

CONNER DAILEY

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EDUCATION

Master of Science in Physics

University of Nevada, Reno

Advisor: Dr. Andrei Derevianko

Thesis Title: “Probing exotic fields with networks of atomic clocks” (see Published Theses)

August 2017 - August 2019

GPA: 3.845/4.0

Bachelor of Science in Physics

University of Nevada, Reno

Advisor: Dr. Andrei Derevianko

Minors: Astronomy and Mathematics

August 2014 - May 2017

GPA: 3.827/4.0

Secondary Education

Truckee Meadows Community College High School

Edward C. Reed High School

August 2013 - May 2014

August 2010 - June 2013

OTHER ACADEMIC PROGRAMS

PRISMA⁺ Internship Program

Johannes Gutenberg University, Mainz, Germany

January 2020 - Present

The 37th Advanced School in Theoretical Physics:

New Ideas for Old Puzzles in Particle Physics

The Israel Institute of Advanced Studies, Jerusalem

December 2019 - January 2020

PUBLICATIONS

- C. Dailey, C. Bradley, D. F. J. Kimball, I. Sulai, S. Pustelny, A. Wickenbrock, and A. Derevianko. Quantum sensor networks as exotic field telescopes for multi-messenger astronomy. *arXiv e-prints*, page arXiv:2002.04352, February 2020.
- B. M. Roberts, G. Blewitt, C. Dailey, M. Murphy, M. Pospelov, A. Rollings, J. Sherman, W. Williams, and A. Derevianko. Search for domain wall dark matter with atomic clocks on board global positioning system satellites. *Nature Communications*, 8, October 2017.
- B. M. Roberts, G. Blewitt, C. Dailey, and A. Derevianko. Search for transient ultralight dark matter signatures with networks of precision measurement devices using a bayesian statistics method. *Physical Review D*, 97:083009, April 2018.
- E. Savalle, B. M. Roberts, F. Frank, P. Pottie, B. T. McAllister, C. Dailey, A. Derevianko, and P. Wolf. Novel approaches to dark-matter detection using space-time separated clocks, February 2019.
- S. Heck, A. Gatton, K. A. Larsen, W. Iskandar, E. G. Champenois, R. Strom, A. Landers, D. Reedy, C. Dailey, J. B. Williams, T. Severt, B. Jochim, I. Ben-Itzhak, R. Moshhammer, R. Dörner, D. S. Slaughter, and Th. Weber. Symmetry breaking in the body-fixed electron emission pattern due to electron-retroaction in the photodissociation of H_2^+ and D_2^+ close to threshold. *Physical Review Research*, 1:033140, December 2019.

PUBLISHED THESES

“Probing exotic fields with networks of atomic clocks”

Masters Thesis, University of Nevada, Reno, 2019-08

Abstract:

An exotic light field (ELF) is a class of field beyond the standard model that could be produced in high-energy astrophysical events with enough amplitude to be detected with precision measurement sensors. A model that describes an ELF as a pulse of ultra-relativistic matter waves and an estimate of the sensitivity for current and future networks of atomic clocks to detect ELFs is developed here. The global positioning system (GPS) is presented as an existing network of atomic clocks that has the potential to probe ELFs. A first proof-of-principle search for ELFs emitted as bursts from the GW170817 neutron star merger was performed with data from GPS. Although no concrete evidence was found for ELFs, a foundation has been produced for future searches for ELFs originating from many other astrophysical events, such as gamma ray bursts, black hole mergers, and solar flares for the last 20 years of GPS operation.

PROFESSIONAL RESEARCH EXPERIENCE

Graduate Research Assistant

January 2018 to December 2019

University of Nevada, Reno

Advisor: Dr. Andrei Derevianko

- Collaborated with international research groups to characterize global networks of precision measurement devices as exotic light field telescopes
- Formulated a propagation model for ultra-relativistic wave pulses
- Developed analysis methods for state-of-the-art 1 Hz sample rate GPS atomic clock data

Undergraduate Research Assistant

January 2016 to May 2017

University of Nevada, Reno

Advisor: Dr. Andrei Derevianko

- Searched for dark matter transient events in GPS atomic clock data using Monte-Carlo optimization
- Developed a program to simulate dark matter transient events on the GPS network
- Calculated the direction and annual variation of the velocity of the Earth in the Milky Way

Undergraduate Research Assistant

April 2016 to July 2017

University of Nevada, Reno

Advisor: Dr. Joshua Williams

- Designed and assembled Helmholtz coils used for an electron-attachment experimental apparatus
- Traveled twice to the Lawrence Berkley National Lab to conduct data acquisition at the Advanced Light Source

OTHER RESEARCH EXPERIENCE

Astronomy Thesis

January 2017 to May 2017

University of Nevada, Reno

Advisor: Dr. Melodi Rodrigue

- Used the newly constructed Great Basin Observatory to conduct its first ever astronomical research
- Developed a program to calculate asteroid orbital parameters from observations using a least squares method, and demonstrated $< 10\%$ inaccuracy in orbit determination

TEACHING EXPERIENCE

Graduate Teaching Assistant

August 2019 to December 2019

University of Nevada, Reno

Supervisor: Dr. Bernhard Bach

- Taught and supervised students destined for scientific fields in a laboratory setting while they performed experiments in electromagnetism, circuits, gravity, and optics

Graduate Teaching Assistant

July 2017 to May 2018

University of Nevada, Reno

Supervisor: Dr. Bernhard Bach

- Taught and supervised students in a laboratory setting while they performed experiments in electromagnetism, circuits, gravity, and optics
- Supervised over seventy students for each of two semesters

Undergraduate Learning Assistant

August 2015 to December 2015

University of Nevada, Reno

Supervisor: Dr. David Bennum

- Taught and tutored students in introductory physics courses
- Helped students understand physics concepts such as Newtonian mechanics, rotational dynamics, and electromagnetism

FIRST-AUTHOR CONFERENCE PRESENTATIONS

APS April Meeting 2019 “Quarks 2 Cosmos”

April 2019

Denver, Colorado, USA

Session ID: L09.00006

Type: Invited Talk

Title: “Progress in dark matter search with the global positioning system”

APS Division of Atomic and Molecular Physics Meeting 2018

June 2018

Fort Lauderdale, Florida, USA

Session ID: M01.00081

Type: Poster Presentation

Title: “Searching for Dark Matter and Exotic Physics with Atomic Clocks and the GPS Constellation”

PhysCon 2016

November 2016

San Francisco, California, USA

Session ID: S1 - 54

Type: Poster Presentation

Title: “Preliminary steps in detecting Dark Matter with the GPS Satellite Constellation”

CO-AUTHOR CONFERENCE PRESENTATIONS

APS Division of Atomic and Molecular Physics Meeting 2019 May 2019
Milwaukee, Wisconsin, USA
Session ID: S01.00035
Title: “Global Network of Clocks and Magnetometers as Exotic Light Field Telescopes”

APS Division of Atomic and Molecular Physics Meeting 2018 June 2018
Fort Lauderdale, Florida, USA
Session ID: D06.00007
Title: “New Precision Measurements from GPS. DM Observatory for Exotic Physics Searches: Atomic Clock Phases every Second to < 0.1 ns”

APS Division of Atomic and Molecular Physics Meeting 2017 June 2017
Sacramento, California, USA
Session ID: Q1.00023
Title: “Using Global Network Precision Measurements to Search for Exotic Physics”

APS April Meeting 2017 “Quarks 2 Cosmos” January 2017
Washington D.C., USA
Session ID: C6.00002
Title: “First Results of the GPS.DM Observatory: Search for Dark Matter and Exotic Physics with Atomic Clocks and GPS Constellation”

American Geophysical Union, Fall Meeting 2016 December 2016
San Francisco, California, USA
Session ID: G53A-05
Title: “First Results in the Search for Dark Matter from the GPS.DM Observatory”

AFFILIATED COLLABORATIONS

The Global Positioning System as a Dark Matter observatory (GPS.DM) 2016-Present
The Global Network of Optical Magnetometers for Exotic physics (GNOME) 2018-Present

HONORS AND AWARDS

UNR College of Science Dean’s List 2015, 2016, 2017, 2018
Nevada Undergraduate Research Award 2016
2013 UNR Physics Exam Award 2013
Silver Scholar Award 2009

SCHOLARSHIPS

Governor Guinn Millennium Scholarship 2014, 2015, 2016, 2017
TMCC/UNR Thompson Scholarship 2014, 2015
ASUN Academic Scholarship 2015, 2016

SKILLS

Computer Languages: Mathematica, C++, Python, R

Software Tools: L^AT_EX, Bash, Adobe Lightroom, Microsoft Office

Subject Proficiencies: Bayesian statistics, special and general relativity, fundamental interactions

MEMBERSHIPS

American Physical Society

Society of Physics Students

Sigma Pi Sigma

National Society of High School Scholars

OTHER AWARDS AND INTERESTS

Second Place Recurve Flight 2

February 2015

The Vegas Shoot, International Archery Tournament

Eagle Scout

April 2014

Boy Scouts of America

Interests:

Archery

Astrophotography

Camping and Traveling