CHARLES A. HILL

Electromagnetic Analytical Scientist and Instrumental Astrophysicist

763.222.6359 • chill01@mmm.com • chillphysics.com • chill90 • chillphysics

EDUCATION

University of California, Berkeley Aug 2013 – Dec 2020
PhD in Physics, Astrophysics and Cosmology

Boston University Aug 2008 – May 2012
BA in Physics, summa cum laude
Physics Department Faculty Award

EXPERIENCE

3M Corporate Research Analytical Lab (CRAL) Jan 2021 – Present
Senior Research Physicist, Electromagnetics Group Leader

- Coordinate, fund, expand, and conduct electrical measurements of adhesives, polymers, thin-film dielectrics, composites, liquids, powders, multi-layer systems, and more
- Invent and develop new analytical capabilities for dielectric, magnetic, and non-destructive materials characterization
- Specialize in millimeter-wave (1-100 GHz) measurements using dielectric resonators, resonant cavities, coaxial and rectangular waveguides, and free-space apparatuses
- Write new Python tools for improved millimeter-wave simulations and analysis
- Serve several technical leadership roles, including Electromagnetics Group Leader, Materials Characterization Technology Leader, Applied Physics and Optics Tech Forum Chapter Chair, and 5G Technology Working Group Analytical Liaison

Lawrence Berkeley National Laboratory (LBNL) Sep 2014 – Dec 2020
Graduate Researcher

- Design and construct meter-scale, sub-Kelvin cryostats for cosmic microwave background (CMB) telescopes.
- Build low-temperature, opto-mechanical assemblies and high-throughput, cryo-compatible mm-wave anti-reflection coatings for the POLARBEAR (PB) and Simons Observatory (SO) CMB experiments.
- Develop, implement, and support a custom-built Python simulation package to forecast the sensitivities of CMB observatories including PB, SO, the LiteBIRD satellite (LB), and CMB Stage-4 (S4).
- Formalize a theoretical framework for the impact of correlated photon noise on the sensitivity of densely packed GHz bolometers at sub-Kelvin temperatures and use it to inform the detector designs of SO, LB, and S4.
- Lead several groups and have delivered 300+ presentations on their behalf at meetings, seminars, and conferences.
- Manage schedules, scopes, and equipment budgets (∼100k) of critical-path projects to meet deadlines.
- Collaborate with dozens of vendors to produce novel hardware solutions for mm-wave optics and cryo-vacuum applications.

University of California, Berkeley Aug 2013 – Aug 2014
Graduate Instructor

- Facilitated discussion and laboratory sessions of introductory physics for biologists and architects.
- Won UC Berkeley's student-elected *Outstanding Graduate Student Instructor Award*.

SELECT PUBLICATIONS

Measurements of glass bubble powders from 1-100 GHz in resonant cavities and free space Jan 2022
C. A. Hill, A. Gregory, B. L. Givot, N. Pettit, Y. Wu
Submitted to the *24th International Microwave and Radar Conference*, MIKON 2022

A cryogenic continuously rotating half-wave plate for the POLARBEAR-2b cosmic microwave background receiver Sep 2020
C. A. Hill, A. Kusaka, P. Ashton, P. Barton, *et al.*
Review of Scientific Instruments, 10.1063/5.0029006

BoloCalc: a sensitivity calculator for the design of Simons Observatory Jul 2018
C. A. Hill, S. M. Bruno, S. M. Simon, *et al.*
Proceedings of SPIE, 10.1117/12.2313916

A large-diameter cryogenic rotation stage for half-wave plate polarization modulation on the POLARBEAR-2 experiment May 2018
C. A. Hill, A. Kusaka, P. Barton, *et al.*
Journal of Low Temperature Physics, 10.1007/s10909-018-1980-6

Design and development of an ambient-temperature continuously-rotating achromatic half-wave plate for CMB polarization modulation on the POLARBEAR-2 experiment Jul 2016
C. A. Hill, S. Beckman, *et al.*
Proceedings of SPIE, 10.1117/12.2232280

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