

Benjamin J. Roman

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Education

Texas A&M University (College Station, TX)

Ph.D. in Physical Chemistry, Defended October 2020

University of North Texas (Denton, TX)

B.S. in Chemistry, Completed December 2014

Employment and Research History

Post-Doctoral Researcher (November 2020 – Present)

University of Texas, Department of Chemical Engineering

Advisor: Delia Milliron

Graduate Student Researcher (June 2015 – October 2020)

Texas A&M University, Department of Chemistry

Advisor: Matthew Sheldon

- Examined one photon photoluminescence up-conversion in all-inorganic lead halide perovskite nanocrystals using fluorescence microscopy.
- Designed a method for optical thermometry using the thermal dependence of one photon up-conversion and used this thermometry technique to show that CsPbBr₃ nanoparticles can be cooled using below-gap optical excitation.
- Collaborated with a team of researchers to elucidate the formation mechanism of CsPbBr₃ nanoparticles.
- Designed a method for room temperature deposition of gold nanoparticles onto the surface of all-inorganic lead halide perovskite nanocrystals.

Undergraduate Researcher (January 2014 – December 2014)

University of North Texas, Department of Chemistry

Advisor: Paul Marshall

- Investigated the heat capacity clusters of potassium chloride using *ab initio* density functional theory calculations.

Awards

Graduate:

DOW Chemical Graduate Scholarship (2020)

Young Researcher's Conference 2nd Place Poster Presentation Award (2019)

Texas A&M Conference on Energy Best Oral Presentation Award (2017)

Texas A&M University Association of Former Students Graduate Merit Fellowship (2015 – 2019)

Undergraduate:

University of North Texas James L. Carrico Award (2015)

Journal Publications

1. B. Roman, N. Mireles Villegas, K. Lytle, M. Sheldon. "Optically Cooling CsPbBr₃ Nanoparticles." See arXiv: <https://arxiv.org/abs/1912.04995>
2. J.-R. Wen, B. Roman, F. Rodriguez Ortiz, N. Mireles Villegas, N. Porcellino, M. Sheldon. "Chemical Availability of Bromide Dictates CsPbBr₃ Growth." *Chemistry of Materials*, **2019**, *31*, 8551-8557.
3. F. Rodriguez Ortiz, B. Roman, J.-R. Wen, N. Mireles Villegas, D. Dacres, M. Sheldon. "The Role of Gold Oxidation State in the Synthesis of Au-CsPbX₃ Heterostructure or Lead-free Cs₂Au^IAu^{III}X₆ Perovskite Nanoparticles." *Nanoscale*, **2019**, *11*, 18109-18115.
4. B. Roman, M. Sheldon. "Six-fold Plasmonic Enhancement of Thermal Scavenging via CsPbBr₃ Anti-Stokes Photoluminescence." *Nanophotonics*, **2019**, *8*, 599-605.
5. B. Roman, M. Sheldon. "The role of mid-gap states in all-inorganic CsPbBr₃ nanoparticle one photon up-conversion." *Chemical Communications*, **2018**, *54*, 6851-6854.
6. B. Roman, J. Otto, C. Galik, R. Downing, M. Sheldon. "Au Exchange or Au Deposition: Dual Reaction Pathways in Au-CsPbBr₃ Heterostructure Nanoparticles." *Nano Letters*, **2017**, *17* (9), 5561.
7. D. Parobek, B. Roman, Y. Dong, H. Jin, E. Lee, M. Sheldon, D. H. Son. "Exciton-to-Dopant Energy Transfer in Mn-Doped Cesium Lead Halide Perovskite Nanocrystals." *Nano Letters*, **2016**, *16* (12), 7376.

Contributed Presentations

Submitted Talks at National Meetings:

1. Optical Cooling with CsPbBr₃ Perovskite Nanocrystals *via* One Photon Up-Conversion Luminescence. Materials Research Society Meeting, Phoenix, AZ, April 2019.
2. Hybrid Metal-Semiconductor Nanoparticles for Hot Electron Luminescence Up-Conversion. American Chemical Society National Meeting, New Orleans, LA, March 2018.
3. Au Exchange or Au Deposition: Dual Reaction Pathways in Au-CsPbBr₃ Heterostructure Nanoparticles. American Chemical Society National Meeting, Washington, DC, August 2017.

Other Oral Presentations:

4. Optical Cooling with CsPbBr₃ Nanoparticles *via* One Photon Up-Conversion. Texas A&M Conference on Energy, September 2019
5. Optical Cooling with CsPbBr₃ Perovskite Nanocrystals *via* One Photon Up-Conversion Luminescence. Texas A&M Student Research Week, March 2019.
6. Semiconductor Nanoparticles for One Photon Luminescence Up-Conversion. Texas A&M Conference on Energy, September 2018.
7. Hybrid Au-CsPbBr₃ Nanoparticles for Optoelectronic Applications. Texas A&M Conference on Energy, September 2017.
8. All-Inorganic Perovskite Heterostructure Nanocrystals: Au-CsPbBr₃. Texas A&M Student Research Week, March 2017.
9. Heterostructured Perovskite Nanocrystals for Applications in Optical Energy Conversion. Texas A&M Conference on Energy, September 2016.

Submitted Posters at National Meetings:

1. Optical cooling with CsPbBr₃ Perovskite nanocrystals via One Photon Up-Conversion Luminescence. Young Researchers Conference, College Station, TX, June 2019.
2. Hybrid Metal-Semiconductor Nanoparticles for One Photon Luminescence Up-Conversion. Gordon Research Conference, Smithfield, RI, July 2018.
3. Plasmonic Heterostructured Nanoparticles for Luminescence Up-Conversion. Gordon Research Conference, West Dover, VT, July 2016.

Other Poster Presentations:

4. Optical Cooling with CsPbBr₃ Perovskite Nanocrystals *via* One Photon Up-Conversion Luminescence. Texas A&M Cotton Medal Symposium, March 2019.
5. Hybrid Au-CsPbBr₃ Nanoparticles for Optoelectronic Applications. DOW Chemical Student Symposium, May 2017.

Teaching Activities

Teaching Assistant (Fall 2015, Spring 2016)
Texas A&M University Department of Chemistry

Mentored Undergraduate Researchers

** denotes authorship credit on a publication*

Nicholas Porcellino* (January 2018 – December 2018)

Richard Reyes (REU, Summer 2018)

David Dacres* (REU, Summer 2017)

Rachel Davidson* (REU, Summer 2016)

Joseph Otto* (January 2016 – December 2016)

Christopher Galik* (August 2015 – December 2016)

Jennifer Miller (REU, Summer 2015)

Workshops and Training

What Matters in Mentoring, University of Wisconsin-Madison, 2017.

Mentoring Undergraduate Researchers Workshop, Texas A&M University, 2015.