

Sarah Hagen

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I. EDUCATION

- Aug 2021 – Present **PhD in Physics** (in progress)
Department of Physics, University of Illinois Urbana-Champaign
Urbana, IL
- Sept. 2020 – June 2021 *Institut National de Sciences Appliquées Lyon (Exchange)*
Villeurbanne, France
- Aug 2017 – May 2021 **B.S. in Physics** (Minor in Mathematics)
Southern Illinois University Carbondale
Carbondale, IL
- Aug 2017 – May 2021 **B.S. in Languages, Cultures, International Studies: French**
Southern Illinois University Carbondale
Carbondale, IL
- Aug 2014 – May 2017 **Diploma**
Lemont High School
Lemont, IL
- Aug 2013 – July 2014 *St. Johannis Schule Gymnasium*
Bremen, Germany

II. RESEARCH EXPERIENCE

- Aug. 2021 – Present **Chitambar Quantum Information Group**
Department of Electrical and Computer Engineering, UIUC, Urbana, IL
 - Cryptographic reductions in the quantum setting
(Advisor: Eric Chitambar)
Work which includes an exploration of zero-communication reductions of PR boxes and similar correlations aims to achieve larger goal of better understanding the relationships between classical and quantum cryptography
- June 2020 – Aug. 2021 **Research Collaboration**
Department of Physics, SIU Carbondale, Carbondale, IL
Department of Electrical and Computer Engineering, UIUC, Urbana, IL
 - Exploring monogamy of nonlocality
(Advisor: Eric Chitambar)
Previous results focused on nonlocality are expanded by considering monogamy relationships and their potential unification with monogamy of entanglement

- Sept. 2020 – June 2021 **Projet de Fin d'Études (End of Studies Project)**
Département des Sciences et Génie Matériaux
(Department of Materials Science and Engineering)
Institut National des Sciences Appliquées Lyon, Villeurbanne, France
- Electro-optical characterization of avalanche photodiodes
 (Advisor: Francis Calmon)
 Single photon avalanche diodes (SPADs) are characterized using both electric and optical techniques with focus on measuring dark count rate and timing jitter; Simulation of SPADs for jitter analysis
- Jan. 2018 – May 2021 **Quantum Information and Computation Research Group**
Department of Physics
Southern Illinois University Carbondale, Carbondale, IL
- Entanglement and correlation detection protocols
 (Advisor: Mark Byrd)
 Examine the ability to use a unitary associated with the exchange Hamiltonian to detect initial system-environment correlations present in an open system
 - Analytic and numerical analysis of positive maps in open quantum system dynamics
 (Advisor: Mark Byrd)
 Exploratory study of the evolution of open quantum systems
- May – Aug. 2019 **Physics REU Program**
Department of Physics
University of Illinois Urbana-Champaign, Urbana, IL
- Distributing nonlocality using local states
 (Advisor: Eric Chitambar)
 Discovered that nonlocality can be distributed between two parties using only local initial correlations between these and a third party
- March – May 2019 **Individual Research Project (PHYS450 Final Project)**
Department of Physics
Southern Illinois University Carbondale, Carbondale, IL
- Anomalous Hall Effect in Doped Topological Insulator
 $\text{Sm}_{0.1}\text{Bi}_{1.9}\text{Se}_3$
 (Advisors: Stephen Hofer, Dipanjan Mazumdar)
- Aug. 2016 – May 2017 **Lemont Quarry R.O.V. Exploration** (funded by CITGO)
Science Department
Lemont High School, Lemont, IL
- Establishment of research focus and evaluation criteria
 (Advisor: Erin Horan)

III. EMPLOYMENT HISTORY

- Jan. 2021 – Present **Research Assistant**
Department of Physics, UIUC, Urbana, IL
- Expanded research work to include examination of quantum information theoretic reductions
 - Apply existing ideas from classical information theory to quantum and extra-quantum correlations, including nonlocal boxes
 - Member of a research collaboration including Dakshita Khurana and Lav Varshney
- Aug. 2021 – May 2022 **Teaching Assistant**
Department of Physics, UIUC, Urbana, IL
- Led several discussion sections for introductory algebra- and calculus-based physics: mechanics, thermodynamics, electricity & magnetism
 - Graded student problem sets and quizzes
 - Created additional instructional content including compiled practice problems, explanations, and student resources
 - Ranked 9.5/10 by anonymous student survey
 - Ranked as “Excellent” (4.3+/5 rating) and “Outstanding” (> Excellent)
- Feb. 2020 – May 2020 **Student Researcher**
SIUC Department of Physics, Supervisor: Dr. Mark Byrd
- Researched entanglement and correlation detection protocols as part of the Quantum Information and Computation Group
 - Collaborated with other group members to expand research focus
 - Summarized research results in LaTeX format and worked towards their publication
- Dec. 2019 – May 2020 **Private Tutor** (high school physics)
Self-employed
- Tutored two high school sophomores in physics at a regular and advanced (AP) level (mechanics, waves, electricity & magnetism) on a one-on-one basis several times a week
 - Students grades were raised at least one letter grade compared to previous results and they increased their overall comprehension of the subject

- Aug. 2018 – Dec. 2019 **Office Assistant**
SIUC Department of Physics
- Represented the department in a positive manner with respect to faculty, staff, undergraduate and graduate students, visiting speakers, prospective students and their families, and other guests
 - Significantly improved the department's design of promotional materials and created advertisements for courses, seminars, tutoring opportunities, invited talks, and social events
 - Managed a large part of the organizational administrative duties like the filing system, printing, course evaluations, and inter-university communications

- Dec. 2017 – Jan. 2018 **Sales Associate**
New York & Company, Bolingbrook, IL
- Assumed the responsibility of welcoming customers in the front of the store and maintained an overview of business in the store
 - Tagged and folded new merchandise
 - Constructed new displays according to provided guidelines

IV. LEADERSHIP

- April 2022 *Mentor* – **Physics REBoot Venezuela** | ICTP Physics without Frontiers
- Co-mentored a group of 6 primarily undergraduate students on quantum algorithms project during one-week period
 - Evaluated student project presentations
- Jan. 2022 – Present *Founder and Lead Organizer* – **Illinois Physics French Club**
- Founded organization within the UIUC Physics Department
 - Currently around 30 members, with about 15 regular attendees
 - In charge of programming for bi-weekly official meetings and additional (roughly bi-weekly) informal meetings
- Sept. 2021 – Jan. 2022 *Member* – **Local Organizing Committee CUWiP 2022 at UIUC**¹
- Organized the 2022 Conference for Undergraduate Women in Physics at the UIUC campus location
 - Speaker on several panels on applying to graduate school and beyond class activities
 - Headed a subcommittee responsible for check-in and other organizational tasks
- May 2019 – May 2020 *President* – **Society of Physics Students (SIUC Chapter)**
- Planned trips to the Materials Research Laboratory at the University of Illinois Urbana-Champaign and Oak Ridge National Laboratory
 - Coordinated meetings and social events and directed T-shirt fundraiser
 - Liaison to faculty advisor
- Aug. 2017 – Present *Member* – **University Honors Program**
- Participated in 18 hours of honors coursework
 - Responsible for over 20 hours of personal volunteer work for each year (60+ hours to date)

¹conference was canceled due to coronavirus concerns

- Jan. – March 2020 *Co-Chair – **SIU STEM Confluence Organizing Committee**¹*
- Coordinated subcommittees and headed up Production subcommittee
 - Liaison to faculty advisor, guest speakers, caterer and university
 - Planned all-day event for over 100 people
- Jan. 2018 – Dec. 2019 *Leadership Team– **Newman Catholic Student Center***
- Acted as social media chair and promoted the organization
 - Organized service event opportunities for students
 - Student planner and liaison for largest annual fundraiser with around 200 guests and coordinated approximately 40 student volunteers
 - Leader for several retreats and weekly small groups
- April 2018 – May 2019 *Vice President – **Society of Physics Students (SIUC Chapter)***
- Planned trips to the MURR nuclear reactor at the University of Missouri, Argonne National Laboratory, and the Adler Planetarium in Chicago, IL
 - Coordinated service activities for Physics Day and two Expanding Your Horizons conferences
 - Planned all meetings and social events and the member responsible for promotional T-Shirt fundraiser
- Nov. 2017 – May 2019 *Ambassador - **Saluki Ambassadors***
- Tour guide for weekly college visits and for special events like university celebrations and open houses
 - Represented university at annual interview weekend and acted as a liaison to prospective students and their families
- Nov. 2018, April 2019 *Workshop Leader – **Expanding Your Horizons Conference***
- Designed workshop plan with Department of Physics staff
 - Coordinated 10+ student volunteers for each workshop
 - Served as liaison to conference organizers
 - Taught workshop content to girls in grades 6-9
- Aug. 2016 – May 2017 *Co-Founder – **Lemont High School STEM Outreach***
- Developed concept for outreach program with co-founder
 - Liaised with middle school principal and teacher
 - Taught coding skills to 6th graders
 - Organized hands-on workshops for middle school participants

V. AWARDS & HONORS

- June 2020 **ISEP French and German Language Annette Kade Fund Scholarship**
International Student Exchange Program
- Competitive scholarship awarded to students studying abroad
- June 2020 **SIUC Dean's List**
Southern Illinois University Carbondale
- Award presented to students with a 3.5 GPA or higher each semester
- April 2020 **College of Science Honors Student**
SIUC College of Science
- Awarded presented to College of Science students with at least a 3.5 GPA annually

- March 2020 **Mary Eleanor Bushek Travel Award for Foreign Language Study**
SIUC Department of Languages, Cultures, and International Trade
- Annual award presented to one individual
- Jan. 2020 **Women in Physics Group Grant**
American Physical Society
- One of 19 American universities awarded this grant for the 2019 year
 - Group leader and grant writer for the SIUC group
- Jan. 2020 **SIUC Dean's List**
Southern Illinois University Carbondale
- Award presented to students with a 3.5 GPA or higher each semester
- Nov. 2019 **Emerging Researchers National Travel Award**
Emerging Researchers National Conference
- Award presented to students who demonstrate need and a competitive abstract for a scientific presentation
- June 2019 **SIUC Dean's List**
Southern Illinois University Carbondale
- Award presented to students with a 3.5 GPA or higher each semester
- May 2019 **Illinois Quantum Computing Summer School Travel Grant**
2019 Illinois Quantum Computing Summer School
- Competitive award for attendees demonstrating financial need
- April 2019 **SIUC College of Science Honors Student**
SIUC College of Science
- Awarded presented to College of Science students with at least a 3.5 GPA annually
- Feb. 2019 **DAAD RISE Germany Internship and Scholarship** (not accepted)
German Academic Exchange Service (DAAD)
- Competitive research exchange program placement and scholarship awarded to 300 of 1901 applicants
- Jan. 2019 **SIUC Dean's List**
Southern Illinois University Carbondale
- Award presented to students with a 3.5 GPA or higher each semester
- Oct. 2019 **SIUC Speaker's Forum Invited Speaker**
SIUC Department of Communications
- One of 6 speakers selected to present a talk each semester
- June 2018 **SIUC Dean's List**
Southern Illinois University Carbondale
- Award presented to students with a 3.5 GPA or higher each semester
- May 2018 **SIUC Physics Department Tuition Waiver**
SIUC Department of Physics
- Scholarship presented to one Department of Physics student annually
- April 2018 **SIUC College of Science Honors Student**
SIUC College of Science
- Awarded presented to College of Science students with at least a 3.5 GPA annually
- Jan. 2018 **Saluki Ambassador of the Month**
Saluki Ambassadors at SIUC
- Award presented to one or two members each month

- Jan. 2018 **SIUC Dean's List**
Southern Illinois University Carbondale
 - Award presented to students with a 3.5 GPA or higher each semester
- May 2017 **CITGO Fueling Education Scholarship**
CITGO Petroleum Corporation – Lemont Refinery
 - Award presented to 5 Lemont High School seniors
- May 2017 **Lemont Chamber of Commerce Scholarship**
Lemont Township Chamber of Commerce
 - Award presented to two Lemont High School seniors annually
- May 2017 **LHS Departmental Award: Science**
Lemont High School Science Department
 - Award presented to one Lemont High School senior annually
- May 2017 **LHS Departmental Award: Social Studies**
Lemont High School Social Studies Department
 - Award presented to one Lemont High School senior annually
- April 2017 **SIUC Chancellor's Scholarship**
Southern Illinois University Carbondale
 - Scholarship covering tuition, fees, and room & board presented to 26
 out of 435 incoming student finalists

VI. CONFERENCES AND FORMATION

- July 12th-23rd, 2021 **LPS Summer of Quantum Workshop**
Online | hosted by Laboratory for Physical Sciences, College Park, MD
- Feb. 6th – 8th, 2020 **Emerging Researchers National Conference**,
Washington, D.C.
- Jan. 17th – 19th, 2020 **Conferences for Undergraduate Women in Physics**,
University of Chicago, Chicago, IL
- Jun. 17th – 20th, 2019 **Illinois Quantum Computing Summer School**,
Discovery Partners Institute, Chicago, IL

VII. TALKS

- Feb. 7th, 2020 **Emerging Researchers National Conference**
Washington, D.C.
“*Local States Can be Used to Distribute Nonlocality*”; co-authors: Eric Chitambar, Brian Doolittle; oral
- Jan. 18th, 2020 **Conference for Undergraduate Women in Physics**
University of Chicago, Chicago, IL
“*Distributing Nonlocality Using Local States*”; oral
- August 30th, 2019 **Department of Physics Seminar Series**
Southern Illinois University Carbondale, Carbondale, IL
“*Distributing Nonlocality Using Local States: A Summer REU Experience*”; oral
- August 2nd, 2019 **Department of Physics REU Program Final Talks**
University of Illinois Urbana-Champaign, Urbana, IL
“*Distributing Nonlocality Using Local States*”; co-authors: Eric Chitambar, Brian Doolittle; oral
- Nov. 13th, 2018 **Department of Communication Studies Fall Speaker’s Forum**
Southern Illinois University Carbondale, Carbondale, IL
“*International Students at SIU*”; oral

VIII. PUBLICATIONS

- 2021 **Hagen, S.** and Byrd, M. (2021) Detecting initial system-environment correlations in open systems. *Phys. Rev. A* **104**, 042406, <https://doi.org/10.1103/PhysRevA.104.042406>

IX. VOLUNTEERING

- Aug. 2017 – May 2020 **Volunteer**
SIUC University Honors Program
- Aug. 2017 – May 2020 **Volunteer**
Newman Catholic Student Center at SIUC
- Nov. 2017 – May 2019 **Campus Tour Guide & Student Panel Speaker**
SIUC Saluki Ambassadors

April 2019	Group Leader – Physics Day at SIUC <i>Society of Physics Students/SIUC Department of Physics</i>
Nov. 2018	Workshop Leader <i>Expanding Your Horizons Conference</i>
April 2018	Presenter - Physics Day at SIUC <i>Society of Physics Students</i>
April 2018	Volunteer <i>The BIG Event at SIUC</i>
March 2018	Volunteer <i>Rebuilding Homes Destroyed by Hurricane Harvey (through Newman)</i>
Aug. 2017	Volunteer <i>SIU Carbondale Eclipse</i>
Aug. 2016 – May 2017	Co-Founder and Volunteer <i>Lemont STEM Outreach</i>
Aug. 2015 – May 2017	Academic Tutor <i>National Honor Society. National Science Honors Society</i>

X. STUDENT ORGANIZATIONS

Feb. 2022 – Present	UIUC German Club
Jan. 2022 – Present	UIUC French Club
Aug. 2018 – May 2020	SIUC Student Section
Aug. 2017 – May 2020	Newman Catholic Student Center
Aug. 2017 – May 2020	Society of Physics Students
Nov. 2017 – May 2019	Saluki Ambassadors
Aug. 2017 – May 2018	Saluki Astronomy Association

XI. COMPUTING SKILLS

- **Mathematica** (Advanced)
- **LaTeX** (Advanced)
- **Python** (Intermediate)
- **MatLab** (Beginner)

XII. LANGUAGES

- **English** (Native)
- **German** (Native)
- **French** (Fluent)
- **Spanish** (Beginner)
- **ASL** (Beginner)

XIII. REFERENCES

Dr. Eric Chitambar

Position: Faculty in Electrical and Computer Engineering
Department of Electrical and Computer Engineering
University of Illinois Urbana-Champaign
1308 W. Main St., Urbana, IL 61801
Phone: (763) 242-3381
E-Mail: echitamb@illinois.edu

Dr. Mark Byrd

Position: Faculty in Physics
Department of Physics
Southern Illinois University Carbondale
1245 Lincoln Dr., Carbondale, IL 62901
Phone: (618) 453-2271
E-Mail: mbyrd@siu.edu

Dr. Francis Calmon

Position: Faculty in Materials Science and Engineering (SGM)
Department of Materials Science and Engineering (SGM)
National Institute of Applied Sciences Lyon
7-9 Avenue Jean Capelle, 62921 Villeurbanne Cedex, France
Phone: +33 4-72-43-70-48
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Dr. Thushari Jayasekera

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Dr. Saikat Talapatra

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Dr. Dipanjan Mazumdar

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