Karl J. Ahrendsen

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EDUCATION

PhD Degree, Physics — expected December 2021
University of Nebraska, Lincoln, NE
Concentration: Atomic, Molecular, and Optical Physics
Topic: Spin-Polarized Electron Physics
Advisor: Dr. Timothy Gay

Master's Degree, Physics — December 2018
University of Nebraska, Lincoln, NE

Bachelor of Science, Physics, Summa Cum Laude — May 2014
Buena Vista University, Storm Lake, IA
Majors: Computational Physics and Computer Science / Mathematics

RESEARCH EXPERIENCE

Scattering of Polarized Electrons from Atoms & Molecules — 2015-Present

I used a "Rb spin filter" to produce polarized electrons and explored methods to improve the efficiency of its operation. The spin filter produces polarized rubidium atoms by optical pumping which are used for the creation of a beam of spin-polarized electrons. I also designed a target vacuum chamber and conducted experiments investigating interactions between spin-polarized electrons and chiral molecules. Working on this project, I

- gained extensive experience operating, maintaining, and troubleshooting high-vacuum hardware and components.
- polarized rubidium atoms using high-power optical pumping techniques and quantified the polarization using a probe laser system (both CW).
- operated a custom-built electron gun, tuning and aligning elements to maximize electron transmission at energies between 1 and 130 eV.
- designed new electron optics to steer and monitor the electron beam.
- investigated the effect of buffer gas pressure on rubidium polarization and transfer to electron polarization.
- measured rubidium density using Faraday rotation and absorption techniques.
- designed a new vacuum chamber using CAD software to contain chiral molecule collision experiments.
- assembled vacuum components including required support systems.
- machined essential system components using end mills and engine lathes.

RESEARCH EXPERIENCE (Continued)

Photoemission from Chiral Tungsten 2018-Present

I collaborated with Dr. Elaine Seddon's research team from the University of Manchester (UK) on a project investigating the spin-polarization of electrons photoemitted from a chiral tungsten surface. I was a team member for the collection of data at the Elettra synchrotron facility and assisted in post-beamrun data analysis. As a team member on this project, I

- performed augmentations and accompanying documentation to an existing LabVIEW program for monitoring temperature and adjusting current to a heating filament.
- managed a data collection shift at the synchrotron as part of a two-person team.
- optimized team efficiency by developing new communication protocols between shift workers.
- organized and analyzed low energy electron diffraction (LEED) images of the chiral samples, comparing results to kinematic simulations.

AWARDS AND HONORS

Datapalooza 2019: Best in Show Award

I organized a team of four graduate students in a data science competition sponsored by Mutual of Omaha. We used publicly available data to construct a machine learning model which produced a likelihood score of purchasing the company's Full Term Life Insurance policy for every zip code in the United States.

CIRTL Associate

The Center for the Integration of Research, Teaching and Leanrning (CIRTL) is a network of 37 universities seeking to enhance excellence in STEM undergraduate education. I completed course work and activities demonstrating knowledge of evidence-based teaching practices.

UNL Center for Civic Engagement Big Red Integrity Award 2019

PUBLICATIONS

K.J. Ahrendsen, S. Reyes, and T.J. Gay, *Helmholtz Spacing of Thin Rectangular Magnetic Field Coils*, Rev. Sci. Instrum. **91**, 116103 (2020).

PRESENTATIONS

K.J. Ahrendsen, W.J. Brunner, and T.J. Gay, *Studies of Spin Transfer Efficiency in a Rb Spin-Exchange Cell*, APS Division of Atomic, Molecular and Optical Physics Annual Meeting, Online Conference, 2020. (Oral Presentation)

N.K. Lewis, **K.J. Ahrendsen**, Y. Lassailly, I. Vobornik, J. Fujii, T.J. Gay, W.R. Flavell, and E.A. Seddon, *Photoemission Studies of Spin-Polarized Electrons from Chiral Tungsten*, APS Division of Atomic, Molecular and Optical Physics Annual Meeting, Online Conference, 2020. (Poster)

PRESENTATIONS (Continued)

K.J. Ahrendsen, W.J. Brunner, and T.J. Gay, *Studies of Collision Dynamics in Rb Spin-Exchange Cells*, APS Division of Atomic, Molecular and Optical Physics Annual Meeting, Milwaukee, WI, 2019. (Poster)

K.J. Ahrendsen *Teaching STEM: by the Numbers*, University of Nebraska Teaching and Learning Community Forum, Lincoln, NE, 2018. (Poster)

TEACHING EXPERIENCE

Recitation TA Algebra-Based Descriptive Physics 2016
Provided individual guidance to students working on team worksheets. Monitored students throughout class to identify any misconceptions and help to clarify content. Met once a week for 50 minutes. Total Sections Taught: 3
University of Nebraska, Lincoln, NE

Recitation TA, Calculus-Based Physics 2015
Prepared "team problems" in conjunction with other TAs to allow students additional practice on course material. Met once a week for 50 minutes. Total Sections Taught: 3
University of Nebraska, Lincoln, NE

Lab Instructor, Calculus-Based Physics 2014-2015
Provided short 10 minute introduction to topic of lab to remind students of material which was covered in lecture relevant to the lab. Guided students in conducting experiments and writing lab reports once a week for 3 hours. Graded reports based on experimental methods and logic of approach. Total Sections Taught: 2
University of Nebraska, Lincoln, NE

Recitation TA, Algebra-Based Physics 2014-2015
Met weekly for 50 minutes with students to supplement lecture portion of course. Provided detailed walk-throughs of example problems to provide students with more exposure to course material and problem solving strategies. Organized and led exam study sessions for students who were interested in additional practice. Total Sections Taught: 2
University of Nebraska, Lincoln, NE

OUTREACH

- **Saturday Science** - Guided 5th grade students in completing weekly hour-long exploratory physics experiments related to various physics concepts. (2014-2020)
- **Nerd Nite Speaker** - Communicated complex scientific topics (neutrinos 2017, open source software 2018) to the general public in interactive talks.
- **Nano Days Volunteer** - Engaged shopping mall patrons in discussions related to nanotechnology, describing how information is stored digitally (2019).
- **Science SLAM** - Finalist in Science Slam competition responding to the prompt: "When did you first feel like a 'real' scientist?" (2018).

OUTREACH (Continued)

- **State Museum Volunteer** - Engaged museum patrons (primarily children 4-10 and their families) in discussions on various physics related topics, such as gravity, the solar eclipse, laser light, and rotary motion. (2017-2018)
- **2017 Total Solar Eclipse**
  - **Eclipse Presidential Address** - By special invitation, presented an informational address on solar eclipses to the University President and his distinguished guests.
  - **Eclipse Informational Videos** - Developed content and starred in a series of 4 educational University-sponsored videos to educate the general public about solar eclipses.
  - **Community Liaison** - Spoke with interested community members at the University sponsored viewing party for the eclipse.
- **Graduate Student Seminar Speaker** - Presented a talk for physics graduate students introducing the LaTeX document preparation software and providing hands on experience for learning how to use it. (2017)
- **Science Cafe Speaker** - Presented "The Physics of Ice Skating," given in conjunction with the University of Nebraska State Museum. (2017)