

REBECCA Coles  
Curriculum Vitae  
02/09/2021

Brookhaven National Laboratory  
Detector System and Application Support  
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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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- 2020      Oleg Chubar, Rebecca Coles, Lutz Wiegart, Andrei Fluerașu, 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 (21 August 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](https://doi.org/10.1117/12.926606).

## GRANTS AND AWARDS

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- 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](https://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](https://clas.wayne.edu/physics/news/category/awards)

## RESEARCH EXPERIENCE

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- 2020-2021 Automation of Nuclear Forensics using Synchrotron X-rays  
Nonproliferation and National Security: Detector Systems and Applications  
Brookhaven National Laboratory, Upton NY  
Post-Doc (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:
- SnapPy Automation Software: for security reasons this software is not open source. However, code samples are available upon request.
- 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](https://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](https://doi.org/10.1117/12.2568833)

Software:

- Synchrotron Radiation Workshop (SRW)  
[github.com/ochubar/SRW](https://github.com/ochubar/SRW)
- SRW 2D Random Objects  
[github.com/racoles/SRW\\_2D\\_random\\_objects](https://github.com/racoles/SRW_2D_random_objects)
- NSLSII CHX Data Acquisition from BlueSky  
[github.com/NSLS-II-CHX/srw-image-tools](https://github.com/NSLS-II-CHX/srw-image-tools)
- Sirepo Simulations  
[beta.sirepo.com/srw#/simulations](https://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).

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](https://doi.org/10.1117/12.2312592)
- The commissioning instrument for the dark energy spectroscopic instrument  
[doi.org/10.1117/12.2312885](https://doi.org/10.1117/12.2312885)

Software:

- Metrology software  
[github.com/racoles/DESI\\_CI\\_MET](https://github.com/racoles/DESI_CI_MET)
- Centroid machine learning software  
[github.com/racoles/centroiding](https://github.com/racoles/centroiding)
- Imaging software  
[github.com/racoles/general\\_image\\_processing\\_functions](https://github.com/racoles/general_image_processing_functions)

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:

- CCD research and development at Lawrence Berkeley National Laboratory  
[doi.org/10.1117/12.926606](https://doi.org/10.1117/12.926606)

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).

Software:

- Metrology software  
[github.com/racoles/RSA\\_Metrology](https://github.com/racoles/RSA_Metrology)
- CCD surface debris detection software  
[github.com/racoles/lint](https://github.com/racoles/lint)

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/site/sdsspca](https://sites.google.com/site/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

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Frequently used programming languages:

Python, Java, C++, MATLAB, Qt

General experience programming languages:

IDL, R, C, Mathematica, SQL, PHP

Documenting languages:

YAML, L<sup>A</sup>T<sub>E</sub>X, Sphinx, SLAC eTraveler, Confluence, JIRA, Jupyter Notebook

## RELATED PROFESSIONAL SKILLS

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CAD Software:

Autodesk Inventor, SolidWorks, OpenSCAD

Video Recording and Editing Software:

Camtasia

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

## CONFERENCE ACTIVITY AND SYMPOSIUMS

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- 2021      Consortium for Monitoring Technology and Verification  
University of Michigan, Michigan  
Guest Presenter (talk)  
[mtv.engin.umich.edu](http://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](http://grc.org/x-ray-science-conference/2019)
- 2019      National Synchrotron Light Source II (NSLS-II) Seminar  
Brookhaven National Laboratory (BNL): Upton, New York  
Guest Presenter (talk)  
[bnl.gov/nsls2/seminars](http://bnl.gov/nsls2/seminars)
- 2018      Particle, Astro, and Nuclear Physics Seminar (PAN)  
Wayne State University: Detroit, Michigan  
Guest Presenter (talk)  
[clas.wayne.edu/physics/seminars/pan](http://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](http://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](http://bnl.gov/paccd2016)
- 2016      American Astronomical Society (AAS) 227th Conference  
Kissimmee, Florida  
Presenter (poster)  
[aas.org/meetings/aas227](http://aas.org/meetings/aas227)
- 2015      LSST Project and Community Workshop  
Bremerton, Washington  
[lsst.org/news/events](http://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](http://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](http://astro.fnal.gov/events/conferences)

## TEACHING EXPERIENCE

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- 2014      Astronomy: Graduate Teaching Assistant
- 2013      Electrodynamics: Graduate Teaching Assistant
- 2009-2010      Electrodynamics: Graduate Teaching Assistant

## SERVICE TO PROFESSION

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- 2021      Mentor in Science Undergraduate Laboratory Internship program (SULI):  
2021 (one intern)  
2020 (one intern)  
2019 (two interns)  
[science.osti.gov/wdts/suli](http://science.osti.gov/wdts/suli)
- 2020      Department of Energy's CyberForce Competition (Argonne National Laboratory)  
Cyber defense competitions to exercise interactive and scenario-based events.  
[cyberforcecompetition.com](http://cyberforcecompetition.com)
- 2019      Department of Energy's CyberForce Competition (Brookhaven National Laboratory)  
Cyber defense competitions to exercise interactive and scenario-based events.  
[cyberforcecompetition.com/prior-competitions/doe-cyberforce-competition-2019](http://cyberforcecompetition.com/prior-competitions/doe-cyberforce-competition-2019)
- 2017      STEM-Prep Summer Institute (Brookhaven National Laboratory)  
Presentation Title: LSST and the History of Dark Energy and Dark Matter  
[bnl.gov/education/programs](http://bnl.gov/education/programs)
- 2016      Girls Inc. (Brookhaven National Laboratory)  
Presentation Title: LSST and the Universe  
[bnl.gov/newsroom/news.php?a=213027](http://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](http://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](http://bnl.gov/pubsci)
- 2015      Custer Observatory (Long Island, New York)  
Presentation Title: Dark Matter and Dark Energy  
[custerobservatory.org](http://custerobservatory.org)

## **AFFILIATIONS**

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LSST Dark Energy Science Collaboration (DESC): Member  
[lsstdesc.org](http://lsstdesc.org)

American Astronomical Society (AAS): Member  
[aas.org](http://aas.org)