Kelsey Morgan

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Education

2015	**Ph.D.** Physics, University of Wisconsin-Madison
2008	**B.A.** Physics, University of Chicago

Research Experience

2017–present	**Guest Researcher**, Quantum Sensors Group - Quantum Electromagnetics Division, Physical Measurement Laboratory, National Institute of Standards and Technology
	Research Associate, Department of Physics, University of Colorado-Boulder
2015–2017	**National Research Council Postdoctoral Fellow**, Quantum Devices Group - Dr. Dan Swetz, Physical Measurement Laboratory, National Institute of Standards and Technology
2009–2015	**Graduate Research Assistant**, X-ray Quantum Calorimeter (XQC) collaboration - Prof. Dan McCammon, Department of Physics, University of Wisconsin-Madison
2008–2009	**Lab Assistant**, Sunyaev-Zel'dovich Array (SZA) project - Prof. John Carlstrom, Department of Physics, University of Chicago
2007–2009	**Undergraduate Research Assistant**, J-PARC E-14 "K0TO" collaboration - Prof. Yau Wah, Department of Physics, University of Chicago

Research Collaborations

NIST Quantum Calorimeters

I lead the Quantum Calorimeter group's "pixel development" team, which aims to advance the design of transition edge sensor (TES) pixels to meet the spectroscopy needs of both NIST and collaborators worldwide, including spectrometers at or planned for deployment to RIKEN, SSRL, NSLS-II, LANL, and BESSY-II. My research interests include developing TES soft X-ray spectrometers, studying the physics of superconducting calorimetric devices, and advancing SQUID multiplexing techniques for large arrays.

HAUS-Kat Soft X-ray Spectrometer at BESSY-II (Principal Investigator)

Collaboration between University of Colorado-Boulder, NIST, Max Planck Institute, and BESSY-II to develop a soft X-ray spectrometer for catalysis research at the BESSY-II synchrotron in Berlin, Germany. The spectrometer will provide sub-eV energy resolution for soft X-rays to enable novel studies of real catalytic systems.

TES x-ray spectrometer for exotic atom spectroscopy (Principal Investigator)
: Collaboration between University of Colorado-Boulder, NIST, and RIKEN to develop a ahrd X-ray TES spectrometer for the study of Quantum Electrodynamics effects under extremely intense electric fields from the viewpoint of atomic physics via muonic atom x-ray spectroscopy.

TES x-ray spectrometers at SSRL (collaborator):
: Collaboration between NIST, the University of Colorado-Boulder, and SLAC to support the use of TES microcalorimeter x-ray spectrometers at SSRL beamlines 10-1 and 13-3, as well as developing and deploying upgrades to those instruments to enhance their performance.

ATHENA X-ray Satellite (collaborator):
: Recently selected European Space Agency mission, in collaboration with NIST, Stanford, and NASA Goddard Space Flight Center to develop a 3,168 pixel TES x-ray focal-plane array for the next space-based x-ray observatory.

Honors & Awards

2020	Physical Measurement Laboratory (PML) Distinguished Associate Award
2018	Physical Measurement Laboratory (PML) Distinguished Associate Award
2015–2017	National Research Council Postdoctoral Research Fellowship
2011–2015	NASA Space Technology Research Fellow (NSTRF)
2011	NASA Earth and Space Science Fellowship (declined)
2011	University of Wisconsin-Madison Karl Guthe Jansky & Alice Knapp Jansky Fellowship for Physics & Astronomy

Research Presentations

Low Temperature Detectors 19 Conference, July 2021 *(poster)*
"Readout of thermally multiplexed transition-edge sensors with a microwave SQUID multiplexer"

Invited talk: Young Scientists Plenary at the Applied Superconductivity Conference, November, 2020
"Science in Seconds: the bigger, faster future of superconducting detectors"

Applied Superconductivity Conference, virtual conference, October-November 2020 *(poster)*
"Developing Mo/Au bilayer TES for soft X-ray spectroscopy at light sources"

Invited talk: University of Washington Online XAFS Journal Club Series, March, 2020
"Hot Science with Cool Sensors"

Low Temperature Detectors 18 Conference, Milan, Italy, July 2019 *(poster)*
"Expanding the capability of microwave multiplexed readout for fast signals in microcaloriemters"

Applied Superconductivity Conference, Seattle, WA, October 2018
"Using transition models to guide design of soft x-ray TESs for LCLS-II"

Denver X-ray Conference, Westminster, CO, August 2018
"Realizing the potential of TES microcalorimeters for X-ray and gamma ray science at light sources"

Invited talk: 2017 SSRL/LCLS Users' Meeting, Palo Alto, CA, September 2017
"TES: a high efficiency, high resolution, energy-dispersive area detector"

Low Temperature Detectors 17 Conference, Fukuoka, Japan, July 2017
"Dependence of transition width on current and critical current in transition-edge sensors"

Invited talk: Quantum Electromagnetics Division Seminar, NIST, Boulder, CO, July 2017
"High speed, high resolution transition-edge sensors for next-generation light sources"

Applied Superconductivity Conference, Denver, CO, September 2016
"High speed, high resolution TES detectors for next-generation light sources"

Low Temperature Detectors 16 Conference, Grenoble, France, July 2015 *(poster)*
"Transition-edge sensor microcalorimeters for a diffuse soft x-ray sounding rocket mission"

Invited talk: NASA Early Stage Technology Workshop, Washington, D.C., March 2015.
"Developing transition-edge sensors for new space-based applications"

Invited talk: High Energy Astrophysics Division 14th Meeting, Chicago, IL, August 2014
"Studying the Hot ISM with the X-ray Quantum Calorimeter Sounding Rocket"

Invited talk: Conference on the Application of Accelerators in Research and Industry (CAARI), Fort Worth, TX, August 2012
"Charge Exchange X-ray Emission: Astrophysical Observations and Potential Diagnostics,"

Invited talk: Albion College Undergraduate Seminar, Albion, MI, October 2012
"See the Milky Way in X-rays: Using Low Temperature Detectors and Sounding Rockets to Study the Diffuse X-ray Background,"

Applied Superconductivity Conference, Portland, OR, October 2012 *(poster)*
"Position Dependent Pulse Shape in TES Thermometers Coupled to Bi/Au Absorbers,"

AAS High Energy Astrophysics Division Meeting, Newport, RI, September 2011 *(poster)*
"Distribution of the Galactic 3/4 keV Diffuse X-ray Background from ROSAT Data,"

Publications

Publications with fifteen or more authors have the alphabetized author list shortened to et. al.

62. C.J. Titus, *et al.*, "Advancing the in-situ characterization of light elements via X-ray absorption spectroscopy using superconducting detectors." *Microscopy and Microanalysis*, 27 (S1), 2890-2891, 2021.
61. T. Okumura,*et al.*, "Deexcitation Dynamics of Muonic Atoms Revealed by High-Precision Spectroscopy of Electronic K X rays." *Physical Review Letters*, 127 (5), 053001, 2021.
60. A. Wessels, *K.M. Morgan*, J.D. Gard, G.C. Hilton, J.A. Mates, C.D. Reintsema, D.R. Schmidt, D.S. Swetz, J.N. Ullom, L.R. Vale, L.R. and D.A. Bennett, "A model for excess Johnson noise in superconducting transition-edge sensors." *Applied Physics Letters*, 118 (20), p.202601, 2021.
59. M. Carpenter, *et al.*, "Hyperspectral X-ray Imaging: Progress Towards Chemical Analysis in the SEM." *IEEE Transactions on Applied Superconductivity* 31 (5), 2021.
58. T. Okumura, *et al.*, "Dynamical Response of Transition-Edge Sensor Microcalorimeters to a Pulsed Charged-Particle Beam." *IEEE Transactions on Applied Superconductivity*, 31 (5), 1-4, 2021.
57. M. Durkin, *et al.*, "Mitigation of Finite Bandwidth Effects in Time-Division-Multiplexed SQUID Readout of TES Arrays." *IEEE Transactions on Applied Superconductivity*, 31 (5), 1-5, 2021.
56. D. Yan, *et al.*, "Transition-Edge Sensor Optimization for Hard X-ray Applications." *IEEE Transactions on Applied Superconductivity*, 31 (5), 1-5, 2021.
55. P. Szypryt, *et al.*, "Design of a 3000-Pixel Transition-Edge Sensor X-Ray Spectrometer for Microcircuit Tomography." *IEEE Transactions on Applied Superconductivity*, 31 (5), 1-5, 2021.
54. S. Yamada, *et al.*, "Broadband high-energy resolution hard x-ray spectroscopy using transition edge sensors at SPring-8," *Review of Scientific Instruments*, 92 (1): 013103, 2021.
53. L. MiajaAvila, G.C. O'Neil, Y.I. Joe, **K.M. Morgan**, J.W. Fowler, W.B. Doriese, B. Ganly, D. Lu, B. Ravel, D.S. Swetz, and J.N. Ullom, "Valencetocore Xray emission spectroscopy of titanium compounds using energy dispersive detectors," *XRay Spectrometry*, 50 (1): 9-20, 2021.
52. J. Fowler, G.C. O'Neil, B.K. Alpert, D. Bennett, E.V. Denison, W.B. Doriese, G.C. Hilton, L.T. Hudson, Y.I. Joe, **K.M. Morgan**, and D. Schmidt, "Absolute energies and emission line shapes of the L x-ray transitions of lanthanide metals," *Metrologia*, 2020.
51. J.C. Weber, **K.M. Morgan**, D. Yan, C.G. Pappas, A.L. Wessels, G.C. ONeil, D.A. Bennett, G.C. Hilton, D.S. Swetz, J.N. Ullom, and D.R. Schmidt, "Development of a transition-edge sensor bilayer process providing new modalities for critical temperature control," *Superconductor Science and Technology*, 33 (11): 115002, 2020.
50. S. Okada *et al.*, "X-ray Spectroscopy of Muonic Atoms Isolated in Vacuum with Transition Edge Sensors," *Journal of Low Temperature Physics*, 1-7, 2020.
49. M.H. Carpenter *et al.*, "Hyperspectral X-ray Imaging with TES Detectors for Nanoscale Chemical Speciation Mapping," *Journal of Low Temperature Physics*, 2020.
48. T. Hashimoto *et al.*, "Integration of a TES-based X-ray spectrometer in a kaonic atom experiment," *Journal of Low Temperature Physics*, 199: 1018, 2020.

47. Y.I. Joe, Y. Fang, S. Lee, S. XL Sun, A. Gilberto, W.B. Doriese, **K.M. Morgan**, J.W. Fowler, L.R. Vale, F. Rodolakis, J.L. McChesney, J.N. Ullom, D.S. Swetz, P. Abbamonte, "Resonant soft X-ray scattering from from stripe-ordered La_2 − xBa$_x$CuO$_4$ detected by a transition-edge array detector," *Physical Review Applied*, 13 (3): 034026, 2020.
46. C.J. Titus *et al.*, "Count rate optimizations for TES detectors at a femtosecond X-ray laser," *Journal of Low Temperature Physics*, 2020.
45. P. Szypryt *et al.*, "A transition-edge sensor-based X-ray spectrometer for the study of highly charged ions at the National Institute of Standards and Technology electron beam ion trap," *Review of Scientific Instruments*, 90 (12): 123107, 2019.
44. **K.M. Morgan** *et al.*, "Expanding the capability of microwave multiplexed readout for fast signals in microcalorimeters," *Journal of Low Temperature Physiscs*, 2019.
43. S.J. Lee *et al.*, "Soft X-ray spectroscopy with transition-edge sensors at Stanford Synchrotron Radiation Lightsource beamline 10-1," *Review of Scientific Instruments*, 90 (11): 113101, 2019.
42. D. Wulf *et al.*, "A high spectral resolution study of the soft x-ray background with the X-ray Quantum Calorimeter," *The Astrophysical Journal*, 884 (2): 120, 2019.
41. X. Zhang *et al.*, "Controlling the thermal conductance of silicon nitride membranes at 100 mK temperatures with patterned metal features," *Applied Physics Letters*, 115 (5): 052601, 2019.
40. J.C. Weber *et al.*, "Configurable error correction of code-division multiplexed TES detectors with a cryotron switch," *Applied Physics Letters*, 114 (23): 232602, 2019.
39. M. Durkin *et al.*, "Demonstration of Athena X-IFU compatible 40-row time-division-multiplexed readout," *IEEE Transactions on Applied Superconductivity*, 29 (5), 2019.
38. W.B. Doriese *et al.*, "Optimization of time- and code-division-multiplexed readout for Athena X-IFU," *IEEE Transactions on Applied Superconductivity*, 29 (5), 2019.
37. C.D. Reintsema *et al.*, "High-throughput, DC-parametric evaluation of flux-activated-switch-absed TDM and CDM SQUID multiplexers," *IEEE Transactions on Applied Superconductivity*, 29 (5), 2019.
36. **K.M Morgan** *et al.*, "Use of transition models to design high performance TESs for the LCLS-II soft x-ray spectrometer," *IEEE Transactions on Applied Superconductivity*, 29 (5), 2019.
35. D.A. Bennett *et al.*, "Microwave SQUID multiplexing for the Lynx x-ray microcalorimeter," *Journal of Astronomical Telescopes, Instruments, and Systems*, 5 (2): 021007, 2019.
34. F.T. Jaeckel *et al.*, "Energy Calibration of high-resolution X-ray TES microcalorimeters with 3 eV optical photons," *IEEE Transactions on Applied Superconductivity*, 29 (5), 2019.
33. D. Li *et al.*, "TES x-ray spectrometer at SLAC LCLS-II," *Journal of Low Temperature Physics*, 193 (5-6): 1287-1297, 2018.
32. C.G. Pappas, J.W. Fowler, D.A. Bennett, W.B. Doriese, Y.I. Joe, **K.M. Morgan**, G.C. ONeil, J.N. Ullom, D.S. Swetz, "A highly linear calibration metric for TES X-ray microcalorimeters," *Journal of Low Temperature Physics*, 193 (3-4): 249-257, 2018.

31. C.J. Titus, *et al.*, "Error-correcting codes for code-division multiplexed TES detectors," *Journal of Low Temperature Physics*, 193 (3-4): 556-561, 2018.
30. Y. Zhou *et al.*, "Mapping TES temperature sensitivity and current sensitivity as a function of temperature, current and magnetic field with IV curve and complex admittance measurements," *Journal of Low Temperature Physics*, 193 (3-4): 321-327, 2018.
29. D. Yan *et al.*, "Microstructure analysis of bismuth absorbers for transition-edge sensor X-ray microcalorimeters," *Journal of Low Temperature Physics*, 193 (3-4): 225-330, 2018.
28. **K.M. Morgan**, "Hot science with cool sensors," *Physics Today*, 71 (8), 2018.
27. C.J. Titus *et al.,* "L-edge spectroscopy of dilute, radiation-sensitive systems using a transition-edge-sensor array," *The Journal of Chemical Physics* 147(21): 214201, 2017.
26. D. Yan *et al.,* "Eliminating the non-Gaussian spectral response of X-ray absorbers for transition-edge sensors," *Applied Physics Letters*, 111(19): 192602, 2017.
25. J.W. Fowler, B.K. Alpert, W.B. Doriese, J. Hays-Wehle, Y.-I. Joe, **K.M. Morgan**, G.C. O'Neil, C.D. Reintsema, D.R. Schmidt, J.N. Ullom, D.S. Swetz, "When "Optimal Filtering" isn't," *IEEE Transactions on Applied Superconductivity*, 27(4): 1-4, 2017.
24. **K.M. Morgan**, C.G. Pappas, D.A. Bennett, J.D. Gard, J.P. Hays-Wehle, G.C. Hilton, C.D. Reintsema, D.R. Schmidt, J.N. Ullom, D.S. Swetz, "Dependence of transition width on current and critical current in transition-edge sensors," *Applied Physics Letters*, 110(21): 212602, 2017.
23. D.G Seely, V.M. Andrianarijaona, D. Wulf, **K. Morgan**, D. McCammon, M. Fogle, P.C. Stancil, R.T. Zhang, C.C. Havener, "Line ratios for soft-x-ray emission following charge exchange between O 8+ and Kr," *Physical Review A*, 95(5): 052704, 2017.
22. J. Fowler *et al.,* "A reassessment of absolute energies of the X-ray L lines of lanthanide metals," *Metrologia*, 54(4): 494, 2017.
21. W.B. Doriese *et al.,* "A practical superconducting-microcalorimeter X-ray spectrometer for beamline and laboratory science," *Review of Scientific Instruments*, 88(5): 053108, 2017.
20. S. Zhang, M.E. Eckart, F.T. Jaeckel, K.L. Kripps, D. McCammon, **K.M. Morgan**, Y. Zhou, "Mapping the resistance of a superconducting transition edge sensor as a function of temperature, current, and applied magnetic field," *Journal of Applied Physics*, 121(7): 074503, 2017.
19. P. Chabera, *et al.,* "A low-spin Fe(III) complex with 100 ps ligand-to-metal charge transfer photoluminescence," *Nature*, 543(7647): 695-699, 2017.
18. J.K. Ahn, *et al.,* "A new search for the $K_L \to \pi^0 \nu\bar{\nu}$ and $K_L \to \pi^0 X^0$ decays," *Progress of Theoretical and Experimental Physics*, 2017(2):021C01, 2017.
17. W. Liu, *et al.,* "The structure of the local hot bubble," *The Astrophysical Journal*, 834(1):33, 2016.
16. J.W. Fowler, B.K. Alpert, W.B. Doriese, J. Hays-Wehle, Y-I Joe, **K.M. Morgan**, G.C. ONeil, C.D. Reintsema, D.R. Schmidt, J.N. Ullom, D.S. Swetz, "When "optimal filtering" isnt." *IEEE Transactions on Applied Superconductivity*, 27(4), 2016.
15. P.J. Lowell, J.A.B. Mates, W.B. Doriese, G.C. Hilton, **K.M. Morgan**, D.S. Swetz, J.N. Ullom, D.R. Schmidt, "A thin-film cryotron suitable for use as an ultra-low-temperature switch," *Applied Physics Letters*, 109(14):142601, 2016.

14. **K.M. Morgan**, B.K. Alpert, D.A. Bennett, E.V. Denison, W.B. Doriese, J.W. Fowler, J.D. Gard, G.C. Hilton, K.D. Irwin, Y.I. Joe, G.C. O'Neil, C.D. Reintsema, D.R. Schmidt, J.N. Ullom, D.S. Swetz, "Code-division-multiplexed readout of large arrays of tes microcalorimeters," *Applied Physics Letters*, 109 (11):112604, 2016.
13. Y. Uprety, *et al.,* "Solar wind charge exchange contribution to the ROSAT all sky survey maps," *The Astrophysical Journal*, 829(2):83, 2016.
12. F.T. Jaeckel, K.L. Kripps, **K.M. Morgan**, S. Zhang, D. McCammon, "Fabrication of superconducting Mo/Cu bilayers using ion-beam- assisted e-beam evaporation," *Journal of Low Temperature Physics*, 184(3-4): 647653, 2016.
11. D. Wulf, F. Jaeckel, D. McCammon, and **K.M. Morgan**, "Technique for recovering pile-up events from microcalorimeter data," *Journal of Low Temperature Physics*, 184(1-2):431435, 2016.
10. W.B. Doriese, *et al.,* "Developments in time-division multiplexing of x-ray transition-edge sensors," *Journal of Low Temperature Physics*, 184(1-2):389395, 2016.
9. E. Figueroa-Feliciano, A.J. Anderson, D. Castro, D.C. Goldfinger, J. Rutherford, M.E. Eckart, R.L. Kelley, C.A. Kilbourne, D. McCammon, **K. Morgan**, F.S. Porter, A.E. Szymkowiak, "Searching for kev sterile neutrino dark matter with x-ray microcalorimeter sounding rockets," *The Astrophysical Journal*, 814(1):82, 2015.
8. **K. Morgan**, F.T. Jaeckel, K.L. Kripps, D. McCammon, "Ion-beam-assisted deposition of Mo thin films for TES applications," *IEEE Transactions on Applied Superconductivity*, 25(3):15, 2015.
7. M. Galeazzi, *et al.,* "The origin of the local 1/4-kev x-ray flux in both charge exchange and a hot bubble," *Nature*, 512(7513):171173, 2014.
6. **K.M. Morgan**, S.E. Busch, M.E. Eckart, C.A. Kilbourne, D. McCammon, "Large area transition edge sensor x-ray microcalorimeters for diffuse x-ray background studies," *Journal of Low Temperature Physics*, 176(3-4):331336, 2014.
5. M.S. Hokin, D. McCammon, **K.M. Morgan**, S.R. Bandler, S.J. Lee, S.H. Moseley, S.J. Smith, "Narrow line x-ray calibration source for high resolution microcalorimeters," *Journal of Low Temperature Physics*, 176(3-4): 566570, 2014.
4. S.L. Snowden, *et al.,* "Pressure equilibrium between the local interstellar clouds and the local hot bubble," *Astrophysical Journal Letters*, 791(1):L14, 2014.
3. M. Fogle, D. Wulf, **K. Morgan**, D. McCammon, D.G. Seely, I.N. Draganic, and C.C. Havener, "X-ray-emission measurements following charge exchange between C6+ and H2," *Physical Review A*, 89(4):042705, 2014.
2. X. Defay, **K. Morgan**, D. McCammon, D. Wulf, V.M. Andrianarijaona, M. Fogle, D.G. Seely, I.N. Draganic, and C.C. Havener, "X-ray emission measurements following charge exchange between C6+ and He," *Physical Review A*, 88(5): 052702, 2013.
1. **K. Morgan**, *et al.,* "Charge exchange x-ray emission: Astrophysical observations and potential diagnostics," *AIP Conference Proceedings*, 1525: 4954. 2013.

Non-refereed Publications

iii. S.J. Smith, *et al.,* "Transition-edge sensor pixel parameter design of the microcalorimeter array for the X-ray Integral Field Unit on Athena," *SPIE Astronomical Telescopes+ Instrumentation*, 99052H99052H, 2016.

ii. S.R. Bandler, *et al.,* "Development of x-ray microcalorimeter imaging spectrometers for the X-ray Surveyor mission concept," *SPIE Astronomical Telescopes+ Instrumentation*, 99050Q 99050Q, 2016.

i. N.E. Thomas, *et al.,* "The DXL and Storm sounding rocket mission," *SPIE Optical Engineering+ Applications*, 88590Z88590Z, 2013.

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