Fabrizio Vassallo

Argentine · 7975 Slayter Union, Granville, Ohio, USA 43023
vassal_f1@denison.edu · www.vassalloef.com

Education

2020 – Present: **B.S. in Physics & Mathematics,** Denison University
Overall & Major GPA: 4.00/4.00
Phi Beta Kappa (Junior Early Inductee)

Research experience

Aug 2023 – Present: **Senior Research & Thesis (Particle Phenomenology)**
Advisor: Christopher Verhaaren
Brigham Young University and Denison University
- Significantly extending summer work on slowly-rotating Q-balls, which are non-topological solitons with applications, for instance, in various dark matter theories.
- Found first-order perturbative solutions to Q-ball PDEs and explored consequences.
- Steered investigation down the new route of $(2+1)$ Q-vortices, which are largely unexplored and could significantly simplify the problem.

Jun 2023 – Aug 2023: **Summer Research (Particle Phenomenology)**
Advisor: Christopher Verhaaren
Brigham Young University
- Recast a new model for slowly-rotating Q-balls for exploratory numerical analysis using Green's functions and boundary value problem techniques.
- Derived new model's main results and carried out initial perturbative analysis.
- Studied basics of calculus of variations, abstract algebra, and classical field theory.

Aug 2021 - May 2023: **Undergraduate Research Assistant (AMO Physics)**
Advisor: Wesley Walter
Denison University
- Contributed during the school year to the writing, editing, and revision process of the Phys. Rev. A paper about lead we published in 2022 and led the writing process of the article about lanthanum we are preparing for submission soon.
- Aided in the analysis of the data taken at the DESIREE facility of Stockholm University in early 2021, which resulted in a publication on the lifetime of Bi^-.

May 2022 – Jul 2022: **Summer Research (AMO Physics)**
Advisor: Wesley Walter
Denison University and Stockholm University
- Worked at the DESIREE experiment of Stockholm University on measuring the lifetime of certain excited states of La^- to test its potential as the first anion used in laser cooling. Analyzed data gathered using Origin and various fitting methods.
- Redesigned from scratch the LabVIEW program that controls the crossed ion-beam–laser-beam apparatus at Denison to implement a new continuous-wave laser.

May 2021 – Jul 2021: **Summer Research (AMO Physics)**
Advisor: Wesley Walter
Denison University
- Researched the energy spectrum of Pb^-, measuring the electron affinity (EA) of the main isotopes of lead with unprecedented precision. Our work resolved a controversy regarding isotope shifts in the EA of Pb.
- Designed, constructed, and implemented an automatic laser pulse energy stabilizer.

Publications

Physics research:

1. Measurement of the electron affinity of lead and its isotope shifts.
   Walter, C. W., Vassallo, F. E., & Gibson, N. D.
   Physical Review A, Volume 106, Issue 1, 2022.
2. Measurement of Lanthanum Anion Excited-State Lifetimes.
   Walter, C. W., Vassallo, F. E., Gibson, N. D., *et al.*
   Manuscript in preparation.

History of science research:

3. Powerful Math: What Biology's Modern Synthesis Reveals About the Twofold Influence of Numbers.
   Vassallo, F. E.
   Synthesis, Harvard University, Volume 1, Issue 7, 2023.

Others:

4. Science Comes to Life at PhysCon: Scholarly Adventures in Washington, DC.
   Vassallo, F. E.
   Radiations, American Institute of Physics, Volume 29, Issue 2, 2023.
5. The calm amidst the storm: A literary nonfiction tale.
   Vassallo, F. E.
   Exile Magazine, Denison University, Volume 68, Issue 1, 2022.

Presentations at scientific conferences

2023:

1. *Slowly-Rotating Q-Balls.*
   Speaker. APS Eastern Great Lakes Meeting. Cleveland, Ohio, USA.
2. *Slowly-Rotating Q-Balls.*
   Poster presentation. Denison University Symposium. Granville, Ohio, USA.

2022:

3. *Lifetime measurements of excited states of La^-.*
   Poster presentation. Optica FiO+LS Symposium. Rochester, New York, USA.
4. *Lifetime measurements of excited states of La^-.*
   Poster presentation. PhysCon 2022. Washington DC, USA.
5. *Lifetime of excited states of La^- at DESIREE.*
   Poster presentation. Denison University Symposium. Granville, Ohio, USA.

2021:

6. *Measurement of the isotope shifts in the electron affinity of lead.*
   Speaker. Optica FiO+LS Symposium. Online.
7. *Measurement of the isotope shifts in the electron affinity of lead.*
   Poster presentation. Denison University Symposium. Granville, Ohio, USA.

Teaching and mentoring

Teaching assistant:

1. *"Principles of Physics: Quarks to Cosmos,"* Fall 2023.
2. *"Modern Physics,"* Spring 2023.
3. *"Applied Mathematics for Physical Systems,"* Spring 2023.
4. *"Darwin and Darwinism,"* Fall 2022.
5. *"Introduction to Proofs,"* Fall 2022.
6. *"Linear Algebra & Differential Equations,"* Spring 2022.

Tutoring:

7. *"Principles of Physics: Quarks to Cosmos,"* Fall 2021.
8. *"Multi-Variable Calculus,"* Fall 2021.

Leadership and Involvement

2021 – 2022: **Society of Physics Students**
Co-president, Denison University
Organized events to bring the physics community together with fun activities, from decorating the building for Halloween to coordinating a stargazing night with faculty. Recognized by the American Institute of Physics as a Distinguished Chapter.

Honors and Awards

2023:	Membership of the Phi Beta Kappa Honor Society (Junior Early Inductee)
	Membership of the Pi Mu Epsilon Honor Society
	Membership of the Sigma Xi Honor Society
	Ben Leslie Experimentalist Award
	Senior Fellow of the Mathematics Department
	Senior Fellow of the Physics Department
2022:	Chosaburo Kato Memorial Award
	Forbes B. Wiley Award
	Junior Fellow of the Physics Department
	Membership of the Sigma Pi Sigma Honor Society
2021:	Membership of the Phi Honor Society
	Forbes B. Wiley Award
	Introductory Physics Award

Various skills

Theoretical Skills:	Study of partial differential equations; numerical analysis in Mathematica; and analytical perturbative methods.
Lab skills:	Designing and building electrical and electronic circuits; DAQ interfacing; analyzing and interpreting large data sets; running and planning experiments; and working with Ultra-High Vacuum (UHV) systems.
Programming:	Python, R, and Mathematica.
Software:	Office Suite, AutoCAD, Autodesk Inventor, Origin, LabVIEW, and LaTeX.
Languages:	Spanish (native), English (C2, proficient), and German (A2, basic).