REBECCA Coles

Curriculum Vitae
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Brookhaven National Laboratory
Detector System and Application Support
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Google Scholar: scholar.google.com/citations?hl=en&user=Wyd4aTMAAAAJ
SPIE: https://spie.org/profile/Rebecca.Coles-4092890

EDUCATION

2016 Ph.D. Physics
Department of Physics and Astronomy
Wayne State University

2012 M.S. Physics
Department of Physics and Astronomy
Wayne State University

2007 B.S. Physics (Minor in Mathematics)
Department of Physics and Astronomy
Wayne State University

RELEVANT FIRST AUTHOR PUBLICATIONS
(More Publications Listed in Research Experience Section)

2022 Rebecca A. Coles, Biays Bowerman, Martin Schoonen, Juergen Thieme, and Andrew Duffin "Automation of submicron resolution x-ray spectroscopy measurements and analysis using supervised and unsupervised machine learning algorithms", Proc. SPIE 12227, Applications of Machine Learning 2022, 122270K (3 October 2022)
https://doi.org/10.1117/12.2633459

2022 Rebecca A. Coles, Biays Bowerman, Steven Glozek, and Susan Pepper, “Development of Nuclear Forensics using Synchrotron Radiation-Based Analysis at the National Synchrotron Light Source-II”. Proc. LLNL NCV-ASAP-2022. Lawrence Livermore National Laboratory Internal Paper

2021 Rebecca Coles, Biays Bowerman, Lynne Ecker, Ericmoore Jossou, Juergen Thieme, Martin Schoonen, Mehmet Topsakal, "Evaluation of Use of Synchrotron-based High-Resolution Chemical and Structural Analysis Techniques for Customs and Border Protection Law Enforcement Applications," Department of Homeland Security Internal Paper (September 15, 2021)

2020 Oleg Chubar, Rebecca Coles, Lutz Wiegart, Andrei Fluerasu, Maksim Rakitin, James Condie, Paul Moeller, Rob Nagler, "Simulations of coherent scattering experiments at storage ring synchrotron radiation sources in the hard x-ray range," Proc. SPIE 11493, Advances in Computational Methods for X-Ray Optics V, 1149310 (August 21, 2020)
doi.org/10.1117/12.2568833

2018 R. Coles; M. Derwent; P. Martini; T. O'Brien; A. Ross; S. Tie. DESI Commissioning Instrument Metrology. Proc. SPIE 10706, Advances in Optical and Mechanical Technologies for Telescopes and Instrumentation III, 107061L (July 10 2018);
arxiv.org/abs/1807.09283

2017 R. Coles; J. Chiang; D. Cinabro; J. Haupt; H. Neal; A. Nomerotski; P. Takacs. An automated system to measure the quantum efficiency of CCDs for astronomy. Journal of Instrumentation, 12.04 C04014 (April 18, 2017);
dx.doi.org/10.1088/1748-0221/12/04/C04014

2012 C. J. Bebek ; R. A. Coles ; P. Denes ; F. Dion ; J. H. Emes ; R. Frost ; D. E. Groom ; R. Groulx ; S. Haque ; S. E. Holland ; A. Karcher ; W. F. Kolbe ; J. S. Lee ; N. P. Palaio ; N. A. Roe ; C. H. Tran ; G. Wang; CCD research and development at Lawrence Berkeley National Laboratory . Proc. SPIE 8453, High Energy, Optical, and Infrared Detectors for Astronomy V, 845305 (September 25, 2012);
dx.doi.org/10.1117/12.926606

GRANTS AND AWARDS

2015 Department of Energy Grant: Office of Science Graduate Student Research (SCGSR)
Brookhaven National Laboratory
Award: $36,000 + $4000 for travel
Term length: 12 months
science.osti.gov/wdts/scgsr

2014 American Association of Physics Teachers Award (Gustafson Memorial)
Wayne State University
Award: $750
clas.wayne.edu/physics/news/category/awards

RESEARCH EXPERIENCE

2022-2023 Developer for National Nuclear Data Center continuous integration system:
National Nuclear Data Center (NNDC)
Brookhaven National Laboratory, Upton NY
Assistant Scientist (Current Position):

- ADVANCE project to automate all the testing needed for the ENDF/B-VII.1 We quickly realized that the quasi-automated suite could be completely automated and turned into a continuous integration (CI) system.

Software:
•ADVANCE Evaluated Nuclear Data File (ENDF/B)
https://www.nndc.bnl.gov/endf-dev/qa/

2020-2022 Automation of Nuclear Forensics using Synchrotron X-rays
Nonproliferation and National Security: Detector Systems and Applications
Brookhaven National Laboratory, Upton NY
Assistant Scientist:

- Created SnapPy (Synchrotron Network Automation Program in Python) software for using machine learning and synchrotron beamline controls to create non-destructive chemical analysis and elemental maps of environmental samples for nuclear forensics (Python and Qt).
- Automating the workflow for rapidly measuring and producing elemental maps of large-area samples using the Submicron Resolution X-ray Spectroscopy Beamline (SRX) at the National Synchrotron Light Source II, Brookhaven National Laboratory, through a novel combination of supervised and unsupervised machine learning algorithms.

Publications:
• Automation of submicron resolution x-ray spectroscopy measurements and analysis using supervised and unsupervised machine learning algorithms
doi.org/10.1117/12.2633459
• Development of Nuclear Forensics using Synchrotron Radiation-Based Analysis at the National Synchrotron Light Source-II. Proc. LLNL NCV-ASAP-2022
• Development of synchrotron-based analyses of environmental samples. Proc. INMM (2022)

2019-2020 Simulations of X-ray Scattering
Experimental Development at National Synchrotron Light Source II (NSLS-II)

Brookhaven National Laboratory, Upton NY
Post-Doc:

- Created Python package to generate randomized 3D samples to simulate actual nano-materials/glass/colloids/etc. that are studied at various beamlines (C++ and Python)
- Set up GPU for simulation processing (CUDA, Imod, Conda, MPI processing).
- Created machine learning algorithm to automatically select propagation parameters for a user input of a beamline sample for the Synchrotron Radiation Workshop software (Reinforcement Learning, SVM, but also attempted instance based kNN).
- Wrote software to access HDF5 x-ray scattering data from beamlines at NSLSII. The software handled: data acquisition from the beamline servers, displaying images and beamline data, adding scaling and image cropping functions (h5py).
- Created simulations of samples for the NSLSII CHX beamline to prepare beamline scientists for future experiments, as well as to verify experimental data (C++, Python, NSLSII BlueSky).
- Created educational video tutorials for the Sirepo Simulation software (Camtasia).

Publications:
• Analysis of Hard X-Ray Focusing by 2D Diamond CRL
doi.org/10.1117/12.2568980
• Simulations of Coherent Scattering Experiments at Storage Ring Synchrotron Radiation Sources in the Hard X-Ray Range
doi.org/10.1117/12.2568833

Software:
•Synchrotron Radiation Workshop (SRW)
github.com/ochubar/SRW
•SRW 2D Random Objects
github.com/racoles/SRW_2D_random_objects
•NSLSII CHX Data Acquisition from BlueSky
github.com/NSLS-II-CHX/srw-image-tools
•Sirepo Simulations
beta.sirepo.com/srw#/simulations

2018-2019 Sloan Digital Sky Survey (SDSS-V)
Imaging Science Laboratory
Ohio State University, Columbus OH
Post-Doc:

- Created mechanical and software apparatus for thermometry testing of computer system cold temperature survivability (C++, Python, wagoIO).

Software:
•Centroid Machine Learning Software
github.com/racoles/centroiding

2017-2018 Dark Energy Spectroscopic Instrument (DESI)
Imaging Science Laboratory
Ohio State University, Columbus OH
Post-Doc :

- Analyze DESI Commissioning Instrument images using my custom deep learning metrology software (R and PyTorch).
- Aligned and focused the DESI Commissioning Instrument for use on the DESI telescope by writing and implementing metrology software and procedures (Python with Tkinter GUI).

Publications:
•DESI Commissioning Instrument Metrology
doi.org/10.1117/12.2312592
•The Commissioning Instrument for the Dark Energy Spectroscopic Instrument
doi.org/10.1117/12.2312885

Software:
•DESI Metrology software
github.com/racoles/DESI_CI_MET

2015-2017 Large Synoptic Survey Telescope (LSST)
Instrumentation Division
Brookhaven National Laboratory, Upton NY
Graduate Researcher:

- Construction of camera LSST camera (CCD sensor installation, electronics, and testing systems).
- Installing and imaging X-ray sources.
- Testing camera readout electronics.
- Focal plane metrology using SmartScope metrology measurements and analysis.
- Develop and maintain LSST Camera Control Software (CCS).
- Construction of backside illuminated CCD camera (CCD sensor installation, electronics, and testing systems).
- Construction of quantum efficiency testing apparatus for LSST CCDs.

- Mechanical design and construction of electro-optical hardware, and programming.
- CCD handling.
- General clean room and CCD handling experience.
- Perform residual gas analysis (RGA) on LSST cryostats.
- Frequently use vacuum and cryo systems, and have experience in designing systems that use such equipment.

Publications:
•LSST: from Science Drivers to Reference Design and Anticipated Data Products
iopscience.iop.org/article/10.3847/1538-4357/ab042c

Software:
•Metrology software
github.com/racoles/RSA_Metrology
•CCD surface debris detection software
github.com/racoles/lint

2011-2013 Baryon Oscillation Spectroscopic Survey (BigBOSS)
Microsystems Laboratory
Lawrence Berkeley National Laboratory, Berkeley CA
Graduate Researcher:

- Identified limitations and redesigned quantum efficiency testing apparatus to fit BigBOSS CCDs.
- Design and installation of X-ray sources for system calibration.
- Construction of quantum efficiency testing apparatus for LSST CCDs.
- Experience in vacuum, optics, electronics, and cryo systems, and frequent CCD handling.
- On programming team for the quantum efficiency testing apparatus automation,
- Developed a program to map the quantum efficiency of BigBoss CCDs (IDL).

Publications:
•CCD Research and Development at Lawrence Berkeley National Laboratory
doi.org/10.1117/12.926606

2008-2011 Wayne State University
Department of Physics and Astronomy
Detroit MI
Scientific Analyst:

- Supernova data analysis.
- Wrote programs that use principle component analysis to reduce supernova data (R).
- Built and maintained a Beowulf scientific server to provide computing resources for the university's physics department.

Software:
•Supernova Principle Component Analysis
sites.google.com/view/sdsspca

2008 Tevatron Particle Accelerator
Particle Accelerator Division
Fermilab, Batavia IL
Particle Accelerator Technician:

- Performed stabilization measurements on quadruple and dipole magnets in the Tevatron Particle Accelerator.

2007 Supernova Acceleration Probe (SNAP)
Particle Astrophysics Division
Fermilab, Batavia IL
Science Associate:

- Programmed and tested voltage regulating board prototype FRIC0 (Fermilab Regulator Integrated Circuit).

2006 Sloan Digital Sky Survey (SDSS)
Particle Astrophysics Division
Fermilab, Batavia IL
National Science Foundation (NSF) Associate:

- Organized spectroscopic date on supernova candidates.
- Created a mysql database and web application to host supernova candidate data.

PROGRAMING LANGUAGES

Frequently used programming languages:
Python, Java, C++, MATLAB, Qt

General experience programming languages:
IDL, R, C, Mathematica, SQL, PHP

Documenting languages:
YAML, LaTeX, Sphinx, SLAC eTraveler, Confluence, JIRA, Jupyter Notebook

RELATED PROFESSIONAL SKILLS

Certified Analyst for BlueDragon Hyper-Integrated Causal Analysis Problem Solving Methodology:
bluedragon-hca.com

CAD Software:
Autodesk Inventor, SoldWorks, OpenSCAD

Video Recording and Editing Software:
Camtasia, Filmora

3D printers:
Fablicator, Makerbot, MakerGear, Anet A8, FlashForge

3D printing and model rendering software:
Cura, Flashprint, Autodesk Meshmixer, Simplify3D, 3DF Zephyr

Optical design software:
Zemax

Entrepreneurial Training for Department of Energy Researchers:
Opportunity Analysisiologist training in PSW-lite

CONFERENCE ACTIVITY AND SYMPOSIUMS

2022 Association of Materials-Centric Engineers and Scientists (ASM) Joint Meeting with the American Nuclear Society (ANS)
Association of Materials-Centric Engineers and Scientists (ASM) Conference, New York
Invited Speaker (talk)
http://DoL1.eng.sunysb.edu/asm/

2022 SPIE Optical Engineering + Applications: Applications of Machine Learning 2022
Conference 12227, San Diego
Guest Presenter (talk)
spiedigitallibrary.org/conference-proceedings-of-spie/12227.toc

2021 Synchrotron Radiation-Based Capabilities in Support of the Nuclear Forensics and Nonproliferation Mission
International Atomic Energy Agency Conference, New York
Guest Presenter (Interview)
https://vimeo.com/brookhavennationallab/review/567881200/98232dfd5a

2021 Consortium for Monitoring Technology and Verification
University of Michigan, Michigan
Guest Presenter (talk)
mtv.engin.umich.edu

2019 Gordon Research Conferences for X-Ray Science
Stonehill College: Easton, Massachusetts
Presenter (poster)
grc.org/x-ray-science-conference/2019

2019 National Synchrotron Light Source II (NSLS-II) Seminar
Brookhaven National Laboratory (BNL): Upton, New York
Guest Speaker (talk)
bnl.gov/nsls2/seminars

2018 Particle, Astro, and Nuclear Physics Seminar (PAN)
Wayne State University: Detroit, Michigan
Guest Speaker (talk)
clas.wayne.edu/physics/seminars/pan

2018 SPIE Astronomical Telescopes + Instrumentation
Austin, Texas
Presenter (talk)
spie.org/conferences-and-exhibitions/past-conferences-and-exhibitions/astronomical-instrumentation-and-telescopes-2018

2016 Precision Astronomy with Fully Depleted CCDs (PACCD)
Brookhaven National Laboratory (BNL): Upton, New York
Presenter (poster)
bnl.gov/paccd2016

2016 American Astronomical Society (AAS) 227th Conference
Kissimmee, Florida
Presenter (poster)
aas.org/meetings/aas227

2015 LSST Project and Community Workshop
Bremerton, Washington
lsst.org/news/events

2008 Baryon Acoustic Oscillations (BAO) Telescope Conference
Fermilab: Batavia, Illinois
Host (assistant)
cerncourier.com/a/conference-probes-the-dark-side-of-the-universe

2007 Gravitations Lensing Conference
Fermilab: Batavia, Illinois

Host (assistant)
astro.fnal.gov/events/conferences

TEACHING EXPERIENCE

2014 Astronomy: Graduate Teaching Assistant

2009-2013 Electrodynamics: Graduate Teaching Assistant

SERVICE TO PROFESSION

2022 Mentor in Science Undergraduate Laboratory Internship program (SULI):
Fall 2022: Cluster Analysis Testing
Spring 2022: Synchrotron Image Analysis
Fall 2021:Synchrotron Image Analysis
Spring 2021:Data Parsing for Analysis
Summer 2020: Simulation of Experiments
science.osti.gov/wdts/suli

2021 Department of Energy's CyberForce Competition (Brookhaven National Laboratory)
Cyber defense competitions to exercise interactive and scenario-based events.
2021 (Red Team)
2020 (Red Team)
2019 (Red Team)
cyberforcecompetition.com

2017 STEM-Prep Summer Institute (Brookhaven National Laboratory)
Presentation Title: LSST and the History of Dark Energy and Dark Matter
bnl.gov/education/programs

2016 Girls Inc. (Brookhaven National Laboratory)
Presentation Title: LSST and the Universe
bnl.gov/newsroom/news.php?a=213027

2016 Science National Laboratory Day (Washington DC)
Presentation Title: Big Data for LSST
bnl.gov/newsroom/news.php?a=26331

2015 PubSci: The Dark Universe (Brewology Pub in Long Island, New York)
Presentation Title: The Dark Universe
bnl.gov/pubsci

2015 Custer Observatory (Long Island, New York)
Presentation Title: Dark Matter and Dark Energy
custerobservatory.org

AFFILIATIONS

Brookhaven Women In Science (BWIS): Lifetime Member
bnl.gov/bwis/

Dark Energy Science Collaboration (DESC): Member
lsstdesc.org

American Astronomical Society (AAS): Member
aas.org