# Adrian F. Helmling-Cornell

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## Education

M.S. in Physics from the University of Oregon, 2020.
B.S. in Honors Physics from Purdue University, 2018.

## Research Activities

**LIGO Scientific Collaboration** June 2019 - Present

Supervised by Raymond Frey and Robert Schofield.
Observing gravitational radiation from astrophysical sources. Identifying and mitigating sources of environmental noise that couple into the gravitational wave detector. Searching for sources of blip glitches in the gravitational wave data channel. Validating and vetting event candidates during LIGO's third observing run. Monitoring the data quality of the detector from week-to-week. Producing materials for the outreach group.

**Modulation Experiment** May 2016 - May 2018

Supervised by Rafael Lang and Cassie Reuter.
Investigated claims of time-varying $\beta$-decay rate in certain isotopes associated with changing flux of dark matter candidate particles of solar origin. Calibrated photomultiplier tubes used for detecting radioactive decays. Designed a method for discriminating between decays from radioactive sources and background radiation. Mitigated the effects of pileup in the photomultiplier tubes.

## Publications

1. "All-sky search for continuous gravitational waves from isolated neutron stars in early O3 LIGO data," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration), *Phys. Rev. D* **104**, no.8, 082004 (2021) [arXiv: 2107.00600 [gr-qc]].
2. "LIGO's Quantum Response to Squeezed States," L. McCuller *et al.* (LIGO Detector/Instrument Science Group), *Phys. Rev. D* **104**, no.6, 062006 (2021) [arXiv: 2105.12052 [physics.ins-det]].
3. "Search for anisotropic gravitational-wave backgrounds using data from Advanced LIGO's and Advanced Virgo's first three observing runs," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration), *Phys. Rev. D* **104**, no.2, 022005 (2021) [arXiv: 2103.08520 [gr-qc]].
4. "Upper limits on the isotropic gravitational-wave background from Advanced LIGO's and Advanced Virgo's third observing run," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration), *Phys. Rev. D* **104**, no.2, 022004 (2021) [arXiv: 2101.12130 [gr-qc]].
5. "Observation of gravitational waves from two neutron-star black hole coalescences," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration), *ApJL* **915**, L21 (2021) [arXiv: 2106.15163 [astro-ph.HE]].
6. "Approaching the motional ground state of a 10 kg object," C. Whittle *et al.* (LIGO Detector/Instrument Science Group), *Science* **372**, no.6548, 1333-1336 (2021) [arXiv: 2102.12665 [quant-ph]].
7. "Environmental noise in Advanced LIGO detectors," P. Nguyen *et al.*, *Class. Quantum Grav.* **38**, no.14, 145001 (2021) [arXiv: 2101.09935 [astro-ph.IM]].

8. "Constraints on cosmic strings using data from the third Advanced LIGO-Virgo observing run," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration), *Phys. Rev. Lett.* **126**, no.24, 241102 (2021) [arXiv: 2101.12248 [gr-qc]].
9. "Tests of general relativity with binary black holes from the second LIGO-Virgo gravitational-wave transient catalog," R. Abbott *et al.* (LIGO-Virgo Collaboration), *Phys. Rev. D* **103**, no.12, 122002 (2021) [arXiv: 2010.14529 [gr-qc]].
10. "GWTC-2: compact binary coalescences observed by LIGO and Virgo during the first half of the third observing run," R. Abbott *et al.* (LIGO-Virgo Collaboration), *Phys. Rev. X* **11**, 021053 (2021) [arXiv: 2010.14527 [gr-qc]].
11. "LIGO detector characterization in the second and third observing runs," D. Davis *et al.*, *Class. Quantum Grav.* **38**, no.13, 135014 (2021) [arXiv: 2101.11673 [astro-ph.IM]].
12. "Population properties of compact objects from the second LIGO-Virgo Gravitational-Wave Transient Catalog," R. Abbott *et al.* (LIGO-Virgo Collaboration), *ApJL* **913**, no.1, L7 (2021) [arXiv: 2010.14533 [astro-ph.HE]].
13. "Diving below the spin-down limit: Constraints on gravitational waves from the energetic young pulsar PSR J0537-6910," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration), *ApJL* **913**, no.2, L27 (2021) [arXiv: 2012.12926 [astro-ph.HE]].
14. "Point absorbers in Advanced LIGO," A.F. Brooks *et al.* (LIGO Detector/Instrument Science Group), *Appl. Optics* **60**, no.13, 4047-4063 (2021) [arXiv: 2101.05828 [physics.ins-det]].
15. "All-sky search in early O3 LIGO data for continuous gravitational-wave signals from unknown neutron stars in binary systems," R. Abbott *et al.* (LIGO-Virgo Collaboration), *Phys. Rev. D* **103**, no.6, 064017 (2021) [arXiv: 2012.12128 [gr-qc]].
16. "Sensitivity and performance of the Advanced LIGO detectors in the third observing run," A. Buikema *et al.* (LIGO Detector/Instrument Science Group), *Phys. Rev. D* **102**, no.6, 062003 (2020) [arXiv: 2008.01301 [astro-ph.IM]].
17. "Reducing scattered light in LIGO's third observing run," S. Soni *et al.* (LIGO Detector/Instrument Science Group), *Class. Quantum Grav.* **38**, no.2, 025016 (2020) [arXiv: 2007.14876 [astro-ph.IM]].
18. "Gravitational-wave constraints on the equatorial ellipticity of millisecond pulsars," R. Abbott *et al.* (LIGO-Virgo Collaboration), *ApJL* **902**, no.1, L21 (2020) [arXiv: 2007:14251 [astro-ph.HE]].
19. "Improving the robustness of the advanced LIGO detectors to earthquakes," E. Schwartz *et al.* (LIGO Detector/Instrument Science Group), *Class. Quantum Grav.* **37**, no.23, 235007 (2020) [arXiv: 2007.12847 [physics.ins-det]].
20. "Quantum correlations between the light and kilogram-mass mirrors of LIGO," H. Yu *et al.* (LIGO Detector/Instrument Science Group), *Nature* **583**, no.7814, 43-47 (2020) [arXiv: 2002.01519 [quant-ph]].
21. "Quantum-enhanced Advanced LIGO detectors in the era of gravitational-wave astronomy," M.Tse *et al.* (LIGO Detector/Instrument Science Group), *Phys. Rev. Lett.* **123**, no.23, 231107 (2019).
22. "A precision experiment to investigate long-lived radioactive decays," J.R. Angevaare *et al.*, *JINST* **13**, no.07, P07011 (2018) [arXiv: 1804.02765 [nucl-ex]].

**Preprints**

1. "Search for subsolar-mass binaries in the first half of Advanced LIGO and Virgo's third observing run," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2109.12197 [astro-ph.CO]].
2. "Search for continuous gravitational waves from 20 accreting millisecond X-ray pulsars in O3 LIGO data," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2109.092555 [astro-ph.HE]].
3. "Point absorber limits to future gravitational-wave detectors," W. Jia *et al.* (LIGO Detector/Instrument Science Group) [arXiv: 2109.08743 [physics.ins-det]].
4. "GWTC-2.1: Deep extended catalog of compact binary coalescences observed by LIGO and Virgo during the first half of the third observing run," R. Abbott *et al.* (LIGO-Virgo Collaboration) [arXiv 2108.01045 [gr-qc]].
5. "All-sky search for long-duration gravitational-wave bursts in the third Advanced LIGO and Advanced Virgo run," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2107.13796 [gr-qc]].
6. "All-sky search for short gravitational-wave bursts in the third Advanced LIGO and Advanced Virgo run," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2107.03701 [gr-qc]].
7. "Search for intermediate mass black hole binaries in the third observing run of Advanced LIGO and Advanced Virgo," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2105.15120 [astro-ph.HE]].
8. "Constraints on dark photon dark matter using data from LIGO's and Virgo's third observing run," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2105.13085 [astro-ph.CO]].
9. "Searches for continuous gravitational waves from young supernova remnants in the early third observing run of Advanced LIGO and Virgo," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration)[arXiv: 2105.11641 [astro-ph.HE]].
10. "Search for lensing signatures in the gravitational-wave observations from the first half of LIGO-Virgo's third observing run," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2105.06384 [gr-qc]].
11. "Constraints from LIGO O3 data on gravitational-wave emission due to r-modes in the glitching pulsar PSR J0537-6910," R. Abbott *et al.* (LIGO-Virgo-KAGRA Collaboration) [arXiv: 2104.14417 [astro-ph.HE]].

**Presentations**

1. "Blip Glitches in LHO," Gravitational Wave Astronomy North West, virtual meeting, 2020. Presentation available at `dcc.ligo.org/LIGO-G2001007/public`.

**Posters**

1. "No Blip Glitching Found in LIGO Data Acquisition System in O3 or O4 Configuration," LIGO-Virgo-KAGRA Collaboration Meeting, virtual meeting, September 2021.
2. "LIGO Detector Characterization: O2/O3 Successes and O4 Plans," LIGO-Virgo-KAGRA Collaboration Meeting, virtual meeting, March 2021.

**Awards**

1. LVK Instrumental/Experimental Student Poster Prize (September 2021).
2. Weiser First Year Teaching Assistant Award (2019).

**Teaching**

1. PHYS 631 Fall 2020
   **Quantum Mechanics I** - First course of the required sequence of quantum mechanics courses for graduate students. Graded homework assignments and helped design exams.
2. PHYS 391 Spring 2020
   **Physics Experimentation Data Analysis Laboratory** - Laboratory course for second-year majors to introduce them to Python programming and error analysis. Helped adapt existing materials for online distribution, ran virtual lab sessions and graded homework.
3. ASTR 122 Winter 2020
   **Birth and Death of Stars** - Survey course for interested non-scientists. Gave a guest lecture on gravitational wave astronomy, wrote exam questions, graded homework and exams.
4. PHYS 206 Spring 2019
   **Introductory Physics Laboratory III** - Laboratory to complement PHYS 203. Ran labs, further refined activities to improve quality of written work produced by students, graded homework and exams.
5. PHYS 203 Spring 2019
   **General Physics III** - Algebra-based course on electricity and magnetism, special relativity and a qualitative introduction to topics in quantum mechanics. Ran tutorial sections and graded exams.
6. PHYS 205 Winter 2019
   **Introductory Physics Laboratory II** - Laboratory to complement PHYS 202. Ran labs, graded homework and exams.
7. PHYS 202 Winter 2019
   **General Physics II** - Algebra-based course on fluids, geometric optics and heat transfer. Ran tutorial sections and graded exams.
8. PHYS 204 Fall 2018 and Fall 2019
   **Introductory Physics Laboratory I** - Laboratory to complement PHYS 201. Ran labs, designed activities to improve quality of written work produced by students, graded homework and exams.
9. PHYS 201 Fall 2018 and Fall 2019
   **General Physics I** - Algebra-based course on kinematics & Newton's laws of motion for non-majors. Ran tutorial sessions, graded exams, wrote exam questions and came up with new activities to reinforce difficult topics for students.
10. PHYS 172 Spring 2016 and Fall 2016
    **Modern Mechanics** - Assisted graduate teaching assistant with programming lab sections associated with a calculus-based course for engineering and non-physics science majors. Assisted students in troubleshooting Python/VPython code and interpreting simulation results.

**Education and Public Outreach**

Produced publicly-available graphics for observed gravitational waves listing detection statistics and inferred merger parameters (2019 - 2020)
Reviewed official popular summaries of collaboration papers for clarity and correctness (2019, 2021)
Led regular tours of LIGO Hanford intended for visitors (2019)

**Department Service**

Graduate admissions committee member (2021-2022)
Graduate student representative to department faculty search committee (2021)
Graduate student representative to department head search committee (2020 - 2021)
Vice President, physics graduate students (2020 - 2021)
Graduate student representative to faculty committee (2020 - 2022)
Graduate student representative to graduate studies committee (2019 - 2021)