots: Matching Solid-State to Solution-Phase Photoluminescence Performance for Near-Unity Down-Conversion Efficiency. *ACS Appl. Mater. Interfaces* **2015**, 7, 13125-13130.
- [16] Wang, F., Karan, N. S., Nguyen, H. M., Ghosh, Y., Sheehan, C. J., Hollingsworth, J. A. & Htoon, H. Correlated Structural-Optical Study of Single Nanocrystals in a Gap-bar Antenna: Effects of Plasmonics on Excitonic Recombination Pathways. *Nanoscale* **2015**, 7, 9387-9393.
- [17] Acharya, K. P., Nguyen, H. M., Paulite, M., Piryatinski, A., Zhang, J., Casson, J. L., Xu, H., Htoon, H. & Hollingsworth, J. A. Elucidation of Two Giants: Challenges to Thick-shell Synthesis in CdSe/ZnSe and ZnSe/CdS Core/Shell Quantum Dots. *J. Am. Chem. Soc.* **2015**, 137, 3755-3758.
- [18] Karan, N. S., Keller, A. M., Sampat, S., Roslyak, O., Arefin, A., Hanson, C. J., Casson, J. L., Desireddy, A., Ghosh, Y., Piryatinski, A., Iyer, R., Htoon, H., Malko, A. V. & Hollingsworth, J. A., Plasmonic Giant Quantum Dots: Hybrid Semiconductor-Metal Nanostructures for Truly Simultaneous Optical Imaging, Photothermal Effect and Thermometry. *Chem. Sci.* **2015**, 6, 2224-2236.
- [19] Paulite, M., Acharya, K. P., Nguyen, H. M., Hollingsworth, J. A. & Htoon, H. Inverting Asymmetric Confinement Potentials in Core/Thick-Shell Nanocrystals. *J. Phys. Chem. Lett.* **2015**, 6, 706-711.
- [20] Xu, E. Z., Li, Z., Martinez, J. A., Sinitsyn, N., Htoon, H., Li, N., Swartzentruber, B., Hollingsworth, J., Wang, J., Zhang, S. X. Diameter dependent thermoelectric properties of individual SnTe nanowires *Nanoscale* **2015**, 7, 2869-2876.
- [21] Gao, Y., Roslyak, O., Dervishi, E., Karan, N. S., Ghosh, Y., Sheehan, C. J., Wang, F., Gupta, G., Mohite, A., Dattelbaum, A. M., Doorn, S. K., Hollingsworth, J. A., Piryatinski, A. & Htoon, H. Hybrid Graphene-Giant Nanocrystal Quantum Dot Assemblies with Highly Efficient Biexciton Emission. *Adv. Optical Mater.* **2015**, 3, 39-43.
- [22] Acharya, K. P.; Ji, Z.; Holesinger, T. G.; Crisp, J. A.; Ivanov, S. A.; Sykora, M.; Hollingsworth, J. A. Layer-by-Layer Fabrication of Nanowire Sensitized Solar Cells: Geometry-Independent Integration. *Adv. Funct. Mater.* **2014**, 24, 6843-6852.
- [23] Chu, X.-L.; Brenner, T.J.K.; Chen, X.-W.; Ghosh, Y.; Hollingsworth, J. A.; Sandoghdar, V.; Göttinger, S. Experimental realization of an optical antenna for collecting 99% of photons from a quantum emitter. *Optica* **2014**, 1, 203-208.
- [24] Keller, A. M.; Ghosh, Y.; DeVore, M. S.; Phipps, M. E.; Stewart, M. H.; Lidke, D. S.; Wilson, B. S.; Hollingsworth, J. A.;\* Werner, J. H.\* 3-Dimensional Tracking of Non-blinking 'Giant' Quantum Dots in Live Cells. *Adv. Funct. Mater.* **2014**, 24, 4796-4803. (\*co-corresponding authors)
- [25] Mangum, B. D., Wang, F., Dennis, A., Hollingsworth, J. A. & Htoon, H. Competition between Auger Recombination and Hot Electron Trapping in Blinking of Type II InP/CdS Nanocrystals. *Small* **2014**, 14, 2892-2901.
- [26] Pietryga, J. M.; Hollingsworth, J. A. Mid-Infrared Emitting Lead Selenide Nanocrystal Quantum Dots in *Inorganic Syntheses* **2014**, 36, 198-202.
- [27] Mangum, B. D.; Sampat, S.; Ghosh, Y.; Hollingsworth, J. A.; Htoon, H.; Malko, A. V. Influence of Core Size on Biexciton Quantum Yield in Giant CdSe/CdS Nanocrystals. *Nanoscale* **2014**, 6, 3712-20.
- [28] Hollingsworth, J. A. Nanoscale engineering facilitated by controlled synthesis: From structure to function. *Coordin. Chem. Rev. (Invited Review Article)* **2014**, 263-64, 197-216.
- [29] Nagy, A.; Hollingsworth, J. A.; Hu, B.; Steinbrück, A.; Stark P. C.; Rios-Valdez, C.; Vuyisich, M.; Stewart, M.; Atha, D. H.; Nelson, B. C.; Iyer, R. Functionalization-Dependent Induction of Cellular Survival Pathways by CdSe Quantum Dots in Primary Normal Human Bronchial Epithelial Cells. *ACS Nano* **2013**, 7, 8397-8411.

- [30] Laocharoensuk, R.; Palaniappan, K.; Smith, N. A.; Dickerson, R. M.; D. Werder, Baldwin, J. K.; Hollingsworth, J. A. Flow-based solution–liquid–solid nanowire synthesis, *Nature Nanotechnology* **2013** *8*, 660–666. (Highlighted in *NPG Asia Materials*.) Cited 30 times
- [31] Hollingsworth, J. A. Heterostructuring Nanocrystal Quantum Dots Toward Intentional Suppression of Blinking and Auger Recombination. (*Invited Review Article*) *Chem. Mater.* **2013**, *25*, 1318–1331. Cited 25 times
- [32] Mangum, B. D., Ghosh, Y., Hollingsworth, J. A.; Htoon, H. Disentangling the Effects of Clustering and Multi-exciton Emission in Second-Order Photon Correlation Experiments. *Opt. Express.* **2013**, *21*, 7419–26.
- [33] Park, Y.-S.; Ghosh, Y.; Xu, P.; Mack, N. H.; Wang, H.-L.; Hollingsworth, J. A.; Htoon, H. Single-Nanocrystal Photoluminescence Spectroscopy Studies of Plasmon-Multiexciton Interactions at Low Temperature. *J. Phys. Chem. Lett.* **4**, 1465–1470 **2013**.
- [34] Park, Y.-S.; Ghosh, Y.; Chen, Y.; Piryatinski, A.; Xu, P.; Mack, N. H.; Wang, H.-L.; Klimov, V. I.; Hollingsworth, J. A.; Htoon, H. Super-Poissonian Statistics of Photon Emission from Single Core-Shell Nanocrystals Coupled to Metal Nanostructures. *Phys. Rev. Lett.* **110**, 117401 **2013**.
- [35] Dennis, A. M.; Mangum, B.; Piryatinski, A.; Park, Y.-S.; Hannah, D.; Casson, J.; Williams, D.; Schaller, R.; Htoon, H.; Hollingsworth, J. A. Suppressed Blinking and Auger Recombination in Near-Infrared Type-II InP/CdS Nanocrystal Quantum Dots. *Nano Lett.* **2012** *12*, 5545–5551. Cited 45 times
- [36] Ghosh, Y.; Mangum, B.D.; Casson, J. L.; Williams, D. J.; Htoon, H.; Hollingsworth, J. A. New Insights into the Complexities of Shell Growth and the Strong Influence of Particle Volume in Non-Blinking “Giant” Core/Shell Nanocrystal Quantum Dots. *J. Am. Chem. Soc.* **2012**, *134*, 9634–9643. Cited >70 times.
- [37] Nagy, A.; Steinbrück, A.; Gao, J.; Doggett, N.; Hollingsworth, J. A.; Iyer, R. Comprehensive analysis of the effects of CdSe quantum dot size, surface charge, and functionalization on primary human lung cells. *ACS Nano* **2012** *6*, 4748–62.
- [38] Kundu, J.; Ghosh, Y.; Dennis, A. M.; Htoon, H.; Hollingsworth, J. A. Giant Nanocrystal Quantum Dots: Stable Down-Conversion Phosphors that Exploit a Large Stokes Shift and Efficient Shell-to-Core Energy Relaxation. *Nano Lett.*, **2012**, *12*, 3031–3037. Cited 35 times
- [39] Pal, B.N.; Ghosh, Y.; Brovelli, S.; Laocharoensuk, R.; Klimov, V.I.; Hollingsworth, J.A.\*; Htoon, H.\* ‘Giant’ CdSe/CdS Core/Shell Nanocrystal Quantum Dots As Efficient Electroluminescent Materials: Strong Influence of Shell Thickness on Light-Emitting Diode Performance. *Nano Lett.* **2012**, *12*, 331 (\*co-corresponding authors). Cited >135 times
- [40] Galland, C.; Ghosh, Y.; Steinbrück, A.; Hollingsworth, J. A.; Htoon, H.; Klimov, V. I. Lifetime blinking in nonblinking nanocrystal quantum dots. *Nature Comm.* **2012**, *3*:908. Cited >110 times
- [41] Lin, Q.; Xu, Y.; Fu, E.; Baber, S.; Bao, Z.; Yu, L.; Deng, S.; Kundu, J.; Hollingsworth, J.; Bauer, E.; McCleskey, T. M.; Burrell, A. K.; Jia, Q.; Luo, H. Polymer-assisted chemical solution approach to YVO<sub>4</sub>:Eu nanoparticle networks. *J. Mater. Chem.*, **2012**, *22*, 5835.
- [42] Galland, C.; Ghosh, Y.; Steinbrück, A.; Sykora, M.; Hollingsworth, J.A.; Klimov, V.I.; Htoon, H. Two types of luminescence blinking revealed by spectroelectro-chemistry of single quantum dots. *Nature* **2011**, *479*, 203–207. Cited >320 times
- [43] Malko, A., Y. Park, S. Sampat, C. Galland, J. Vela, Y. Chen, J. Hollingsworth, V. Klimov, and H. Htoon. Pump-intensity- and shell-thickness-dependent evolution of photoluminescence blinking in individual core/shell CdSe/CdS nanocrystals. *Nano Lett.* **2011**, *11*, 5213.
- [44] Brovelli, S.; Schaller, R. D.; Crooker, S. A.; Garcia-Santamaria, F.; Chen, Y.; Viswanatha, R.; Hollingsworth, J. A.; Htoon, H.; Klimov, V. I. Nano-engineered electron–hole exchange interaction controls exciton dynamics in core–shell semiconductor nanocrystals. *Nature Comm.* **2011**, *2*, 280.
- [45] Achermann, M.; Jeong, S.; Balet, L.; Montano, G.A.; Hollingsworth, J.A. Efficient Quantum Dot-Quantum Dot and Quantum Dot-Dye Energy Transfer in Biotemplated Assemblies. *ACS Nano* **2011**, *5*, 1761–68.
- [46] García-Santamaría, F.; Brovelli, S.; Viswanatha, R.; Hollingsworth, J. A.; Htoon, H.; Crooker, S. A.; Klimov, V. I. Breakdown of Volume Scaling in Auger Recombination in CdSe/CdS

- Heteronanocrystals: The Role of the Core-Shell Interface. *Nano Lett.*, **2011**, *11*, 687.
- [47] Park, Y.-S.; Malko, A. V.; Vela, J.; Chen, Y.; Ghosh, Y.; García-Santamaría, F.; Hollingsworth, J. A.; Klimov, V. I.; Htoon, H. Near-Unity Biexciton Emission Quantum Yields in Individual CdSe/CdS Nanocrystals Revealed by Two-Photon-Correlation and Photoluminescence-Saturation Measurements. *Phys. Rev. Lett.* **2011**, *106*, 187401-1-4. *Cited >110 times*
- [48] Rivera, E. M.; Trujillo-Provencio, C.; Steinbruck, A.; Rastogi, P.; Dennis, A.; Hollingsworth, J.; Serrano, E. E. Imaging heterostructured quantum dots in cultured cells with epifluorescence and transmission electron microscopy. *Proc. SPIE* **2011**, *7909*, 79090N.
- [49] Vela, J.; Htoon, H.; Chen, Y.; Park, Y.-S.; Ghosh, Y.; Goodwin, P.M.; Werner, J.H.; Wells, N. P.; Casson, J. L.; Hollingsworth, J. A. Effect of shell thickness and composition on blinking suppression and the blinking mechanism in 'giant' CdSe/CdS nanocrystal quantum dots. *J. Biophotonics* **2010**, *3*, 706-717. *Cited 70 times*
- [50] Htoon, H.; Malko, A. V.; Bussian, D.; Vela, J.; Chen, Y.; Hollingsworth, J. A.; Klimov, V. I. Highly Emissive Multiexcitons in Steady-State Photoluminescence of Individual "Giant" CdSe/CdS Core/Shell Nanocrystals. *Nano Lett.* **2010**, *10*, 2401-07. *Cited 105 times*
- [51] Wooten, A.; Werder, D.; Williams, D.; Casson, J.; Hollingsworth, J. A. Solution-Liquid-Solid Growth of Ternary Cu-In-Se Semiconductor Nanowires from Multiple- and Single-Source Precursors. *J. Am. Chem. Soc.* **2009**, *131*, 16177-16188. *Cited >60 times*
- [52] García-Santamaría, F.; Chen, Y.; Vela, J.; Schaller, R. D.; Hollingsworth, J. A., and Klimov, V. I. Suppressed Auger Recombination in "Giant" Nanocrystals Boosts Optical Gain Performance. *Nano Lett.*, **2009**, *9*, 3482. *Cited >230 times*
- [53] Bussian, D. B.; Malko, A. V.; Htoon, H.; Chen, Y. F.; Hollingsworth, J. A.; Klimov, V. I. Quantum Optics with Nanocrystal Quantum Dots in Solution: Quantitative Study of Clustering. *J. Phys. Chem. C* **2009**, *113*, 2241-2246.
- [54] Hollingsworth, J.A.; Vela, J.; Yongfen Chen, et al. 'Giant' multishell CdSe nanocrystal quantum dots with suppressed blinking: novel fluorescent probes for real-time detection of single-molecule events. *Proc. SPIE* (invited) **2009**, 718904-11.
- [55] Prasankumar, R. P.; Upadhyay, P. C.; Li, Q.; Smith, N.; Choi, S. G.; Azad, A. K.; Talbayev, D.; Wang, G. T.; Fischer, A. J.; Hollingsworth, J.; et al. Ultrafast carrier dynamics in semiconductor nanowires. *Proc. SPIE* **2009**, 7406.
- [56] Vela, J.; Prall, B.; Rastogi, P.; Werder, D.; Casson, J.; Williams, D.; Klimov, V. I., and Hollingsworth, J. A. Sensitization and Protection of Lanthanide Ion Emission in In<sub>2</sub>O<sub>3</sub>:Eu Nanocrystal Quantum Dots. *J. Phys. Chem C* **2008**, *112*, 20246.
- [57] Vela, J. and Hollingsworth, J. A. "Semiconductor Nanocrystals: Doped Compositions" in *Nanomaterials: Inorganic and Bioinorganic Perspectives, Encyclopedia of Inorganic Chemistry, 2nd ed.*, John Wiley & Sons, Ltd., New York, **2008**.
- [58] Wang, F.; Yu, H.; Jeong, S.; Pietryga, J. M.; Hollingsworth, J. A.; Gibbons, P. C., and Buhro, W. E. Scaling of the Effective Band Gaps in Indium-Arsenide Quantum Dots and Wires. *ACS Nano* **2008**, *2*, 1903-1913.
- [59] Chen, Y.; Vela, J.; Htoon, H.; Casson, J. L.; Werder, D. J.; Bussian, D. A.; Klimov, V. I., and Hollingsworth, J. A., "Giant" multishell CdSe nanocrystal quantum dots with suppressed blinking. *J. Am. Chem. Soc.* **2008**, *130*, 5026-5027. *Cited >550 times*.
- [60] Pietryga, J. M.; Werder, D. J.; Williams, D. J.; Casson, J. L.; Schaller, R. D.; Klimov, V. I., and Hollingsworth, J. A. Utilizing the lability of lead selenide to produce heterostructured nanocrystals with bright, stable infrared emission. *J. Am. Chem. Soc.* **2008**, *130*, 4879-4885. *Cited 300 times*
- [61] Kanatzidis, M. G. et al. Report from the 3<sup>rd</sup> Workshop on Future Directions of Solid-State Chemistry: The Status of Solid-State Chemistry and Its Impact in the Physical Sciences. *Progress in Solid State Chemistry* **2008**, *36*, 1-133.
- [62] Pietryga, J. M.; Casson, J. L.; Schaller, R. D.; Klimov, V. I.; Hollingsworth, J. A. Cadmium-stabilized lead selenide nanocrystals for use in solar cells. *Prepr. Paps. Am. Chem. Soc., Div. Fuel Chem.* **2007**, *52*, 822-3.

- [63] Jeong, S. and Hollingsworth, J. A. Polymerization of nanocrystal quantum dot-tubulin bioconjugates. *Special Issue of the IEEE Transactions on Nanobioscience on "Colloidal Quantum Dots for Biomedical Applications"* **2006**, 5, 239.
- [64] Achermann, M.; Bartko, A. P.; Hollingsworth, J. A.; Klimov, V. I. The effect of Auger heating on intraband carrier relaxation in semiconductor quantum rods. *Nature Phys.* **2006**, 2, 557.
- [65] Sapra, S.; Nanda, J.; Pietryga, J. M.; Hollingsworth, J. A.; Sarma, D. D. Unraveling internal structures of highly luminescent PbSe nanocrystallites using variable-energy synchrotron radiation photoelectron spectroscopy. *J. Phys. Chem. B* **2006**, 110, 15244.
- [66] Jeong, S.; Achermann, M.; Nanda, J.; Ivanov, S.; Klimov, V. I.; Hollingsworth, J. A. Effect of the thiol-thiolate equilibrium on the photophysical properties of aqueous CdSe/ZnS nanocrystal quantum dots. *J. Am. Chem. Soc.* **2005**, 127, 10126-10127. *Cited >175 times*
- [67] Hollingsworth, J. A., "Semiconductor Nanocrystal Quantum Dots" in *Encyclopedia of Inorganic Chemistry*, 2<sup>nd</sup> Ed., John Wiley & Sons, Ltd., **2005**.
- [68] Furis, M.; Hollingsworth, J. A.; Klimov, V. I.; Crooker, S. A. Time- and polarization-resolved optical spectroscopy of colloidal CdSe nanocrystal quantum dots in high magnetic fields. *J. Phys. Chem. B* **2005**, 109, 15332.
- [69] Kim, H.; Achermann, M.; Balet, L. P.; Hollingsworth, J. A.; Klimov, V. I. Synthesis and characterization of Co/CdSe core/shell nanocomposites: Bifunctional magnetic-optical nanocrystals. *J. Am. Chem. Soc.* **2005**, 127, 544. *Cited >400 times*
- [70] Pietryga, J. M.; Schaller, R. D.; Werder, D.; Stewart, M. H.; Klimov, V. I.; Hollingsworth, J. A. Pushing the band gap envelope: Mid-infrared emitting colloidal PbSe quantum dots. *J. Am. Chem. Soc.* **2004**, 126, 11752. *Cited >330 times*
- [71] Malko, A. V.; Mikhailovsky, A. A.; Petruska, M. A.; Hollingsworth, J. A.; Klimov, V. I. Interplay between optical gain and photoinduced absorption in CdSe nanocrystals. *J. Phys. Chem. B* **2004**, 108, 5250.
- [72] Hollingsworth, J. A. and Klimov, V. I. "'Soft" chemical synthesis and manipulation of semiconductor nanocrystals" in *Semiconductor and Metal Nanocrystals: Synthesis, Electronic and Optical Properties*, Marcel Dekker, New York, November **2003**.
- [73] Achermann, M.; Hollingsworth, J. A.; Klimov, V. I. Multiexcitons confined within a subexcitonic volume: Spectroscopic and dynamical signatures of neutral and charged biexcitons in ultrasmall semiconductor nanocrystals. *Phys. Rev. B* **2003**, 68, 245302.
- [74] Htoon, H.; Hollingsworth, J. A.; Dickerson, R.; Klimov, V. I. Effect of zero- to one-dimensional transformation on multiparticle Auger recombination in semiconductor quantum rods. *Phys. Rev. Lett.* **2003**, 91, 22, 227401.
- [75] Htoon, H.; Hollingsworth, J. A.; Malko, A. V.; Dickerson, R.; Klimov, V. I. Light amplification in semiconductor nanocrystals: Quantum rods versus quantum dots. *Appl. Phys. Lett.* **2003**, 82, 26, 4776.
- [76] Hollingsworth, J. A.; Banger, K. K.; Jin, M. H. C.; Harris, J. D.; Cowen, J. E.; Bohannon, E. W.; Switzer, J. A.; Buhro, W.; Hepp, A. F. Single source precursors for fabrication of I-III-VI<sub>2</sub> thin-film solar cells via spray CVD. *Thin Solid Films* **2003**, 431, 63.
- [77] Crooker, S. A.; Barrick, T.; Hollingsworth, J. A., and Klimov, V. I. Ultrafast Coherent Terahertz Spectroscopy in High Magnetic Fields and Directed Energy Flows in Quantum Dot Assemblies. *Acta Phys. Polon. A* **2003**, 104, 113.
- [78] Crooker, S. A.; Barrick, T.; Hollingsworth, J. A.; Klimov, V. I. Multiple temperature regimes of radiative decay in CdSe nanocrystal quantum dots: Intrinsic limits to the dark-exciton lifetime. *Appl. Phys. Lett.* **2003**, 82, 2793.
- [79] Crooker, S. A.; Hollingsworth, J. A.; Tretiak, S.; Klimov, V. I. Spectrally resolved dynamics of energy transfer in quantum-dot assemblies: Towards engineered energy flows in artificial materials. *Phys. Rev. Lett.* **2002**, 89, 18, 186802. *Cited >530 times*
- [80] Xu, S.; Mikhailovsky, A. A.; Hollingsworth, J. A.; Klimov, V. I. Hole intraband relaxation in strongly confined quantum dots: Revisiting the "phonon bottleneck" problem. *Phys. Rev. B* **2002**, 6504, 5319.
- [81] Malko, A. V.; Mikhailovsky, A. A.; Petruska, M. A.; Hollingsworth, J. A.; Htoon, H.; Klimov, V. I. From amplified spontaneous emission to microring lasing using nanocrystal quantum dot solids. *Appl. Phys. Lett.* **2002**, 81, 1303.
- [82] Mikhailovsky, A. A.; Malko, A. V.; Hollingsworth, J. A.; Bawendi, M. G.; Klimov, V. I. Multiparticle interactions and stimulated emission in chemically synthesized quantum dots. *Appl. Phys. Lett.* **2002**, 80, 2380.

- [83] Banger, K. K.; Hollingsworth, J. A.; Harris, J. D.; Cowen, J.; Buhro, W. E.; Hepp, A. F. Ternary single-source precursors for polycrystalline thin-film solar cells. *Appl. Organomet. Chem.* **2002**, *16*, 617.
- [84] Kraabel, B.; Malko, A.; Hollingsworth, J.; Klimov, V. I. Ultrafast dynamic holography in nanocrystal solids. *Appl. Phys. Lett.* **2001**, *78*, 1814.
- [85] Henderson, D. O.; Mu, R.; Ueda, A.; Wu, M. H.; Gordon, E. M.; Tung, Y. S.; Huang, M.; Keay, J.; Feldman, L. C.; Hollingsworth, J. A.; Buhro, W. E.; Harris, J. D.; Hepp, A. F.; Raffaele, R. P. Optical and structural characterization of copper indium disulfide thin films. *Mater. Design* **2001**, *22*, 585.
- [86] Hollingsworth, J. A.; Mikhailovsky, A. A.; Malko, A.; Klimov, V. I.; Leatherdale, C. A.; Bawendi, M. Nanocrystal quantum dots: Building blocks for tunable optical amplifiers and lasers. (*featured article*) *Mater. Res. Soc. Symp. – Proc.* **2001**, *667*, G61.
- [87] Hollingsworth, J. A.; Buhro, W. E.; Poojary, D. M.; Clearfield, A. Catalyzed growth of a metastable InS crystal structure as colloidal crystals. *J. Am. Chem. Soc.* **2000**, *122*, 14, 3562. *Cited >85 times*
- [88] Klimov, V. I., Mikhailovsky, A. A., Xu, S., Malko, A., Hollingsworth, J. A., Leatherdale, C. A., Eisler, H. J., Bawendi, M. G. Optical gain and stimulated emission in nanocrystal quantum dots. *Science*, **2000** *290*, 5490, 314. *Cited >2300 times.*
- [89] Hollingsworth, J. A.; Hepp, A. F., and Buhro, W. E. Spray CVD of Copper Indium Disulfide Films: Control of Microstructure and Crystallographic Orientation. *Adv. Mater. CVD* **1999**, *5*, 3, 105.
- [90] Hollingsworth, J. A. and Buhro, W. E. Low-temperature, solution-based routes to nanocrystalline InS powders and thin films. *Mater. Res. Soc. Symp. – Proc.*, **1998**, *495*, 202.
- [91] Hollingsworth, J. A.; Buhro, W. E.; Hepp, A. F.; Jenkins, P. P.; Stan, M. A. Spray chemical vapor deposition of CuInS<sub>2</sub> thin films for application in solar cell devices. *Mater. Res. Soc. Symp. – Proc.*, **1998**, *495*, 171.
- [92] Goel, S. C.; Hollingsworth, J. A.; Beatty, A. M.; Robinson, K. D.; Buhro, W. E. Preparation of volatile molecular lithium-niobium alkoxides. Crystal structures of [Nb( $\mu$ -OCH<sub>2</sub>SiMe<sub>3</sub>)(OCH<sub>2</sub>SiMe<sub>3</sub>)<sub>4</sub>]<sub>2</sub> and [LiNb( $\mu$ <sub>3</sub>-OCH<sub>2</sub>SiMe<sub>3</sub>)-( $\mu$ <sub>2</sub>-OCH<sub>2</sub>SiMe<sub>3</sub>)<sub>2</sub>(OCH<sub>2</sub>SiMe<sub>3</sub>)<sub>3</sub>]<sub>2</sub>. *Polyhedron* **1998**, *17*, 781.

### Professional Activities: Leadership & Service

- Councilor, American Chemical Society (ACS) Colloid and Surface Science Division (national elected position) (2016-2018)
- Represented LANL and CINT at the *2016 National Lab Day*, Washington, D.C.: Technology demonstration and science discussion for Secretary of Energy Moniz, Undersecretary Orr, Congressional Staff and their Staffers. Led team of LANL students, postdocs and technologists in the fabrication and testing of a giant quantum dot-enabled white-light LED demo.
- CINT Nanowire Integration Focus Area: Science Leader (2010-2015)
- CINT Nanophotonics & Optical Nanomaterials (NPON) Thrust: Acting Science Partner Leader (2013 completed)
- Program Committee Member/Chair: *LANL Center for Nonlinear Studies (CNLS) Executive Committee Member* (2013-present), *LANL Director's Colloquium Selection Committee Member/Chair* (Member: 2011-2013; Chair: 2013-present), *LANL Fellows Screening Committee Member* (2011), *SPIE Photonics West QDs for Biomedical Applications* (2007 to present) and *26<sup>th</sup> Rare Earth Research Conference* (2011).
- Chair and organizer: *Center for Nonlinear Studies (CNLS) 2014 Annual Conference: Mesoscale Science*. *CINT 2008 Workshop on Semiconductor Nanowires* and *CINT 2012 Workshop on Advances at the Interface of Biology and Nanomaterials*. Founding Member: *CINT Nanowire Working Group* (2008; ongoing). Chair: *LANL Laboratory Directed Research & Development Chemistry Exploratory Research Committee Chair* (2007-2009). Co-organizer: *CLEO Workshop on Nanophotonics Research at the DOE Nanoscale Science Research Centers*.
- Participant/Expert Presenter/Contributor to National Planning Initiatives: *NSF Third Workshop on Future Directions of Solid-State Chemistry* (2007), *ARPA-E Rare Earth and Critical Materials*

*Workshop* (2010), *DOE Solid-State Lighting R&D Workshop* (2012), *DOE Joint (BES/EERE) Solid State Lighting Roundtable on Science Challenges* (2011, 2014, 2015 & 2016).

- Guest Co-Editor: Chemistry of Materials Special Issue: *Synthetic and Mechanistic Advances in Nanocrystal Growth*.
- Mentor: 10 high school, undergraduate and postbaccalaureate students; 22 postdoctoral researchers (16 as mentor, 6 as co-mentor).
- Technical reviewer for: Molecular Foundry DOE Nanoscale Science Research Center (Berkeley), NIH, NSF, DOE Early Career Research Program (2010-2014), Canada Foundation for Innovation (2014), LANL LDRD Program, as well as Journal of the American Chemical Society, Nano Letters, ACS Nano, *Angewandte Chemie*, *Small*, *The Journal of Physical Chemistry*, *Chemistry of Materials*, *Nanotechnology*, *Langmuir*, *Solid State Communications*, *Nature Communications*, *Nature Materials*, *Nature Nanotechnology*, etc.

#### **Invited Talks/Seminars (Since 2007):**

- [1] (Invited Talk) **Gordon Research Conference**: Inorganic Chemistry (2007; Salve Regina University Newport, RI): *Near- to Mid-Infrared-Emitting Nanocrystal Quantum Dots: And, Yes, They're Stable!*
- [2] (Invited Talk) **Nanoscale Epitaxial Semiconductor Structures (NESS) Workshop** (2007 ICAM-I2CAM, Los Alamos, NM): *Solution Growth of Core/Shell Infrared-Emitting Nanocrystal Quantum Dots*.
- [3] (Invited Talk) **SPIE Photonics West Meeting in Colloidal Quantum Dots for Biomedical Applications IV** (2009; San Jose, CA): *'Giant' multishell CdSe nanocrystal quantum dots with suppressed blinking: Novel fluorescent probes for real-time detection of single molecule events*.
- [4] (Invited Talk) **NM-AVS Meeting** (2009): *"Giant" Nanocrystal Quantum Dots: Suppressed Blinking and Auger Recombination through Solution-Phase Physical- and Electronic-Structure Engineering*.
- [5] (Invited Talk) **International Symposium: Topical Problems of Biophotonics** in the *Nanobiophotonics Topical Conference* (2009; Nizhny Novgorod, Russia): *Suppressed blinking and suppressed auger recombination in 'giant' nanocrystal quantum dots: Novel fluorescent probes for advanced bioimaging applications*.
- [6] (Invited Talk) **Materials Research Society Spring Meeting** (2010): *Novel Functional Semiconductor Nanocrystal Quantum Dots and Nanowires for Applications Involving Energy Conversion*.
- [7] (Invited Talk) **ARPA-E Rare Earth and Critical Materials Workshop** (2010, Washington, D.C.): (Phosphors Talk 1) *"Giant" Nanocrystal Quantum Dots: Disruptive Technology for Efficient and Robust Light-Emission*.
- [8] (Invited Talk) **241<sup>ST</sup> American Chemical Society National Meeting** (Spring, 2011): *Direct and indirect redox processes of semiconductor nanocrystal quantum dots: Implications for biological applications*.
- [9] (Invited Talk) **SPIE Nanoscience + Engineering Active Photonic Materials IV Conference** (August 2011): *'Giant' nanocrystal quantum dots: a new class of active emitters for photonics applications*.
- [10] (Invited Talk) **242<sup>nd</sup> American Chemical Society National Meeting** (Fall, 2011): *Nanocrystal quantum dot architectures and assemblies for light emission applications*.
- [11] (Invited Talk) **Solid-State Lighting EFRC Workshop** (September, 2011): *Giant nanocrystal quantum dots: A new class of optical nanomaterials for light emission applications*.
- [12] (Invited Talk) **DOE Joint (BES/EERE) Solid State Lighting Roundtable on Science Challenges** (October, 2011): *Giant nanocrystal quantum dots: A new class of optical nanomaterials for light emission applications*.
- [13] (Invited Talk) **Materials Research Society Spring Meeting** (2012): *Process-dependent properties in colloiddally synthesized "giant" core/shell nanocrystal quantum dots*.
- [14] (Invited Talk) **Energy@MagLab Workshop** (Fall 2012; Tallahassee, Florida): *LED Lighting and Quantum Dots*.



- [15] (Invited Talk) **Gordon Research Conference**: Nanomaterials for Applications in Energy Technology (2013): *Giant Nanocrystal Quantum Dots for Light-Emission Applications*
- [16] (Invited Talk) **CLEO: 2013 Conference**: Non-blinking "Giant" Nanocrystal Quantum Dots: Ideal Probes for Real-time Three-dimensional Tracking.
- [17] (Invited Talk) **Materials by Design Workshop** in LANL Materials Summer Research Group (July, 2013): *Nanoscale Heterostructures Designed for Optimal Light Emission*.
- [18] (Invited Talk) **246<sup>th</sup> American Chemical Society National Meeting** (Fall, 2013): "Giant" heterostructured nanocrystal quantum dots: *From suppressed blinking to solid-state lighting*.
- [19] (Invited Talk) **University of New Mexico Cancer and Nano Workshop** (August, 2013): *Heterostructured Quantum Dots: From Molecular Probes Toward Cancer Therapy*.
- [20] (Invited Talk) **Gordon Research Conference**: Colloidal Semiconductor Nanocrystals (inaugural meeting; 2014): *Nanoscale Engineering for Function: The Blinking Story*.
- [21] (Invited Talk) **DOE Joint (BES/EERE) Solid State Lighting Roundtable on Science Challenges** (October, 2014): *Next-Generation Giant Quantum Dots: Solving the Solid-State Performance Conundrum*.
- [22] (Invited Talk) **Materials Research Society Spring Meeting** (2015): *Engineering Semiconductor Nanocrystals for Optimizing Applications in Light Emission: Next-Generation 'Giant' Quantum Dots*.
- [23] (Invited Talk) **Materials Research Society Spring Meeting** (2015): *Flow–Solution–Liquid–Solid Nanowire Synthesis: From Fundamentals and Controlled Heterostructuring Toward Applications*.
- [24] (Invited Talk) **SPIE Active Photonic Materials VII** (2015): *Redefining Giant Quantum Dot Functionality through Synthesis and Integration: From Multifunctionality to Directed Photoluminescence*.
- [25] (Invited Talk) **NIST Advancing Nanoparticle Manufacturing** (2015): *From Control to Scale-up: Benefits from Continuous-Flow Chemistry and Automating Batch Reactions*.
- [26] (Invited Talk) **DOE Joint (BES/EERE) Solid State Lighting Roundtable on Science Challenges** (October, 2015): *Next-Generation Giant Quantum Dots: Solving the Solid-State Performance Conundrum*.
- [27] (Invited Talk) **IEEE Nanomed 2015** (November, 2015; 9th Int Conf on Nano Molecular Medicine and Engineering).
- [28] (Invited Talk) **Plasmonics and its Applications Workshop, CU Boulder** (March, 2016): Beyond Small Size: Small-scale Structure Engineering for New Function.
- [29] (Invited Talk) **Plasmonics and its Applications Workshop, CU Boulder** (March, 2016): Ultra-photostable 'giant' quantum dots as effective molecular probes and components for plasmonics-enabled theranostic nanoparticles.
- [30] (Invited Talk) **SPIE Optics + Photonics 2016** (August/September, 2016): *Structure-Property Relations in Engineered Semiconductor Nanomaterials San Diego*.

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- [31] (Invited Seminar) **LANL MSCookies and Tea Seminar Series** (2007): *Nanocrystal Quantum Dot Fluorophores: Controlling Optical Properties Through Chemistry*.
  - [32] (Invited Seminar) **University of New Mexico INCBN IGERT Seminar Series** (NSF Integrative Graduate Education and Research Traineeship in Integrating Nanotechnology with Cell Biology and Neuroscience) (2008): *Nanocrystal Quantum Dots: Fluorophores for Advanced Molecular Probes*.
  - [33] (Invited Seminar) **Boston University (invitation by BU Women in Chemistry)** (2008): *Nanocrystal Quantum Dot Fluorophores: Fine-Tuning Optical Properties Through Chemistry*.
  - [34] (Invited Seminar) **University of California, Davis** (2008): *The Shell's the Thing: Stable PbSe and Non-blinking CdSe Quantum Dots*.
  - [35] (Invited Seminar) **University of Nevada, Reno** (2008): *The Shell's the Thing: Stable PbSe and Non-blinking CdSe Quantum Dots*.

- [36] (Invited Seminar) **University of New Mexico** (2010): *“Giant” Nanocrystal Quantum Dots: Advances in Controlling Properties through Physical and Electronic Structure Manipulation.*
- [37] (Invited Seminar) **New Mexico State University** (2010): *“Giant” Nanocrystal Quantum Dots: Advances in Controlling Properties through Physical and Electronic Structure Manipulation.*
- [38] (Invited Seminar) **Yale University**, Institute for Nanoscience & Quantum Engineering Seminar (2010): *Novel Functional Semiconductor Nanocrystal Quantum Dots & Nanowires for Applications Involving Energy Conversion.*
- [39] (Invited Seminar) **University of Waterloo**, Waterloo Institute for Nanotechnology (September, 2011): *“Giant” Nanocrystal Quantum Dots: A New Class of Optical Nanomaterials for Light Emission Applications.*
- [40] (Invited Seminar) **Molecular Foundry** (LBNL NSRC) (December, 2012): *Heterostructured Nanocrystal Quantum Dots: From Suppressed Blinking To Solid-State Lighting.*
- [41] (Invited Seminar) **University of Texas, Dallas** (November, 2013): *Engineered Semiconductor Nanocrystals: From Synthesis to Application.*
- [42] (Invited Seminar) **University of Texas, Austin** (November, 2013): *Engineered Semiconductor Nanocrystals: From Synthesis to Application.*
- [43] (Invited Seminar) **University of Minnesota** (November, 2014): *Engineered Semiconductor Nanocrystals: From Synthesis to Application.*
- [44] (Invited Seminar) **LANL Q-mat Seminar Series** (August, 2015): *Engineered Solid-State Quantum Emitters: From Synthesis to Application*
- [45] (Invited Seminar) **Wayne State University** (February, 2016): *Beyond Small Size: Small-scale Structure Engineering for New Function*
- [46] (Invited Seminar) **University of Washington, Seattle** (March, 2016): *Beyond Small Size: Structure-Property Relations in Engineered Semiconductor Nanomaterials*