(801)-369-1970
zackrcarson@gmail.com
Zack R. Carson
zackcarson.000webhostapp.com

Education

University of Virginia — Charlottesville, VA
PhD Physics *(Thesis: Probing Fundamental Physics with Gravitational Waves)* — *May 2020*

University of Utah — Salt Lake City, UT
BS Pre-Professional Physics, BS Applied Mathematics, Astrophysics minor — *May 2014*

Experience

Refer to CV or website for additional details. Private git repositories unless specified

Gravitational Wave Outreach (part-time grant) — Charlottesville, VA
University of Virginia — *March 2022 - Current*

Building an educational outreach video game using **Unity** and **C#** to teach students about orbital mechanics and gravitational waves. This work is sponsored by an **NSF** grant co-applied for with Dr. Kent Yagi.

Data Scientist, Machine Learning — New York City, NY
Dataminr — *March 2021 - Current*

- Leading the **Cyber AI** team tasked to detect and alert on cyber security threats against clients using **Natural Language Processing (NLP) and Computer Vision (CV)** machine learning models.
- Analyzing, testing, and training state-of-the-art NLP and CV machine learning models used in production.
- Providing meaningful analysis on internal data and models for external stakeholders.

Data Scientist, Machine Learning — Boulder, CO
TruU — *June 2020 - March 2021*

Built unsupervised machine learning models to verify user identity via behavioral biometrics such as gait (walking), hand, and typing.

Graduate Research Assistant, Gravitational Wave Astrophysics — Charlottesville, VA
University of Virginia, Advisor - Professor Kento Yagi — *March 2018 - May 2020*

- Implemented statistical/orbital analysis methods in **Mathematica**, **Matlab**, **C++**, **Python**, and **Fortran** to probe fundamental physics using the observations of gravitational waves from:
  - the coalescence of neutron stars allows us to probe the ultra-dense nuclear structure within.
  - the *extreme-gravity* collisions of black holes allows us to test Einstein's General Relativity in search of alternative theories of gravity.
- Co-advised undergraduate students Josef Zimmerman and Kristen Schumacher on projects dealing with probing the neutron star structure with multi-messenger gravitational/electromagnetic wave observations.
- Referee for the Physical Review letters and D (PRL, PRD) and the Royal Astronomical Society (MNRAS) academic journals, and Associate member of the LISA consortium, where I completed analyses contemplating tests of General Relativity using various configurations of the LISA space-based interferometer.

Graduate Research Assistant, Quantum Information & Optics — Charlottesville, VA
University of Virginia, Advisor - Professor Olivier Pfister — *March 2016 - March 2018*

Implemented the entanglement of photons using multi-modal ultra-fast lasers to manufacture high levels of *qumode entanglement* - or quantum squeezing - a crucial resource for continuous variable quantum computing

Graduate Research Assistant, High Energy Physics — Charlottesville, VA
University of Virginia, Advisor - Professor Chris Neu — *Dec. 2014 - March 2016*

Implemented machine learning algorithms (boosted decision trees) in **C++** and **ROOT** to simulate the Higgs $\rightarrow$ top-top decay and microscopic black hole production mechanisms at the Large Hadron Collider

Graduate Teaching Assistant — Charlottesville, VA
University of Virginia, Professors Maksim Bychkov, Stefan Baessler, others — *Aug. 2014 - December 2019*

- Instructed mechanics and electromagnetism labs for scientists and engineers for three years, one of which spent as the Lead TA. Also taught Electricity and Magnetism II discussion sections to undergraduate physics majors, and held several graduate graderships for graduate and undergraduate level courses
- Developed a new teaching curriculum to produce more viable, confident, and motivated teaching assistants

Skills

In order of experience

Languages: Python, C#, Mathematica, Matlab, C++, SQL, ROOT, Fortran, HTML, R

Relevant software experience: `UNIX` (Ubuntu), LaTeX, git, XMgrace, Windows, Unity, MacOS

Selected Conferences and Presentations (*Refer to CV or website for additional talks*)

1. "Probing beyond-Kerr spacetimes with the IMR consistency tests of gravitational waves" (Contributed Speaker) – *APS April Virtual Meeting, April 2020*
2. "Multi-messenger probes of the neutron star equation of state" (Invited Speaker) – *Southeastern Section of the American Physical Society (SESAPS) meeting, Wrightsville, NC, November 2019*
3. "Universal relations after GW170817" (Contributed Speaker) – *American Physical Society (APS) April Meeting, Denver Colorado, April 2019*
4. "Constraining nuclear matter parameters & improving Universal Relations after GW170817" (Invited Speaker - Web seminar, Youtube) – *Nuclear Theory Group (host: Dr. Bharat Kumar, University of Tsukuba), March 2019*
5. "Team based design of science laboratories" (Contributed Speaker) – *Innovation in Pedagogy Summit, University of Virginia 2016*

Selected Honors (*Refer to CV for additional honors*)

- University of Virginia department of Physics Research Fellowship Award 2020
- University of Virginia Distinguished Graduate Teaching Award for STEM fields (single recipient) 2019
- University of Virginia Physics Department Poster Competition, 2nd place. 2019
- Google PhD Fellowship Program nominee (one of two from University of Virginia) 2018
- Graduate Physics Students Association Vice President - University of Virginia 2016

Selected Publications (*Refer to website or CV for ten additional publications*)

1. **Carson, Zack**, & Yagi, K. (Eds.). (2021). *Testing General Relativity with Gravitational Waves*, submitted as a chapter of the *"handbook of gravitational wave astronomy"* by C. Bambi, S. Katsanevas and K. Kokkotas; Springer Singapore.
2. **Carson, Zack**, & Yagi, K. (2020d). Probing string-inspired gravity with the inspiral-merger-ringdown consistency tests of gravitational waves. *Class. Quantum Grav.*. Retrieved from https://doi.org/10.1088/1361-6382/aba221
3. **Carson, Zack**, & Yagi, K. (2020a). Asymptotically flat, parameterized black hole metric preserving Kerr symmetries. *Phys. Rev. D*, *101*, 084030. Retrieved from https://link.aps.org/doi/10.1103/PhysRevD.101.084030
4. **Carson, Zack**, & Yagi, K. (2020c). Probing beyond-Kerr spacetimes with the inspiral-ringdown signals of gravitational waves. *Phys. Rev. D*, *101*, 084050. Retrieved from https://link.aps.org/doi/10.1103/PhysRevD.101.084050
5. **Carson, Zack**, & Yagi, K. (2020b). Parameterized and inspiral-merger-ringdown consistency tests of gravity with multiband gravitational wave observations. *Phys. Rev. D*, *101*, 044047. Retrieved from link.aps.org/doi/10.1103/PhysRevD.101.044047
6. **Carson, Zack**, & Yagi, K. (2019). Multi-band gravitational wave tests of general relativity. *Classical and Quantum Gravity Letters*. Retrieved from https://iopscience.iop.org/article/10.1088/1361-6382/ab5c9a
7. **Carson, Zack**, Chatziioannou, K., Haster, C.-J., Yagi, K., & Yunes, N. (2019). Equation-of-state insensitive relations after GW170817. *Phys. Rev.*, *D99*(8), 083016. Retrieved from https://doi.org/10.1103/PhysRevD.99.083016