Michele Kelley

615-812-7238 | mk3g@live.unc.edu | Chapel Hill, NC

EDUCATION

University of North Carolina at Chapel Hill — *Chapel Hill, NC*
Ph.D. in Physics and Astronomy — *Expected May 2023*

University of North Carolina at Chapel Hill — *Chapel Hill, NC*
M.S. in Physics and Astronomy — *May 2020*

Middle Tennessee State University Honors College — *Murfreesboro, TN*
B.S. in Physics and Astronomy — *December 2016*
Minors: Mathematics and Aerospace

FELLOWSHIPS

National Science Foundation Graduate Research Fellow
UNC Royster Society of Fellows *1 of 20 fellows nominated and selected for prestigious, interdisciplinary fellowship at UNC*

SKILLS AND PROJECTS

Programming Languages: Mathematica, LabVIEW, MATLAB, Python, C++
Applications: COMSOL Multiphysics, Fusion360, SOLIDWORKS, Git, LaTeX
Teaching: Introductory calculus-based physics with active learning-based studio
Electronics: Basic RF circuit design, NI DAQs, amplifiers, power supplies, oscilloscopes, etc.
NMR/MRI: Ran Xe and 1H experiments on Bruker BioSpec 9.4T scanner, programmed pulse sequences on Bruker BioSpec 9.4T scanner for polarized Xe, designed continuous-wave NMR experiments, designed and constructed RF coils for low field spectroscopy

Lab built Xe polarizer (in progress)

- *Designing and constructing Xe nuclear spin polarizer.*
- *Developing standard operating procedures for cleaning and filling glass optical cells with alkali metals.*
- *Refurbishing glovebox and using to handle highly sensitive chemical reactions.*
- *Characterizing tunable high-power laser and optimizing optical pumping using optical spectroscopy.*
- *Characterizing magnetic field using low field NMR spectroscopy.*

Alkali metal electronic spin polarimetry (Kelley et al. 2022)

- *Designed and built low-cost diode laser and light polarization detector for Faraday rotation experiments on polarized Rb.*
- *Used Mathematica to perform numerical analysis of complex multi-parameter data sets.*
- *Built a breadboard-based and a NI DAQ and LabVIEW based lock-in amplifier.*

Theoretical models and measurements of Rb-Xe spin-exchange (Kelley et al. 2021)

- *Derived expression for spin-exchange using quantum mechanics, which resolved 30+ year discrepancy between theoretical and experimental values of polarized Xe.*
- *Designed, performed, and analyzed NMR and optical spectroscopy measurements.*
- *Wrote open-source script to estimate Xe polarization using derived theoretical model.*

Finite element method simulations of optical pumping cells (Kelley et al. 2020)

- *Created CAD models of optical pumping cells in SOLIDWORKS and generated fluid dynamics simulations in COMSOL Multiphysics.*
- *Used computing cluster to run simulations.*
- *Performed NMR and optical spectroscopy measurements.*

SERVICE AND LEADERSHIP

Mentor Advised undergraduate researchers in Branca Lab

- James Crisp (Fall 2019 – Spring 2020) *"Finite element method simulations of extended body optical cells"*
- Yifeng Peng (Summer 2021) *"Construction of lock-in amplifier using operational amplifiers"*
- Yifeng Peng (Fall 2021 – Spring 2022) *"Computational fluid dynamics simulations of a small animal ventilator"*

Leader APS Chapter at UNC Chapel Hill co-founder (Fall 2021-present)

- Instituted new graduate student colloquium

Program Coordinator and Mentor "G2U" Graduate to Undergraduate Mentoring Program for URM (2020-present)

- One of the founding leaders of G2U, which has been featured Science magazine

Reviewer International Society of Magnetic Resonance in Medicine abstract reviewer (2021)
Mentor "GrAM" Graduate Achievement through Mentorship Program (2020-2021)
Representative Trainee representative of ISMRM Hyperpolarized Media Study Group (2022)

PUBLICATIONS

Kelley, M. & Branca, R. T. (2022) A simple setup for *in situ* alkali metal electronic spin polarimetry. *AIP Advances, 12,* 095307.

Kelley, M., & Branca, R. T. (2021). Theoretical models of spin-exchange optical pumping: Revisited and reconciled. *Journal of Applied Physics*, *129*(15), 154901.

Kelley, M., Burant, A., & Branca, R. T. (2020). Resolving the discrepancy between theoretical and experimental polarization of hyperpolarized 129Xe using numerical simulations and in situ optical spectroscopy. *Journal of Applied Physics*, *128*(14), 144901.

Kelley, M., Cooper, J., Devito, D., Mushi, R., del Pilar Aguinaga, M., & Erenso, D. B. (2018). Laser trap ionization for identification of human erythrocytes with variable hemoglobin quantitation. *Journal of Biomedical Optics*, *23*(5), 055005.

Kelley, M., Gao, Y., & Erenso, D. (2016). Single cell ionization by a laser trap: a preliminary study in measuring radiation dose and charge in BT20 breast carcinoma cells. *Biomedical Optics Express*, *7*(9), 3438-3448.

4 posters and 1 oral presentation at national research conferences, including the International Society of Magnetic Resonance in Medicine and American Physical Society March Meeting

Other contributed works

McHugh, C. T., Durham, P. G., Atalla, S. W., **Kelley, M.,** Bryden, N. J., Dayton, P. A., & Branca, R. T. (2021). Low-boiling point perfluorocarbon nanodroplets as dual-phase dual-modality MR/US contrast agent. *ChemPhysChem *In production*

Bryden, N. J., McHugh, C. T., **Kelley, M.**, Branca, R. T. (2022) Longitudinal relaxation of hyperpolarized ^{129}Xe in solution and in hollow fiber membranes at low and high magnetic field strengths. *Magnetic Resonance in Medicine*.

McHugh, C. T., Durham, P. G., **Kelley, M.,** Dayton, P. A., & Branca, R. T. (2021). Magnetic resonance detection of gas microbubbles via hyperCEST: A path toward dual modality contrast agent. *ChemPhysChem*, *22*(12), 1219-1228.

McHugh, C. T., **Kelley, M.,** Bryden, N. J., & Branca, R. T. (2021). In vivo hyperCEST imaging: Experimental considerations for a reliable contrast. *Magnetic Resonance in Medicine*.

Bryden, N., Antonacci, M., **Kelley, M.,** & Branca, R. T. (2021). An open-source, low-cost NMR spectrometer operating in the mT field regime. *Journal of Magnetic Resonance*, *332*, 107076.

Antonacci, M. A., McHugh, C., **Kelley, M.,** McCallister, A., Degan, S., & Branca, R. T. (2019). Direct detection of brown adipose tissue thermogenesis in UCP1−/− mice by hyperpolarized 129Xe MR thermometry. *Scientific Reports*, *9*(1), 1-12.

Pasquerilla, M., **Kelley, M.,** Mushi, R., Aguinaga, M. D. P., & Erenso, D. (2018). Laser trapping ionization of single human red blood cell. *Biomedical Physics & Engineering Express*, *4*(4), 045020.