

REBECCA Coles
Curriculum Vitae
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Brookhaven National Laboratory
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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 (Minor in Mathematics)
 Department of Physics and Astronomy
 Wayne State University

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

- 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

- 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
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++ and Python).
- 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
- CHX image tools
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).

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:

- Metrology software
github.com/racoles/DESI_CI_MET
- Centroid machine learning software
github.com/racoles/centroiding
- Imaging software
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

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
- CCD surface debris detection software
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

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

Autodesk Inventor:

Experience with mechanical design and documentation

SoldWorks:

Experience with mechanical design and documentation

Video Recording and Editing Software:

Frequent experience with Camtasia screen recorder and video editor

3D printers:

Frequent experience with: Fablicator, Makerbot, MakerGear, Anet A8, and FlashForge

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

CONFERENCE ACTIVITY AND SYMPOSIUMS

- 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 Presenter (talk)
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
- 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
- 2013 Electrodynamics: Graduate Teaching Assistant
- 2009-2010 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
- 2020 Department of Energy's CyberForce Competition (Argonne National Laboratory)
Cyber defense competitions to exercise interactive and scenario-based events.
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
- 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

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

American Astronomical Society (AAS): Member
aas.org