A person with curly hair and mustache

Description automatically generated**Oliver C. Gorton**

Ph.D. Candidate from San Diego State University and University of California, Irvine,   
ACT Award scholar at Lawrence Livermore National Laboratory.

[ogorton@sdsu.edu](mailto:ogorton@sdsu.edu) **|** [Github](https://github.com/ogorton) **|** [Google Scholar](https://scholar.google.com/citations?hl=en&user=hSQUrwwAAAAJ) **|** ORC ID: [0000-0003-3643-9640](https://orcid.org/0000-0003-3643-9640)

**Research interests**

*Nuclear structure and reactions*: beta-delayed neutron emission, integration of nuclear shell-model and Hauser-Feshbach (statistical) reactions. *Applications* in related fields: the search for dark matter, nuclear data and evaluations, uncertainty quantification, machine learning, high-performance computing.

**Education**

* PhD Computational Science  
  New Predictive Capability for Reaction and Decay Properties of Fission Fragments  
  *University of California, Irvine & San Diego State University* [*joint doctoral program*](https://computationalscience.uci.edu/), 2023 (expected). Advisor: Calvin Johnson
* MS Physics  
  [Efficient Modeling of Nuclei Through Coupling of Proton and Neutron Wavefunctions](https://csu-sdsu.primo.exlibrisgroup.com/permalink/01CALS_SDL/r45sar/alma991023475280402917)  
  *San Diego State University*, 2018. Advisor: Calvin Johnson
* BA Physics  
  *University of California, Berkeley*, 2016

**Training and schools**

* Attended “[FRIB-TA Summer School: A practical walk-through formal scattering theory](https://fribtascattering.github.io/)”, 2021  
  Lectures and hands on exercises in low-energy nuclear scattering theory
* Attended “Agile Development Practices and Tools: A Guided Tour”, 2020  
  Collaborative source control using git, GitHub, and git workflows.
* Attended “Technical Writing Workshop” at LLNL, 2019

**Awards and support**

* [LLNL SD Academic Collaboration Team University Program](https://www.llnl.gov/news/labs-act-awards-focus-collaborative-university-research) (ACT-UP) Award (2022, 2023)  
  Full support, university tuition, travel funds, relocation to LLNL 8 mo./yr.
* [Graduate “G-STEM” Scholarship](https://sites.google.com/sdsu.edu/assics/home) (2018, 2019)  
  National Science Foundation Program, awarded by Computational Science Research Center, San Diego State University   
  Partial support and professional development training.

**Research experience**

**Nuclear reactions, data, and theory at Lawrence Livermore National Laboratory (2018 – Present)**

* High Energy Density Physics Intern, Strategic Deterrence (Summers 2018)
  + Developed code, COMMCAS, to perform uncertainty quantification on Hauser-Feshbach code STAPRE.
  + Applied method to benchmark calculation of surrogate reaction method, resulting in conference proceedings [C3] listed below.
* High Energy Density Physics Intern, Strategic Deterrence (Summers 2019)
  + Further developed and applied COMMCAS for sensitivity analysis of surrogate reaction theory, leading to journal paper [J3] listed below.
  + Initiated collaboration with experimentalists at U. Notre Dame to analyze cross section measurements, leading to journal paper [J4] listed below.
* High Energy Density Physics Intern, Strategic Deterrence (Summers 2020)
  + Further improvements to COMMCAS and integration with various nuclear reaction codes including EMPIRE, TALYS, YAHFC.
  + Found and reported bugs in lab’s new reaction code YAHFC
  + Assisted in feasibility study to determine if and how a Livermore C++ physics code could be ported to GPUs.
* Glenn T. Seaborg Institute (GTSI) Summer Intern, [Seaborg Institute](https://seaborg.llnl.gov/) (Summer 2021)
  + Collaborated with 2021 summer student to integrate COMMCAS with Livermore machine learning tool B-DJINN for emulation of reaction codes.
  + Co-refereed an article for Physical Review C
* [ACT-UP Scholar](https://www.llnl.gov/news/labs-act-awards-focus-collaborative-university-research), Strategic Deterrence (2022 – 2023)
  + Collaborated with 2022 summer student to improve COMMCAS machine learning tools with neural networks, contributing to conference proceedings [C2] listed below.
  + New predictive capability for reaction and decay properties of fission fragments
  + Implemented shell model methods for computing gamma-ray strength functions.

**Nuclear structure and applications at San Diego State University (2016 – Present)**

* Masters and Doctoral student with [Calvin Johnson](http://sci.sdsu.edu/johnson/)
* Helped apply quantum information theory to nuclear shell model, leading to journal paper [J1]
* Co-developed a truncated shell model code.
  + Implemented advanced extremal eigenvalue solvers in modern Fortran.
  + Solved several technical problems related to implementing a quantum many-body solver.
  + Parallelized a shell model code using a hybrid MPI and openMP approach.
* Co-developed a nucleus-WIMP scattering code for direct dark matter detection experiments, resulting in journal paper [J2] listed below.

**Intersection of nuclear physics and quantum chemistry at UC, Irvine (2019-20 academic year)**

* Graduate Student Visitor, Department of Chemistry, [Furche Research Group](https://ffgroup.chem.uci.edu/members/filipp/)  
  Collaborated with chemistry postdoc to develop formalism for Nuclear-Electronic Orbital method using time-dependent density functional theory.

**Codes**

Languages: Modern Fortran, Python (numpy, scipy, MPI4py, multiprocessing, emcee), Bash, C++  
Technologies: Experienced: MPI, openMP, git; Novice: CUDA, RAJA  
Machines: Borax, Quartz in [LC, LLNL](https://hpc.llnl.gov/hardware/compute-platforms) facility

**Primary developer of:**

* **dmscatter** [[Repository]](https://github.com/ogorton/dmfortfactor)  
  A fast Fortran code for WIMP-nucleus form factors and differential event rate spectra. Modern Fortran with Python interface. OpenMP parallel.
  + Journal publication [J2] listed below with multiple citations
  + Being used and applied in [upcoming publication](https://arxiv.org/abs/2305.08991)
* **PANASh** [Not yet released]  
  Proton and neutron approximate shell model code providing advanced basis truncation scheme for nuclei away from stability. MPI and openMP hybrid parallel.
  + Motivated by journal publication [J1] listed below with multiple citations
  + Has been applied in conference proceedings [C1] listed below
  + Separate Journal publication in progress
* **COMMCAS** [Not yet released]  
  Computational Model Monte Carlo Sampler: Uncertainty quantification framework originally designed for Hauser-Feshbach statistical decay codes, now provides generic data-fitting, uncertainty quantification, and neural-network-emulation tools for physics codes. MPI and multiprocessing parallel.
  + Actively in use at LLNL for uncertainty quantification in:
    - Surrogate reaction theory
    - Optical model potentials
  + Has been applied in Journal papers [J3, J4], and Conference proceedings [C2, C3]
* **Wigner** [[Repository]](https://github.com/ogorton/wigner)  
  A library of functions for computation of Wigner 3-j, 6-j and 9-j symbols, written in modern Fortran.

**Journal papers**

1. [Proton-neutron entanglement in the nuclear shell model](https://doi.org/10.1088/1361-6471/acbece)  
   C. W. Johnson and O. C. Gorton  
   *Journal of Physics G: Nuclear and Particle Physics 50 (4) 045110 (2023) |* [arXiv:2210.14338](http://arxiv.org/abs/2210.14338)
2. [dmscatter: A Fast Program for WIMP-Nucleus Scattering](https://doi.org/10.1016/j.cpc.2022.108597)  
   O. Gorton, C. Johnson, C. Jiao, J. Nikoleyczik  
   *Computer Physics Communications 284, 108597 (2023)* | [arXiv:2209.09187](https://arxiv.org/abs/2209.09187)
3. [Cross sections for neutron-induced reactions from surrogate data: Reexamining the Weisskopf-Ewing approximation for (n,n’) and (n,2n) reactions](https://doi.org/10.1103/PhysRevC.107.044612)  
   O. C. Gorton and J. E. Escher  
   *Physical Review C: Nuclear Physics 107 (4), 044612 (2023)* | [arXiv:2102.03452](https://arxiv.org/abs/2102.03452)
4. [Measurements of proton capture in the A=100-110 mass region: Constraints of the 111In(gamma,p)/(gamma,n) branching point relevant to the gamma-process](https://journals.aps.org/prc/abstract/10.1103/PhysRevC.102.055806)  
   O. Olivas-Gomez, A. Simon, O. Gorton, J. E. Escher et al.   
   *Physical Review C: Nuclear Physics 102 (5), 055806 (2020)*

**Conference proceedings**

1. [A Problem in the Statistical Description of Beta-Delayed Neutron Emission](https://doi.org/10.1051/epjconf/202328403013)  
   O. Gorton, C. Johnson, and J. Escher  
   *EPJ Web of Conferences 284, 03013 (2023)* | [arXiv:2210.05904](https://arxiv.org/abs/2210.05904)
2. [Improving nuclear data evaluations with predictive reaction theory and indirect measurements](https://doi.org/10.1051/epjconf/202328403012)  
   J. Escher, K. Bergstrom, E. Chimanski, O. Gorton, E. J. In, M. Kruse, S. Peru, C. Pruitt, R. Rahman, E. Shinkle, A. Thapa, W. Younes  
   *EPJ Web of Conferences 284, 03012 (2023)* | [arXiv:2304:10034](https://doi.org/10.48550/arXiv.2304.10034)
3. [Neutron capture cross sections from surrogate reaction data and theory: connecting the pieces with a Markov-Chain Monte Carlo approach](https://doi.org/10.1007/978-3-030-58082-7_28)  
   O. Gorton and J. E. Escher  
   *Springer Proceedings in Physics, vol 254, pages 229-231 (2021)* | [arXiv:1905:03055](https://arxiv.org/abs/1905.03055)

**Contributed talks**

1. [Gamma-ray strength functions using approximate shell model calculations](https://ogorton.github.io/talks/gorton_t3_2023_LLNL-PRES-853425.pdf)  
   O. Gorton, C. Johnson, J. Escher  
   Talk at T3 “Taking the Temperature” Workshop on Statistical Nuclear Physics for Astrophysics and Applications (Ohio University, August 2023)
2. [Nuclear Shell Model to the Rescue: Efforts to Resolve a Mystery in Beta Delayed Neutron Emission](https://ogorton.github.io/talks/gorton_dnp22.pdf)  
   O. Gorton, C. Johnson, J. Escher  
   Talk at APS Division of Nuclear Physics Fall 2022 Meeting (New Orleans, October 2022)
3. [Crisis in Beta-Delayed Neutron Emission: Shell Model to the Rescue](https://ogorton.github.io/talks/gorton_nd22.pdf)  
   O. Gorton, C. Johnson, J. Escher  
   Talk at Nuclear Data Conference (Sacramento – virtual, July 2022)
4. [DMFortFactor: A Fast and Accessible for Computing WIMP-Nucleus-Scattering Event-Rates](https://ogorton.github.io/talks/gorton_dnp21.pdf)  
   O. Gorton, C. Johnson, C. Jiao  
   Talk at DNP21 APS Conference (Boston – virtual, October 2021)
5. [Better MCMC for Nuclear Data using emcee and B-DJINN](https://ogorton.github.io/talks/gorton_llnl21.pdf)  
   O. C. Gorton, J. E. Escher, K. O. Bergstrom, M. K. Kruse  
   Talk at LLNL Summer Slam (Livermore, August 2021)
6. [Nuclear Physics for WIMPs](https://ogorton.github.io/talks/gorton_csrc21.pdf)   
   O. Gorton and C. W. Johnson  
   Talk at SDSU SIAM Student Chapter Summer Colloquium Series, (San Diego, July 2021)
7. [Cross subsections for neutron reactions from surrogate measurements: Revisiting the Weisskopf-Ewing approximation](https://ogorton.github.io/talks/gorton_dnp20.pdf)  
   O. Gorton and J. E. Escher  
   Talk at DNP20 APS Conference (New Orleans – virtual, October 2020)
8. [Can we get rid of the theorists?](https://ogorton.github.io/talks/gorton_llnl20.pdf)  
   O. Gorton and J. E. Escher  
   Talk at LLNL Summer Slam (Livermore, August 2020)
9. [Big Picture and Background for Nuclear-Electronic Orbital (NEO) Approach: Calculating Mixed Nucleon-Electron Wave Functions](https://ogorton.github.io/talks/gorton_uci20.pdf)  
   O. Gorton  
   Seminar for the Furche Group, Chemistry Department, UC Irvine (Irvine, March 2020)
10. [Indirect measurements of nuclear cross subsections: tempering experimental results with theory](https://ogorton.github.io/talks/gorton_llnl19b.pdf)  
    O. Gorton and J. E. Escher  
    Seminar for HEDP Intern Exit Talk (Livermore, September 2019)
11. [A Markov Chain Monte Carlo Tool for Hauser-Feshbach Codes](https://ogorton.github.io/talks/gorton_llnl18.pdf)O. Gorton and J.E. Escher  
    Seminar for HEDP Intern Exit Talk (Livermore, August 2018)

**Posters**

1. [Proton and Neutron Approximate Shell Model: Factorization-based Importance Truncation](https://ogorton.github.io/posters/gorton_ns22.pdf)  
   O. Gorton, C. Johnson, J. Escher  
   Poster at Nuclear Structure Conference (Berkeley, June 2022)
2. [Sensitivity Study of the Surrogate Method](https://ogorton.github.io/posters/gorton_llnl19a.pdf)  
   O. Gorton and J. E. Escher  
   Poster at LLNL Student Poster Symposium (Livermore, August 2019)
3. [Temperature and Entropy in the Nuclear Shell Model](https://ogorton.github.io/posters/gorton_csrc19.pdf)  
   O. Gorton and C. W. Johnson  
   Poster at SDSU ACCESS event (San Diego, April 2019)
4. [Proton Neutron Interacting Shell Model: Order of Magnitude Reduction for Medium Mass Nuclei](https://ogorton.github.io/posters/gorton_sdsu19.pdf)  
   O. Gorton and C. Johnson  
   Poster at SDSU annual research symposium (San Diego, March 2019)
5. [Neutron capture cross subsections from surrogate reaction data and theory: connecting the pieces with a Markov-Chain Monte Carlo approach](https://ogorton.github.io/posters/gorton_cnr18.pdf)  
   O. Gorton and J. E. Escher  
   Poster at Compound Nuclear Reactions conference [CNR18](https://indico.bnl.gov/event/4158) (Berkeley, September 2018)

**Teaching**

* Graduate Teaching Associate for intro physics lab courses (2016 - 2020)  
  San Diego State University, Department of Physics
  + Independently lead lectures and exams
  + Co-authored [the department-wide manual](https://docs.google.com/document/d/1pejqikoYhlaIMhSzBzUzrnh2hDrC_q-bEcJCeflpX7w/edit?usp=sharing) for Physics 182A/195L Laboratory