

# JAMES R. NEILSON

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Department of Chemistry  
Colorado State University  
1872 Campus Delivery  
Fort Collins, CO 80523-1872

*e-mail:* [james.neilson@colostate.edu](mailto:james.neilson@colostate.edu)  
*phone:* (970) 491-2958  
*www:* <http://sites.chem.colostate.edu/neilsonlab>

## Research Vision

My research pertains to solid-state and materials chemistry; my interest lies in discovering and understanding emergent properties and reactivity of materials to achieve a paradigm of materials design. As materials are key enablers of technology, the goal of this research is to discover and design new functionality in materials, *i.e.*, control macroscopic electronic and magnetic properties through the competition of local interactions in materials. While we primarily perform experiments to make materials, characterize their structure and properties, we gain additional insight through numerical calculations and simulations.

## Employment

**2013–present** Assistant Professor; Colorado State University, Fort Collins, CO USA  
Department of Chemistry

**2011–2013** Post-doctoral Associate; Johns Hopkins University, Baltimore, MD USA  
Departments of Chemistry, Physics & Astronomy, and [the Institute for Quantum Matter](#), with [Professor Tyrel M. McQueen](#): *Development of low-temperature routes to inorganic materials and structure/property relationships in strongly correlated electron materials and superconductors.*

## Education

**2006–2011** University of California Santa Barbara, Santa Barbara, CA USA  
Ph.D., Biomolecular Science & Engineering; Thesis title: *Kinetic Control of Aqueous Hydrolysis: Modulation of Structure/Property Relationships in Inorganic Crystals*. Advisor: [Professor Daniel E. Morse](#)

**2005** University of Cambridge, Cambridge, U.K.  
Undergraduate Research Fellowship, Summer 2005; Research: *Vibrational properties of disordered materials*. Advisor: [Professor Stephen R. Elliot](#)

**2002–2006** Lehigh University, Bethlehem, PA USA  
B.S., Materials Science & Engineering, June 2006. Minor in Spanish. Research: *Chalcogenide glasses and Nanolithography*. Research Advisor: [Professor Himanshu Jain](#).

## Graduate / Undergraduate Awards

National Science Foundation, Graduate Research Fellowship, 2007-2010  
MRS Graduate Student Award, Silver Medalist, 2010  
Barry M. Goldwater Scholar, 2005

## Awards

- Alfred P. Sloan Foundation, Sloan Research Fellowship, 2017-2019.
- Research Corporation for Scientific Advancement, Cottrell Scholar Award, 2017-2020.
- National Science Foundation, Early CAREER Award, 2017-2022.
- Department of Energy Early Career Award, 2016-2021.

## Group / Mentoring

**Current Graduate Students:** Alexandra Koegel (2017–current), Chris Rom (2017–current), Victoria Combs (2016–current); Jewels Fallon (2016–current); Ethan Emerson (2015–current); Eve Mozur (2015–current), *NSF GRF Honorable Mention 2016, ORNL-ANL Neutron and X-ray Scattering School*; Paul Todd (2015–current); Arnold Paecklar (2014–current); Mary Marisa (2013–current), Annalise Maughan (2013–current), *2017 C3E Women in Clean Energy Symposium (by invitation), Ludo Frevel Scholarship International Centre for Diffraction Data (2017), College of Natural Sciences Top Scholar Award, Graduate Student Showcase 2016.*

**Current Postdoctoral Associates:** Dr. Iain Oswald (2017–current).

**Current Undergraduate Interns :** Matt Gorman, (2016–current); Erik Rognerud (2016–current); Julia Trowbridge (2016–current), *College Honors – Celebrating Undergraduate Research and Creativity Symposium (April 2017).*

**Alumni, Graduate Students:** Dr. Andrew Martinolich (2013–2017; Ph.D.), *Postdoctoral Scholar, California Institute of Technology, Ludo Frevel Scholarship International Centre for Diffraction Data (2016), CSU Graduate Student Showcase College of Natural Sciences Graduate Student Research Award 2015, CSU Graduate Student Showcase Great Minds in Research, Honorable Mention 2016*; Michael Tarne (2014–2017, M.S.); Loryn Killpack (2014–2016, M.S.); Greg Terho (2013–2014, M.S.).

**Alumni, Postdoctoral Associates:** Dr. Josh Kurzman (2013–2015).

**Alumni, Visiting Scholars:** Dr. Kate Ross (2014–2015).

**Alumni, Undergraduate Interns :** (Total: 12, including current). Geordan Brickey (2013–2014); Mitchel Bordelon (2013–2016), *NSF Graduate Research Fellowship (2016), German Academic Exchange Service Research in Science and Engineering Scholar (DAAD RISE) (June-August 2014), Highest Honors – Celebrating Undergraduate Research and Creativity Symposium (April 2015), Barry Goldwater Excellence in Education Foundation Honorable Mention (May 2015); Honors Thesis Improvement Grant (Honors program CSU) (January 2016), High Honors – Celebrating Undergraduate Research and Creativity Symposium (April 2016)*; Juliette Granger (2015–2016), *College Honors – Celebrating Undergraduate Research and Creativity Symposium (April 2016)*; J. James Allen (2014–2016), *College Honors – Celebrating Undergraduate Research and Creativity Symposium (April 2016)*; Mohammed Almaker (2016); Kyle Peterson (2016–2017); David Boyle (JMU REU 2016); Alex Milder (Haverford REU 2017); Andrew Candia (2016–2017) *CSU Energy Institute Undergraduate Fellow, 2017 Excellence in Energy – Celebrate Undergraduate Research and Creativity Symposium.*

## Publications (updated January 2, 2018)

With DOI links where available. Also listed at: <http://sites.chem.colostate.edu/neilsonlab/research.html>  
Citation tracking at: [Google Scholar](#).

### In Press or Review (manuscripts available upon request)

J. R. Neilson, N. Drichko, A. Llobet, M. Balasubramanian, M. R. Suchomel, T. M. McQueen, Local increase of symmetry on cooling in  $\text{KNi}_2\text{Se}_2$ . [arXiv]

I. Bhowmick, A. J. Roehl, J. R. Neilson, A. K. Rappé, M. P. Shores, Slow magnetic relaxation in octahedral low-spin Ni(III) complexes. *Under review.*

R. Sarkar, S. Kamusella, S. A. Braeuninger, S. Holenstein, J.-C. Orain, H. Luetkens, V. Grinenko, M. J. Tarne, J. R. Neilson, K. A. Ross, H.-H. Klaus, Magnetic order and spin dynamics in the helical magnetic system  $\text{Fe}_3\text{PO}_4\text{O}_3$ . *Under revision.* [arXiv]

D. Olds, K. V. Lawler, A. A. Paecklar, J. Liu, K. L. Page, P. F. Peterson, P. M. Forster, and J. R. Neilson, Capturing the details of N<sub>2</sub> adsorption in zeolite X using stroboscopic isotope contrasted neutron total scattering. *Chem. Mater.* (2018), ASAP. [doi]

A. E. Maughan, Ganose, A. M. Candia, J. T. Granger, D. O. Scanlon, and J. R. Neilson, Anharmonicity and Octahedral Tilting in Defect-Ordered Hybrid Perovskites. *Chem. Mater.* (2018), ASAP. (ACS Editors' Choice). [doi]



## Awarded US Patents:

1. J. R. Neilson, T. M McQueen, *Magnetocaloric materials for cryogenic liquification*. United States Patent, 9,568,223 (Feb 14, 2017). [USPTO]



## Appeared

42. M. J. Tarne, M. M. Bordelon, S. Calder, J. R. Neilson, K. A. Ross, Tuning the antiferromagnetic helical pitch length and nanoscale domain size in Fe<sub>3</sub>PO<sub>4</sub>O<sub>3</sub> by magnetic dilution. *Phys. Rev. B* (2018) 96, 214431. [arXiv],[doi]
41. E. M. Mozur, A. E. Maughan, Y. Cheng, A. Huq, N. Jalarvo, L. L. Daemen, and J. R. Neilson, Orientational Glass Formation in Substituted Hybrid Perovskites. *Chem. Mater.* (2017), 29(23), 10168-10177. [doi]
40. D. Olds, P. F. Peterson, M. K. Crawford, J. R. Neilson, H.-W. Wang, P. S. Whitfield, K. Page., Combinatorial Appraisal of Transition States for in situ Pair Distribution Function Analysis. *J. Appl. Crystallogr.* (2017) 50, 1-10. [doi]
39. D. Olds, K. Page, A. Paecklar, P. Peterson, J. Liu, G. Rucker, M. Ruiz-Rodriguez, M. Olsen, M. Pawel, S. Overbury, and J. R. Neilson, A high precision gas flow cell for performing in situ neutron studies of local atomic structure in catalytic materials. *Rev. Sci. Inst.* (2017) 88, 034101. [doi]
38. A. J. Martinolich, J. R. Neilson, Towards Reaction-By-Design: Achieving Kinetic Control of Solid State Chemistry with Metathesis. *Chem. Mater.* (2017) 29(2), 479-489. (Invited perspective) [doi]
37. M. E. Marisa, S. Zhou, B. C. Melot, G. F. Peaslee, J. R. Neilson, Paracrystalline Disorder from Phosphate Ion Orientation and Substitution in Synthetic Bone Mineral. *Inorg. Chem.* (2016) 55(23), 12290-12298. [doi]
36. A. J. Martinolich, J. A. Kurzman, J. R. Neilson, Circumventing Diffusion in Kinetically-Controlled Solid-State Metathesis Reactions, *J. Am. Chem. Soc.* (2016), 138(34), 11031-11037. [doi]
35. A. E. Maughan, A. M. Ganose, M. M. Bordelon, D. O. Scanlon, and J. R. Neilson, Defect tolerance to intolerance in the vacancy-ordered double perovskite semiconductors Cs<sub>2</sub>SnI<sub>6</sub> and Cs<sub>2</sub>TeI<sub>6</sub>. *J. Am. Chem. Soc.* (2016), 138(27), 8453-8464. [doi]
34. A. J. Martinolich, R. J. Higgins, M. P. Shores, J. R. Neilson, Lewis Base Mediated Polymorph Selectivity of Pyrite CuSe<sub>2</sub> Through Atom Transfer In Solid State Metathesis. *Chem. Mater.* (2016), 26(6), 1854-1860. [doi]
33. J. A. Kurzman, A. J. Martinolich, and J. R. Neilson. Influence of interstitial Mn on local structure and magnetism in Mn<sub>1+δ</sub>Sb. *Phys. Rev. B* (2015), 92, 184414. [arXiv],[doi]
32. K. A. Ross, M. M. Bordelon, G. S. Terho, J. R. Neilson, Nanosized helical magnetic domains in strongly frustrated Fe<sub>3</sub>PO<sub>4</sub>O<sub>3</sub>. *Phys. Rev. B*, (2015), 92, 134419. [arXiv],[doi]



31. J. R. Neilson, T. M. McQueen, Representational Analysis of Extended Disorder in Atomistic Ensembles Derived from Total Scattering Data. *J. Appl. Crystallogr.*, (2015), 48, 1560–1572. [arXiv],[doi]
30. M. Mourigal, S. Wu, M. B. Stone, J. R. Neilson, J. M. Caron, T. M. McQueen, C. L. Broholm, Block magnetic excitations in the orbitally-selective Mott insulator BaFe<sub>2</sub>Se<sub>3</sub>, *Phys. Rev. Lett.*, (2015), 115, 047401. [arXiv],[doi]
29. J. A. Kurzman, K. E. Dettelbach, A. J. Martinolich, C. P. Berlinguette, J. R. Neilson, Structural Characteristics and Eutaxy in the Photo-Deposited Amorphous Iron Oxide Oxygen Evolution Catalyst. *Chem. Mater.*, (2015), 27(9), 3462–3470. [doi]
28. A. J. Martinolich, J. A. Kurzman, J. R. Neilson, Polymorph Selectivity of Superconducting CuSe<sub>2</sub> Through Kinetic Control of Solid-State Metathesis. *J. Am. Chem. Soc.*, (2015), 137(11), 3827–3833. [doi]
27. A. E. Maughan, J. A. Kurzman, J. R. Neilson, Hybrid Inorganic-Organic Materials with an Optoelectronically Active Aromatic Cation: (C<sub>7</sub>H<sub>7</sub>)<sub>2</sub>SnI<sub>6</sub> and C<sub>7</sub>H<sub>7</sub>PbI<sub>3</sub>. *Inorg. Chem.*, (2015), 54(1), 370–378. [doi]
26. J. P. Sheckleton, J. R. Neilson, T. M. McQueen, Electronic tunability of the frustrated triangular-lattice cluster magnet LiZn<sub>2-x</sub>Mo<sub>3</sub>O<sub>8</sub>, *Mater. Horiz.*, (2015), 2, 76–80. [doi]
25. A. J. Martinolich, J. R. Neilson, Pyrite Formation via Kinetic Intermediates Through Low-Temperature Solid-State Metathesis, *J. Am. Chem. Soc.*, (2014), 136(44) 15654–15659. [doi]
24. J. R. Neilson, N. C. George, M. M. Murr, R. Seshadri, D. E. Morse, Mesostructure from hydration gradients in demosponge biosilica, *Chem. Eur. J.*, (2014), 20(17) 4956-4965. [doi]
23. P. Cottingham, D. C. Miller, J. P. Sheckleton, J. R. Neilson, M. Feyngenson, A. Huq, T. M. McQueen, Dynamic charge disproportionation in the 1D chain material PdTeI. *J. Mater. Chem. C*, (2014), 2, 3238–3246. [doi]
22. L. Tao, G. Rousse, J. R. Neilson, B. C. Melot, T. M. McQueen, C. Masquelier, Magnetic Structures of LiMBO<sub>3</sub> (M = Mn, Fe, Co) lithiated transition metal borates, *Inorg. Chem.*, (2013), 52 (20), 11966–11974. [doi]
21. W. A. Phelan, D. C. Wallace, K. E. Arpino, J. R. Neilson, K. J. Livi, C. R. Seabourne, A. J. Scott, T. M. McQueen, Stacking Variants and Superconductivity in the Bi-O-S System. *J. Amer. Chem. Soc.*, (2013), 135 (14) 5372–5374. [doi]
20. J. R. Neilson, A. Llobet, J. Wen, M. R. Suchomel, T. M. McQueen, Charge density wave fluctuations, heavy electrons, and superconductivity in KNi<sub>2</sub>S<sub>2</sub>, *Phys. Rev. B*, (2013), 87, 045124. [arXiv],[doi]
19. J. R. Neilson, A. Llobet, A. V. Stier, L. Wu, J.-J. Wen, J. Tao, Y. Zhu, Z. B. Tesanovic, N. P. Armitage, T. M. McQueen, Mixed-valence-driven heavy-fermion behavior and superconductivity in KNi<sub>2</sub>Se<sub>2</sub>, *Phys. Rev. B*, (2012), 86, 054512. [arXiv],[doi]
18. L. A. Bawazer, M. Izumi, D. Kolodin, J. R. Neilson, B. Schwenzer, D. E. Morse, Evolutionary selection of enzymatically synthesized semiconductors from biomimetic mineralization vesicles, *Proc. Natl. Acad. Sci. U.S.A.* (2012), 109 (26), E1705-E1714. [doi]
17. J. P. Sheckleton, J. R. Neilson, D. G. Soltan, T. M. McQueen, Possible valence bond condensation in the frustrated cluster magnet LiZn<sub>2</sub>Mo<sub>3</sub>O<sub>8</sub>, *Nat. Mater.* (2012), 11, 493-496. [doi],[arXiv]



16. J. M. Caron, J. R. Neilson, D. C. Miller, K. Arpino, A. Llobet, T. M. McQueen, Orbital Selective Magnetism in the Spin-Ladder Iron Selenides  $Ba_{1-x}K_xFe_2Se_3$ , *Phys. Rev. B*, (2012), 85, 180405(R). [arXiv], [doi] 
15. J. R. Neilson, T. M. McQueen, Bonding, ion mobility, and rate-limiting steps in deintercalation reactions with  $ThCr_2Si_2$ -type  $KNi_2Se_2$ , *J. Am. Chem. Soc.* (2012), 134 (18), 7750-7757. [doi]
14. J. M. Caron, J. R. Neilson, D. C. Miller, A. Llobet, T. M. McQueen, Iron displacements and magnetoelastic coupling in the spin-ladder compound  $BaFe_2Se_3$ , *Phys. Rev. B*, (2011), 84, 180409(R). [arXiv],[doi] 
13. J. R. Neilson, J. A. Kurzman, R. Seshadri, D. E. Morse, Ordering double perovskite hydroxides by kinetically controlled aqueous hydrolysis, *Inorg. Chem.*, (2011), 50, 3003-3009. [doi]
12. J. R. Neilson, B. C. Melot, D. P. Shoemaker, J. Kurzman, R. Seshadri, D. E. Morse, Understanding complex magnetic order in disordered cobalt hydroxides through analysis of the local structure, *Phys. Rev. B*, (2011), 80, 094418. [arXiv],[doi]
11. B. Schwenzer, J. R. Neilson, S. M. Jeffries, D. E. Morse,  $Cd_{1-x}Zn_xO$  [ $0.05 \leq x \leq 0.26$ ] synthesized by vapor-diffusion induced co-nucleation from aqueous metal salt solutions, *Dalton Trans.*, (2011), 40 (6), 1295-1301. [doi]
10. H. L. Zhang, J. R. Neilson, D. E. Morse, Vapor-diffusion-controlled sol-gel synthesis of flaky lithium vanadium oxide and its electrochemical behavior, *J. Phys. Chem. C*, (2010), 114 (45), 19550-19555. [doi]
9. K. Niesz, C. Reji, J. R. Neilson, R. C. Vargas, D. E. Morse, Unusual evolution of ceria nanocrystal morphologies promoted by a low-temperature vapor diffusion based process, *Cryst. Growth Des.*, (2010), 10 (10), 4485-4490. [doi]
8. J. R. Neilson, J. A. Kurzman, R. Seshadri, D. E. Morse, Cobalt coordination and clustering in  $\alpha$ - $Co(OH)_2$  revealed by synchrotron X-ray total scattering, *Chem. Eur. J.* (2010), 16 (33), 9998-10006. [doi]
7. J. R. Neilson, B. Schwenzer, R. Seshadri, D. E. Morse, Kinetic control of intralayer cobalt coordination in layered hydroxides:  $Co_{1-0.5x}^{oct}Co_x^{tet}(OH)_2(Cl)_x(H_2O)_n$ , *Inorg. Chem.* (2009), 48 (23), 11017-11023. [doi]
6. B. Schwenzer, J. R. Neilson, K. Sivula, C. Woo, J. M. J. Frechét, D. E. Morse, Nanostructured *p*-type cobalt layered double hydroxide/*n*-type polymer bulk heterojunction yields an inexpensive solar cell, *Thin Solid Films* (2009) 517, 5722-5727. [doi]
5. B. Schwenzer, L. Z. Pop, J. R. Neilson, T. Sbardellati, D. E. Morse, Nanostructured ZnS and CdS Films synthesized using Layered Double Hydroxide Films as Precursor and Template, *Inorg. Chem.* (2009), 48 (4), 1542-1550. [doi]
4. A. Kovalskiy, J. R. Neilson, A. C. Miller, F. C. Miller, M. Vlček, and H. Jain, Comparative study of electron- and photo-induced structural transformations on the surface of  $As_{35}S_{65}$  amorphous thin films, *Thin Solid Films* (2008) 516, 7511-7518. [doi]
3. J. R. Neilson, A. Kovalskiy, M. Vlček, H. Jain, and F. Miller, Fabrication of nano-gratings in arsenic sulphide films, *J. Non-Cryst. Solids* (2007) 353, 1427-1430. [doi]

2. A. Kovalskiy, H. Jain, J. R. Neilson, M. Vlček, C. M. Waits, W. Churaman, M. Dubey, On the mechanism of gray scale patterning of Ag-containing  $\text{As}_2\text{S}_3$  thin films, *J. Phys. Chem. Solids* (2007) 68, 920-925. [doi]
1. S. N. Taraskin, S. I. Simdyankin, S. R. Elliot, J. R. Neilson, and T. Lo, Universal features of terahertz absorption in disordered materials, *Phys. Rev. Lett.* (2006) 97, 055504. [doi]

**Professional and Honor societies**

American Chemical Society, American Physical Society, Materials Research Society, American Crystallographic Association, Neutron Scattering Society of America, *Phi Beta Kappa*, *Tau Beta Pi*.