

# Sarah Hagen

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## I. EDUCATION

- Aug 2021 – Present     **PhD in Physics** (in progress: Passed Qualifying Exam in Aug. 2022)  
*Dept. of Physics, University of Illinois Urbana-Champaign (UIUC)*  
Urbana, IL
- Sept. 2020 – June 2021     *Institut National de Sciences Appliquées (INSA) 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     **Quantum Information 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)

### III. EMPLOYMENT HISTORY

- Jan. 2023 – Present **Teaching Assistant (Advanced Physics)**  
*Department of Physics, UIUC, Urbana, IL*
- Instructor for discussion section of PHYS435 (Electromagnetic Fields)
  - Grade discussion work
  - Conduct weekly office hour and provide help otherwise needed
- Aug. 2022 – Present **Physics Instructor**  
*Faith & Reason Learning Community, Urbana, IL*
- Design and implement weekly lessons for introductory high school physics
  - Instruct additional laboratory experiences multiple times a semester
  - Provide 1-on-1 help for students upon request

- 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 (Introductory Physics)**  
*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

## IV. LEADERSHIP & ENGAGEMENT

### *Graduate*

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- 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 weekly meetings and special events
- Summer 2020 – Present *Writer – **Personal Blog providing Academic Advice***
- Write posts about undergraduate and graduate school, and related topics (Website found at: <https://hageninter.net>)
- July 2022 – Jan. 2023 *Member – **Local Organizing Committee CUWiP 2023 at UIUC***
- Organized the 2023 Conference for Undergraduate Women in Physics at the UIUC campus location
  - Speaker on several panels on applying to graduate school and life of a graduate student
  - Created parallel session “International Relations in Physics”
  - Check-in and speaker introduction among my roles at conference
- 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
- Sept. 2021 – Jan. 2022 *Member – **Local Organizing Committee CUWiP 2022 at UIUC**<sup>1</sup>*
- 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

### *Undergraduate*

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- 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)
- Jan. – March 2020 *Co-Chair – **SIU STEM Confluence Organizing Committee**<sup>1</sup>*
- Coordinated subcommittees and headed up Production subcommittee
  - Liaison to faculty advisor, guest speakers, caterer and university
  - Planned all-day event for over 100 people

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<sup>1</sup>conference was canceled due to coronavirus concerns

- 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

## V. AWARDS & HONORS

### *Graduate*

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|---------------------|---|
| In Progress         | <p><b>Teacher Scholar Certificate</b><br/> <i>UIUC Center for Innovation in Teaching &amp; Learning (CITL)</i></p> <ul style="list-style-type: none"> <li>- Requirements include teaching formation and observation, forming a teaching philosophy statement, exploration of pedagogy, and service</li> </ul>   |
| Feb. 2023           | <p><b>Best Talk (Networks and Security)</b><br/> <i>CSL Student Conference (see "Talks")</i></p>  |
| Jan. 2023           | <p><b>Graduate Travel Award</b><br/> <i>Department of Physics, UIUC, Urbana, IL</i></p> <ul style="list-style-type: none"> <li>- Award presented for registration for and travel to APS March Meeting</li> </ul>  |
| Sept. 2022          | <p><b>Physics Department French Club Funding Award</b><br/> <i>Department of Physics, UIUC, Urbana, IL</i></p> <ul style="list-style-type: none"> <li>- Financial award for creating events for Physics Dept. French Club</li> </ul>  |
| Completed (pending) | <p><b>Graduate Teacher Certificate</b><br/> <i>UIUC Center for Innovation in Teaching &amp; Learning (CITL)</i></p> <ul style="list-style-type: none"> <li>- Requirements include attending various formation events, teaching observed and critiqued by coordinator, and several written reflections on observation and student feedback collected at various instances</li> </ul> |

## *Undergraduate*

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June 2020	<b>ISEP French and German Language Annette Kade Fund Scholarship</b> <i>International Student Exchange Program</i> <ul style="list-style-type: none"><li>- Competitive scholarship awarded to students studying abroad</li></ul>
June 2020 <sup>2</sup>	<b>SIUC Dean's List</b> <i>Southern Illinois University Carbondale</i> <ul style="list-style-type: none"><li>- Award presented to students with a 3.5 GPA or higher each semester</li></ul>
April 2020 <sup>2</sup>	<b>College of Science Honors Student</b> <i>SIUC College of Science</i> <ul style="list-style-type: none"><li>- Awarded presented to College of Science students with at least a 3.5 GPA annually</li></ul>
March 2020	<b>Mary Eleanor Bushek Travel Award for Foreign Language Study</b> <i>SIUC Department of Languages, Cultures, and International Trade</i> <ul style="list-style-type: none"><li>- Annual award presented to one individual</li></ul>
Jan. 2020	<b>Women in Physics Group Grant</b> <i>American Physical Society</i> <ul style="list-style-type: none"><li>- One of 19 American universities awarded this grant for the 2019 year</li><li>- Group leader and grant writer for the SIUC group</li></ul>
Nov. 2019	<b>Emerging Researchers National Travel Award</b> <i>Emerging Researchers National Conference</i> <ul style="list-style-type: none"><li>- Award presented to students who demonstrate need and a competitive abstract for a scientific presentation</li></ul>
May 2019	<b>Illinois Quantum Computing Summer School Travel Grant</b> <i>2019 Illinois Quantum Computing Summer School</i> <ul style="list-style-type: none"><li>- Competitive award for attendees demonstrating financial need</li></ul>
Feb. 2019	<b>DAAD RISE Germany Internship and Scholarship</b> (not accepted) <i>German Academic Exchange Service (DAAD)</i> <ul style="list-style-type: none"><li>- Competitive research exchange program placement and scholarship awarded to 300 of 1901 applicants</li></ul>
Oct. 2019	<b>SIUC Speaker's Forum Invited Speaker</b> <i>SIUC Department of Communications</i> <ul style="list-style-type: none"><li>- One of 6 speakers selected to present a talk each semester</li></ul>
May 2018	<b>SIUC Physics Department Tuition Waiver</b> <i>SIUC Department of Physics</i> <ul style="list-style-type: none"><li>- Scholarship presented to one Department of Physics student annually</li></ul>
Jan. 2018	<b>Saluki Ambassador of the Month</b> <i>Saluki Ambassadors at SIUC</i> <ul style="list-style-type: none"><li>- Award presented to one or two members each month</li></ul>
April 2017	<b>SIUC Chancellor's Scholarship</b> <i>Southern Illinois University Carbondale</i> <ul style="list-style-type: none"><li>- Scholarship covering tuition, fees, and room &amp; board presented to 26 out of 435 incoming student finalists</li></ul>

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<sup>2</sup> Received this award at the end of each semester while attending SIU on-campus.

## VI. CONFERENCES AND FORMATION

### *Graduate*

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Upcoming	<b>APS March Meeting</b> Las Vegas, NV
Feb. 22 <sup>nd</sup> -24 <sup>th</sup> , 2023	<b>CSL Student Conference</b> Coordinated Science Laboratory, UIUC, Urbana, IL
July 25 <sup>th</sup> -29 <sup>th</sup> , 2022	<b>Graduate School on Post-Quantum and Quantum Cryptography</b> University of California Los Angeles, Westwood, CA
July 11 <sup>th</sup> -15 <sup>th</sup> , 2022	<b>Theory of Quantum Computation, Communication, and Cryptography (TQC)</b> UIUC, Champaign, IL
July 12 <sup>th</sup> -23 <sup>rd</sup> , 2021	<b>LPS Summer of Quantum Workshop</b> Online   hosted by Laboratory for Physical Sciences, College Park, MD

### *Undergraduate*

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Feb. 6 <sup>th</sup> – 8 <sup>th</sup> , 2020	<b>Emerging Researchers National Conference,</b> Washington, D.C.
Jan. 17 <sup>th</sup> – 19 <sup>th</sup> , 2020	<b>Conferences for Undergraduate Women in Physics,</b> University of Chicago, Chicago, IL
Jun. 17 <sup>th</sup> – 20 <sup>th</sup> , 2019	<b>Illinois Quantum Computing Summer School,</b> Discovery Partners Institute, Chicago, IL

## VII. TALKS

### *Graduate*

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Accepted (March 2023)	<b>APS March Meeting</b> Las Vegas, NV <i>"Using Non-Classical Resources to Strengthen Two-Party Zero-Communication Reductions"</i> ; co-author: Eric Chitambar; oral
Feb. 24 <sup>th</sup> , 2023	<b>CSL Student Conference</b> Coordinated Science Laboratory, UIUC, Urbana, IL <i>"Non-Classical Zero Communication Reductions"</i> ; co-author: Eric Chitambar; oral ❖ Awarded "Best Talk" in <i>Networks &amp; Security</i> session
Feb. 22 <sup>nd</sup> , 2023	<b>IQUIST Young Researchers Seminar</b> UIUC, Urbana, IL <i>"Non-Classical Zero Communication Reductions"</i> ; oral

### *Undergraduate*

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Feb. 7 <sup>th</sup> , 2020	<b>Emerging Researchers National Conference</b> Washington, D.C. <i>"Local States Can be Used to Distribute Nonlocality"</i> ; co-authors: Eric Chitambar, Brian Doolittle; oral
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- Jan. 18<sup>th</sup>, 2020 **Conference for Undergraduate Women in Physics**  
University of Chicago, Chicago, IL  
"Distributing Nonlocality Using Local States"; oral
- August 30<sup>th</sup>, 2019 **Department of Physics Seminar Series**  
Southern Illinois University Carbondale, Carbondale, IL  
"Distributing Nonlocality Using Local States: A Summer REU Experience"; oral
- August 2<sup>nd</sup>, 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. 13<sup>th</sup>, 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

### *Graduate*

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July 2022 **Conference Volunteer**  
*TQC at UIUC, Champaign, IL*

See also "Leadership & Engagement"

### *Undergraduate*

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- 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**  
*Society of Physics Students/SIUC Department of Physics*
- Nov. 2018 **Workshop Leader**  
*Expanding Your Horizons Conference*
- April 2018 **Presenter - Physics Day at SIUC**  
*Society of Physics Students*
- April 2018 **Volunteer**  
*The BIG Event at SIUC*
- March 2018 **Volunteer**  
*Rebuilding Homes Destroyed by Hurricane Harvey (through Newman)*



Aug. 2017

**Volunteer**  
*SIU Carbondale Eclipse*

## X. ORGANIZATIONS

### *Graduate*

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Jan. 2022 – Present	<b>UIUC Physics Dept. French Club</b>
Dec. 2021 – Present	<b>Champaign-Urbana Catholic Young Professionals</b>
Aug. 2021 – Present	<b>American Physical Society</b> (graduate student)
Feb. 2022 – May 2022	<b>UIUC German Club</b>

### *Undergraduate*

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Aug. 2018 – May 2020	<b>SIUC Student Section</b>
Aug. 2017 – May 2020	<b>Newman Catholic Student Center</b>
Aug. 2017 – May 2020	<b>Society of Physics Students</b>
Nov. 2017 – May 2019	<b>Saluki Ambassadors</b>
Aug. 2017 – May 2018	<b>Saluki Astronomy Association</b>

## XI. TECHNICAL SKILLS

- **LaTeX** (Advanced)
- **Mathematica** (Proficient)
- **Python** (Proficient)
- **MatLab** (Proficient)

## XII. LANGUAGES

- **English** (Native)
- **German** (Native)
- **French** (Fluent)
- **Spanish** (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  
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**Dr. Mark Byrd**

Position: Faculty in Physics  
Department of Physics  
Southern Illinois University Carbondale  
1245 Lincoln Dr., Carbondale, IL 62901  
Phone: (618) 453-2271  
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**Dr. Francis Calmon**

Position: Faculty in Materials Science and Engineering (SGM)  
Department of Materials Science and Engineering (SGM)  
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**Dr. Thushari Jayasekera**

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**Dr. Saikat Talapatra**

Position: Chair  
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**Dr. Dipanjan Mazumdar**

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