

REBECCA Coles
Curriculum Vitae
12/22/2021

Brookhaven National Laboratory
Detector System and Application Support
Upton, NY 11973 USA

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EDUCATION

- | | |
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| 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)

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| 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

- 2020-2021 Automation of Nuclear Forensics using Synchrotron X-rays
Nonproliferation and National Security: Detector Systems and Applications
Brookhaven National Laboratory, Upton NY
Assistant Scientist (Current Position):
- 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).

Software:

- NSLS-II Image Stitching at Beamlines: TES, SRX, and XFM

github.com/racoles/NSLS-II_Beamline_Image_Stitching

- NSLS-II Area of Interest Unsupervised Machine Learning at Beamlines: TES, SRX, and XFM

github.com/racoles/NSLS-II_Beamline_Unsupervised_Machine_Learning

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 quadrupole 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 data 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, L^AT_EX, Sphinx, SLAC eTraveler, Confluence, JIRA, Jupyter Notebook

RELATED PROFESSIONAL SKILLS

CAD Software:

Autodesk Inventor, SolidWorks, 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

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| 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/brookhavernationallab/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

- 2021 Mentor in Science Undergraduate Laboratory Internship program (SULI):
2021 (one intern)
2020 (one intern)
2019 (two interns)
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): Member
bnl.gov/bwis/

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

American Astronomical Society (AAS): Member
aas.org