

Exponent®
Engineering & Scientific Consulting

Joe Costello, Ph.D.

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Professional Profile

Dr. Costello is an expert on the interactions between light, especially visible and infrared light, and matter. He has extensive experience in using visible and infrared optics to investigate a variety of materials, including semiconductors, semiconducting heterostructures, and strongly driven systems. While investigating these material systems, Dr. Costello has developed expertise in experimental methods such as optical absorption, ultra-high vacuum systems, cryogenics, semiconductor fabrication methods, electronics, and free electron laser operation. In addition, Dr. Costello has extensive experience in using software such as Python, Matlab, Wolfram Mathematica, Zemax Optic Studio, and Labview for statistical analysis, modeling, data analysis, and data visualization. Dr. Costello also utilized GitHub to develop python software for data analysis and data visualization.

Before joining Exponent, Dr. Costello earned a Ph.D. in Physics from the University of California, Santa Barbara studying condensed matter physics. His work focused on understanding the behavior of electrons in strongly driven semiconductors. As a graduate student, Dr. Costello was responsible for all aspects of his experiments including inception, experiment design, sample fabrication, performance of the experiment, upkeep of equipment, data analysis, and communication of results. As a result, Dr. Costello has developed a well-rounded experimental skillset that is especially applicable to the optics, electronics, and data science industries.

At Exponent, Dr. Costello has worked in laser safety analysis, standards review related to lasers and optical hazards, and failure analysis of a variety of electronics products.

Dr. Costello's work has been published in prestigious journals such as Nature, and presented at conferences such as the American Physical Society March Meeting and the Optical Terahertz Science and Technology Conference.

Academic Credentials & Professional Honors

Ph.D., Physics, University of California, Santa Barbara, 2023

M.A., Physics, University of California, Santa Barbara, 2020

B.A., Physics, University of California, Berkeley, 2017

Honorable Mention, National Science Foundation Graduate Research Fellowship 2019

Professional Affiliations

American Physical Society, member. 2019-2023.

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Publications

Joseph B. Costello et al. Breaking a Bloch-wave interferometer: Quasiparticle species-specific temperature-dependent nonequilibrium dephasing. Phys. Rev. B 108, 195205 (2023).

J.B. Costello et al. Reconstruction of Bloch wavefunctions of holes in a semiconductor. Nature 599, 57-61 (2021). Jairo Velasco Jr, et al. Visualization and Control of Single-Electron Charging in Bilayer Graphene Quantum Dots. Nano Lett. 18, 8, 5104-5110 (2018).

Presentations

J. B. Costello et al. Understanding the Effects of Dephasing on Bloch Wave Interferometry via Temperature Dependent Polarimetry of High-order Sidebands in GaAs. Contributed talk, American Physical Society March Meeting, 2023.

J. B. Costello et al. Hamiltonian Reconstruction via Polarimetry of High-Order Sidebands in a Semiconductor. Contributed talk, Conference on Lasers and Electrooptics, 2022.

J.B. Costello et al. Measuring Non-Abelian Berry Curvature in Strained Gallium Arsenide Using Electron-Hole Recollisions. Contributed talk, American Physical Society March Meeting, 2021

J.B. Costello et al. Developing Polarimetry of THz High-Order Sideband Generation as a Method of Measuring Berry Curvature. Contributed talk, Optical Terahertz Science and Technology conference, 2019.

Project Experience

Conducted failure analysis on a variety of electronics. Performed hazard analysis and standards review relating to laser safety, LED safety, and personal protective equipment. Determined the safety of systems with LEDs and lasers by measuring the optical emission of these systems and comparing them to relevant safety standards.