# REBECCA Coles

Curriculum Vitae
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Brookhaven National Laboratory
National Synchrotron Light Source II (NSLSII)
Upton, NY 11973 USA

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## 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
Department of Physics and Astronomy
Wayne State University

## RELEVANT PUBLICATIONS

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);
https://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);
http://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);
http://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
https://science.osti.gov/wdts/scgsr

2014 American Association of Physics Teachers Award (Gustafson Memorial)
Wayne State University
Award: $750

## RESEARCH EXPERIENCE

2019 Simulations of X-ray Scattering (NSLSII)
Brookhaven National Laboratory (BNL), Upton NY
Post-Doc (Current Position):

- 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++ and Python).

Sirepo Simulations (Web App): https://beta.sirepo.com/srw#/simulations
Synchrotron Radiation Workshop: https://github.com/ochubar/SRW
CHX image tools: https://github.com/racoles/NSLSII-CHX-image-tools

2018-2019 Sloan Digital Sky Survey (SDSS-V)
Ohio State University Imaging Science Laboratory, 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)
Ohio State University Imaging Science Laboratory, 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).

Metrology software: https://github.com/racoles/DESI_CI_MET
Centroiding (machine learning) software: https://github.com/racoles/centroiding
Imaging software: https://github.com/racoles/general_image_processing_functions

2015-2017 Large Synoptic Survey Telescope (LSST)
Brookhaven National Laboratory (BNL), 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.

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

2011-2013 Baryon Oscillation Spectroscopic Survey (BigBOSS)
Lawrence Berkeley National Laboratory (LBNL), 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).

2008-2011 Wayne State University
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: https://sites.google.com/site/sdsspca/

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

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

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

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

2006 Sloan Digital Sky Survey (SDSS)
Fermilab, Batavia IL
National Science Foundation (NSF) Student 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

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

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

## RELATED PROFESSIONAL SKILLS

Autodesk Inventor:
Experience with mechanical design and documentation

SoldWorks:
Experience with mechanical design and documentation

3D printers:
Frequent experience with Fablicator, Makerbot, MakerGear, and Anet A8

## CONFERENCE ACTIVITY AND SYMPOSIUMS

2019 Gordon Research Conferences for X-Ray Science
Stonehill College: Easton, Massachusetts
Presenter (poster)

2019 NSLS-II Seminar
Brookhaven National Laboratory (BNL): Upton, New York
Guest Presenter (talk)

2018 Particle, Astro, and Nuclear Physics Seminar (PAN)
Wayne State University: Detroit, Michigan
Guest Presenter (talk)

2018 SPIE Astronomical Telescopes + Instrumentation
Austin, Texas
Presenter (talk)

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

2016 American Astronomical Society (AAS) 227th Conference
Kissimmee, Florida
Presenter (poster)

2015 LSST Project and Community Workshop
Bremerton, Washington

2008 Baryon Acoustic Oscillations (BAO) Telescope Conference
Fermilab: Batavia, Illinois
Host (assistant)

2007 Gravitations Lensing Conference
Fermilab: Batavia, Illinois
Host (assistant)

## TEACHING EXPERIENCE

2014 Astronomy: Graduate Teaching Assistant

2013 Electrodynamics: Graduate Teaching Assistant

2009-2010 Electrodynamics: Graduate Teaching Assistant

## SERVICE TO PROFESSION

2019 Department of Energy's CyberForce Competition (Brookhaven National Laboratory)
Cyber defense competitions to exercise interactive and scenario-based events.
Website: https://cyberforcecompetition.com/

2019 Science Undergraduate Laboratory Internship (Brookhaven National Laboratory)
Advised two wonderful undergraduate interns during their summer term.

2017 STEM-Prep Summer Institute (Brookhaven National Laboratory)
Presentation Title: LSST and the History of Dark Energy and Dark Matter

2016 Girls Inc. (Brookhaven National Laboratory)
Presentation Title: LSST and the Universe

2016 Science National Laboratory Day (Washington DC)
Presentation Title: Big Data for LSST

2015 PubSci: The Dark Universe (Brewology Pub in Long Island, New York)
Presentation Title: The Dark Universe

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

## AFFILIATIONS

LSST Dark Energy Science Collaboration (DESC): Member

American Astronomical Society (AAS): Member