James Michael Callahan II

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Personal Profile

I am an inquisitive STEM educator eager to help students develop lifelong, rational problem-solving skills. My past varied teaching experiences have given me a keen eye for targeting underlying gaps in students' understanding and providing them the conceptual tools to become scientifically and mathematically-literate global citizens. I set out clear expectations for success in my class and engage all students via a menagerie of active learning techniques. Alongside continuing to hone my craft as a high school teacher, I'm broadly interested in exploring current curriculum paradigms in STEM education, with the goal of increasing the value of high school and college for students by emphasizing the development of professional competencies and cross-disciplinary scientific intuition.

Education

Columbia University • *Ph.D. Candidate in Chemical Physics* — Expected Summer 2022

University of Chicago • *M.S. in Chemistry* — December 2018

Harvard University • *B.A. in Chemistry & Physics, magna cum laude with highest honors* — May 2014

Teaching Experience

Lead High School Instructor – Modern Materials Technologies — June 2018 – June 2019
MRSEC (Materials Research Science and Engineering Center), University of Chicago

- Piloted yearlong class at local Southside high school, Lindblom Math and Science Academy
- Spearheaded a team of graduate students in developing materials and delivering student-centered instruction
- Monitored student engagement and content retention to facilitate improvements for future years

Teaching Assistant – General Chemistry I/II/III — Fall 2017; Winter 2018; Spring 2018
University of Chicago

- Led one discussion section and one laboratory section for 17 students over a three-course sequence
- Initiated and collaboratively generated problem-based content for a yearlong series of twelve exam review sessions
- Developed individualized lab report growth plans to help students cultivate their science communication skills

Head Administrative Teaching Fellow – General Chemistry — Spring 2017
Harvard University

- Oversaw course materials, daily website updates, and weekly logistics for course of 107 students
- Created and curated weekly practice problems, then coached seven teaching staff in their implementation
- Previewed course materials and assessments, offering feedback to colleagues to ensure curricular alignment

Teaching Fellow – Organic Chemistry I — Fall 2016
Harvard University

- Implemented active learning strategies in two weekly discussion sections of 16 students each
- Prepared and gave weekly problem-solving review session to entire course of 260 enrolled students

High School Teacher – Physics (College Preparatory) — Aug 2014 – June 2016
Marblehead High School (Marblehead, MA)

- Taught algebra-based, introductory physics course with strong laboratory component to 90 students/year
- Aligned physics curriculum to state guidelines, standardizing learning objectives between instructors
- Communicated proactively with special education staff to support 15 students/year with learning disabilities

Institutional & Community Service

TASC Tutor – Mathematics — Sep 2019 – Dec 2019
Harry Belafonte 115th Street Library (New York, NY)

- Reviewed mathematical concepts with drop-in adult learners in preparation for high school equivalency exam

Panel Coordinator – Graduate Recruitment Initiative Team (GRIT) — Sep 2018 – June 2019
University of Chicago

- Organized and moderated quarterly panels, "Candid Peer Conversations about the Grad Student Experience"

Science Connections Facilitator — Sep 2017 – Dec 2018
Museum of Science and Industry (Chicago, IL)

- Engaged museum guests with interactive demonstrations of gravity and structural engineering

Honors & Awards

NDSEG (National Defense Science & Engineering Graduate) Fellowship 2019 – Present
Three years of full support for independent graduate research

NSF (National Science Foundation) Graduate Research Fellowship – *Declined* 2019
Three years of full support for independent graduate research

Eckhardt Graduate Fellowship 2017-2019
Physical Sciences Division, University of Chicago

Harvard College Research Program Fellowships (4) 2012-2014
Each supported a semester or summer undergraduate research project

Eagle Scout 2010
Troop 9 (Weymouth, MA)

Research Experience

Graduate Research Assistant – Columbia University; University of Chicago July 2017 – present
Advisor: Timothy Berkelbach

- Extend computational, wavefunction-based electronic structure methods towards the solid-state regime
- Apply coupled-cluster methods to strongly correlated fermionic systems such as metals and cold atomic gases

Research Assistant – Harvard University

Advisor: Alán Aspuru-Guzik Fall 2016; Spring 2017

- Simulated computationally how coherent delocalization affects exciton-mediated energy transport

Advisor: Theodore Betley Spring 2013; Fall 2013; Spring 2014

- Explored synthesis of porous superstructures linking magnetic, redox-active hexanuclear clusters
- Employed crystallographic, electrochemical and spectroscopic methods to characterize intermediates

Advisor: Vinothan Manoharan Summer 2012

- Examined interfacial relaxation of colloidal particles using optical traps and holographic microscopy.
- Designed Python scripts to organize and analyze experimentally collected digital holograms.

Research Assistant – University of Waterloo

Advisor: Adrian Lupaşcu Summer 2013

- Customized microfabrication process of graphene-based, superconducting qubit

Publications

Peer-Reviewed

J. M. Callahan; M. F. Lange; T. C. Berkelbach; "Dynamical correlation energy of metals in large basis sets from downfolding and composite approaches." J. Chem. Phys. **154** 211105 (2021) doi:10.1063/5.0049890.

Conference Presentations

Oral Presentations

J. M. Callahan; A. Aspuru-Guzik; "Quantifying the Relations between Coherence, Delocalization, and Exciton Transport Efficiency." All-Hands Meeting, Center for Excitonics, January 2017.

Poster Presentations

J. M. Callahan; T. C. Berkelbach; "Coupled-Cluster Theory for Distinguishable Fermions." Midwest Theoretical Chemistry Conference, Chicago, IL, June 2018.

J. M. Callahan; R. Hernández Sánchez; T. A. Betley; "Toward the Synthesis of Porous, 3D Networks Based on $[Fe_6]$ Clusters." American Chemical Society National Meeting, San Francisco, CA, August 2014; INOR 229.