

Curriculum Vitae: Chad McKell

ABOUT

Title Research Scientist | Acoustics, Audio & Applied Math
Company Sigma Connectivity, on assignment at Meta
Address 10301 Willows Road NE, Redmond, WA 98052
Email cmckell@meta.com
Website chadmckell.com
Languages English (native), Spanish (B2), French (A2)
Code Python, C++/CUDA, MATLAB, LaTeX, Java, HTML
Research acoustic wave simulation and synthetic data engineering for audio AI

EDUCATION

(exp. 2026) **University of California San Diego**, Ph.D. in Computer Music
Research area: Computational Acoustics and Applied Mathematics
Dissertation: *Conformal Symmetry for Exterior Wave Problems*
Co-advisors: Albert Chern (CSE), Miller Puckette (Music; IRCAM)
2017 **University of Edinburgh**, M.S. in Acoustics and Music Technology
Research area: Computational Acoustics. Advisor: Stefan Bilbao.
2015 **Wake Forest University**, M.S. in Physics
2009 **Brigham Young University**, B.S. in Biophysics

EMPLOYMENT

9/24– **Sigma Connectivity, on assignment at Meta**, Research Scientist
3/24–6/24 **University of California San Diego**, Teaching Assistant in Computer Science
6/23–2/24 **Meta, Reality Labs Research**, Research Scientist Intern
8/21–3/22 **Meta, Reality Labs Research**, Research Intern
7/18–7/19 **Applied Research in Acoustics**, R&D Scientist
4/17–9/17 **Lofelt**, Research Consultant – Acquired by Meta in 2022
10/14–8/16 **J.P. Morgan/Neovest (via ConsultNet)**, SDET
9/09–9/11 **Wake Forest University**, Teaching Assistant in Physics

RESEARCH ACTIVITIES

9/24– **Sigma Connectivity, on assignment at Meta**, Research Scientist
Redmond, Washington. Research area: *spatial audio*. Audio research for Reality Labs
Research at Meta. Meta manager: Sebastian Prepelitã.
9/19–9/24 **University of California San Diego**, Ph.D. Student
La Jolla, California. Center for Visual Computing; Department of Music. Research
area: *computational acoustics, applied mathematics*. Mathematical and numerical
modeling for infinite-domain wave simulations, with applications in virtual acoustics
and other wave physics domains. Committee: Albert Chern (co-chair, CSE), Miller
Puckette (co-chair, Music; IRCAM), Melvin Leok (Mathematics), Stefan Bilbao
(IRCAM), Sebastian Prepelitã (Meta), Shahrokh Yadegari (Music).

RESEARCH ACTIVITIES CONT.

- 6/23–2/24 **Meta, Reality Labs Research**, Research Scientist Intern
Redmond, Washington. Research area: *spatial audio*. Audio research for Reality Labs Research at Meta. Included part-time research period (12/23–2/24). Supervisor: Sebastian Prepelitã. Team Lead: Ravish Mehra.
- 8/21–3/22 **Meta, Reality Labs Research**, Research Intern
La Jolla, California. Included part-time research period (1/22–3/22). Research description: see above.
- 7/18–7/19 **Applied Research in Acoustics**, R&D Scientist
Culpeper, Virginia. Research area: *underwater acoustic sensing, acoustic beamforming*. Algorithm development for underwater acoustic recognition, with applications in naval sonar systems. Team Lead: Jonathan Botts.
- 1/17–8/17 **University of Edinburgh**, Master’s Student
Edinburgh, Scotland. Acoustics & Audio Group, Reid School of Music. Research area: *computational acoustics*. Numerical algorithm development for audio-haptic devices, including the Razer Nari Ultimate headphones. Partially funded by Lofelt, a Berlin-based haptics startup acquired by Meta in 2022. Advisor: Stefan Bilbao.
- 1/10–9/13 **Wake Forest University**, Master’s Student
Winston-Salem, North Carolina. Department of Physics. Research area: *optical trapping, fluid dynamics*. Design, construction, and analysis of standing-wave optical traps for Brownian particle tracking. Published work in the Journal of the Optical Society of America B. Advisor: Keith Bonin.
- 8/07–8/09 **Brigham Young University**, Undergraduate Student
Provo, Utah. Department of Physiology and Developmental Biology. Research area: *biophysics*. AFM imaging of artificial lipid bilayers. Advisor: David Busath.

TEACHING EXPERIENCE

As Instructor

UNCSA
SCI 1100 General Physics. Fall 2012 (1 term).

As TA

UCSD
CSE 291 Physics Simulation. Spring 2024 (1 term).
MUS 6 Electronic Music. Fall 2020 (1 term).
MUS 171 Computer Music I. Winter 2022 (1 term).
MUS 172 Computer Music II. 2021–2022 (2 terms).

WFU
PHY 113 General Physics I (Mechanics). 2009–2011 (4 terms).
PHY 114 General Physics II (E&M). Fall 2010 (1 term).

PUBLICATIONS

Manuscripts in Progress

- (1) **C. McKell**, M. Nabizadeh, S. Wang, and A. Chern, “Wave simulations in infinite spacetime”.

Simulating wave propagation on an infinite domain has been a long-standing computational challenge. Conventional approaches to this problem only produce wave simulations on a small subset of the infinite domain. Using the fact that wave propagation on an infinite Minkowski spacetime is equivalent to wave propagation on a bounded Minkowski spacetime under a Kelvin-like transformation, we simulate wave propagation on the entire infinite domain using a finite discretization of the bounded domain with no additional loss of accuracy from the transformation.

- (2) **C. McKell**, *Conformal Symmetry for Exterior Wave Problems*, Ph.D. Dissertation, University of California San Diego. Advisors: Albert Chern and Miller Puckette.

This work presents novel geometric methods for handling open exterior boundaries in wave simulations. First, I discuss extensions to the reflectionless discrete perfectly matched layer for the wave and Helmholtz equations. Then, I demonstrate that the conformal invariance of the wave equation under a Kelvin transform in Minkowski spacetime allows one to convert an infinite domain problem into a bounded domain problem that can be solved using standard numerical methods with no additional loss of accuracy introduced by the transform. I conclude by discussing parallel computing strategies for the geometric boundary models, applications in architectural acoustics and binaural audio, and future work in obstacle boundary flattening.

Journal Articles

- (3) **C. McKell** and K. Bonin, “Optical corral using a standing-wave Bessel beam,” *Journal of the Optical Society of America B*, Vol. 35, No. 8, 1910–1920, 2018.

Conference Proceedings

- (4) **C. McKell**, “Sonification of optically-ordered Brownian motion,” In Proceedings of the International Computer Music Conference (ICMC), Utrecht, Netherlands, September 2016.

Master’s Theses

- (5) **C. McKell**, *Real-Time Physical Modeling for Haptic Feedback Rendering*, Master’s Thesis, University of Edinburgh, Acoustics and Audio Group, 2017. Advisor: Stefan Bilbao.
- (6) **C. McKell**, *Confinement and Tracking of Brownian Particles in a Bessel Beam Standing Wave*, Master’s Thesis, Wake Forest University, Department of Physics, 2015. Advisor: Keith Bonin.