David Davalos

—Mathematical Physicist, Applied Mathematician (Data Science, Machine Learning) and Developer (Python)—

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About me

I am a physicist with a strong background in Mathematics, in particular in many topics related to Quantum Mechanics. Also in applications of mathematics such as Machine Learning and Advanced Statistics, with experience in Scientific Computing. Moreover, I have a solid experience leading academic research and relatively big endeavors, that culminated in publications in peer reviewed journals (and open source libraries). Some of them with practical applications in Quantum Computing. **Currently** I am a Research Fellow in the *Research Center for Quantum Information* under the framework of the Slovak National Research Platform for Quantum Technologies (QUTE), and the initiative to create a quantum network in Slovakia. Also I am a part time Developer on Machine Learning algorithms and backend at *Techisland* (remote). **I am looking to** apply my technical knowledge and leadership skills to solve interesting problems in the private sector, delivering flexibility in development with scientific rigor. **Besides**, I have experience working remotely and I like it.

Personal Information

- Date of Birth: September 21st of 1990.
- Place of Birth: Guadalajara Jal., México.
- Nationality : Mexican, US citizen.

Social and collaborative networks (clickable)

- Personal site
- GitHub
- LinkedIn

Higher Education

- **Ph. D. Physics**
  Institute of Physcis, UNAM, 2015-2020.
- **Master of Physics**
  Institute of Physics, UNAM 2013-2015.
- **Bachelor of Physics**
  Physics department, CUCEI, University of Guadalajara, 2008-2013.

Work Experience

- **Private sector**

- **TechIsland** (May/2022-present)
  Working as Machine Learning Specialist and backend developer. I use Python and AWS with the help of GitHub. I am developing and documenting entire workflows to train, retrain, organize, certify and deploy backends with cores relying on Machine Learning models.

- **Academy**

  - **Institute of Physics Slovak Academy of Sciences**(Aug/2021-present)
    Research fellow at Mario Ziman's group. Investigating algebraic properties of quantum channels, open quantum systems, quantum communication and foundations of quantum mechanics.
  - **Institute of Physics the National Autonomous University of Mexico (IF-UNAM)** (Feb/2020-Jun/2021)
    Postdoctoral researcher at the Dr. Carlos Pineda's group for quantum information and quantum optics. The position was devoted to investigate imperfect quantum measurements on many-body.
  - **Research Group for Quantum Information and Quantum Optics (GIOC)** (Feb/2013-Feb/2020)
    During my Master and PhD in Physics, I worked in the group as a researcher, and leaded or co-leaded at least 4 projects. Some of them culminated in the publications detailed below. Part of my duties consisted in international collaboration in several countries (see further information below). Furthermore, I gave personal consultancies to other members of the research group.
  - **Faculty of Sciences UNAM** (Feb/2013-Feb/2020)
    During my Master and PhD in Physics, I was lecturer and lecturer assistant of many topics, including computational and mathematical physics. See details below.

Programming Skills

- Advanced knowledge of **Python**.
- Advanced knowledge of **Julia** and **Mathematica**.
- Advanced usage of **Git** and **GitHub**.
- Intermediate knowledge of **C++** and **MatLab**.
- Advanced usage of **LaTeX**.
- **AWS** (basic, currently learning and applying it to my work).
- Experience working under **Agile** Project Management methodology and **Scrum** framework (with Jira).
- Extensive use of **GNU/Linux** as user and administrator.

Recent achievements (case studies)

- (Private sector) Using statistical principles, I have extended an unsupervised Machine Learning model to a supervised one, in order to certify it. Besides, this supervision serves as a platform to construct minimum valuable products.
- (Academy) I have found strong mathematical results regarding quantum computation. In particular I discovered a tool to reduce the size of the register of a quantum computer when performing quantum simulations.

Languages

- Spanish (mother language).
- English (fluent).
- German (basic).

Research interests

- Quantum Information Theory.
- Machine Learning algorithms.
- Classical and Quantum Probability Theory.
- Quantum Tensor Networks.

Hobbies

- International history: From Romans to XX century in Europe and America.
- Philosophy of mathematics and natural sciences: Zermelo-Fraenkel+Choice set theory and model theory; heuristics and the path from metaphysics to physics.
- Linux gaming: I enjoy enhancing my experience experimenting with different drivers and WINE (and Proton) versions. I play grand strategy, simulation, fighting and shooting games.

Honors

- Graduated with Honors in the Ph. D. Physics program of UNAM (2020).
- *Alfonso Caso medal* for being the most distinguished graduated in the year 2015 of the program of "Master on Physical sciences" of UNAM (2017).
- *Juan Manuel Lozano Mejía Diploma* for distinguished academic performance in the "Master on Physical sciences" program of UNAM (2016).
- Graduated with Honors in the Master's degree program of "Master on Physical sciences" of UNAM (2015).

Publications

- Pauli component erasing quantum channels. Jose Alfredo de Leon, Alejandro Fonseca, François Leyvraz, David Davalos, and Carlos Pineda. Published: Phys. Rev. A 106, 042604 (2022).
- Fuzzy measurements and coarse graining in quantum many-body systems. Carlos Pineda, David Davalos, Carlos Viviescas, and Antonio Rosado. Published: Phys. Rev. A 104, 042218 (2021).
- Position representation of single-mode Gaussian channels beyond the Gaussian functional form. David Davalos, Camilo Moreno, Juan-Diego Urbina and Carlos Pineda. Published: J. Phys. A: Math. Theor. 53 (2020) 425304.
- Divisibility of qubit channels and dynamical maps. David Davalos, Mario Ziman and Carlos Pineda. Published: *Quantum 3, 144 (2019).*
- Positivity and complete positivity of differentiable quantum processes. Gustavo Montes Cabrera, David Davalos and Thomas Gorin. Published: *Phys. Lett. A 383, 23 (2019).*
- Quantum non-markovianity and localization. David Davalos and Carlos Pineda. Published: *Phys. Rev. A 96, 062127 (2017).*
- Measuring and using non-markovianity. Carlos Pineda, Thomas Gorin, David Davalos, Diego A. Wisniacki and Ignacio Garcia-Mata. Published: *Phys. Rev. A 93, 022117 (2016).*

Preprints

- Quantum dynamics is not strictly bidivisible David Davalos and Mario Ziman. *arXiv:2203.13451v2 [quant-ph]*. Status: under consideration in *Physics Review Letters.*

Graduate Research experience

- **Research Center for Quantum Information (RCQI), Slovak Academy of Sciences, Bratislava, Slovakia**
  Six visits from 2015 to the present date.
  Ongoing collaboration with Dr. Mario Ziman. Currently it is being devoted to the investigation of structural questions on quantum channels and to quantum networks.
- **Institute für Theoretische Physik, Regensburg, Germany**
  September of 2016, April of 2017 and March of 2018.
  Collaboration with Dr. Juan Diego Urbina. It was devoted for the research on continuous variable quantum systems.
- **Departamento de Física "J. J. Giambiagi", University of Buenos Aires, Argentina; Instituto de Investigaciones Físicas de Mar del Plata, Mar del Plata, Argentina**
  April of 2015.
  Collaboration with Dr. Diego Wisniacki and Dr. Ignacio García Mata. It was devoted to research new and meaningful ways to measure quantum information flux from the environment of quantum systems to the central system.
- Research visit/Talk at the **Moscow Institute of Physics and Technology (State University)** for collaboration with Dr. Sergey Filippov. Given the talk titled "Divisibility of quantum channels and entanglement breaking". Dolgoprudny, Moscow Region, Russia, November 12th-23th of 2018.
- Research visit at **Universität Wien** under the supervision of Dr. Carlos Pineda. Vienna, Austria, February 14th-24th of 2018 .
- Research visit/Talk at the **Physikalisches Institut, Albert-Ludwigs Universität Freiburg**, under the supervision of Prof. Dr. Andreas Buchleitner. Given the talk titled "Measuring and using non-markovianity". Freiburg, Germany, October 5th-30th of 2015.

Teaching experience

At the Research Center for Quantum Information Slovak Academy of Sciences (SAV):

- Lecturer of the minicourse "Toolbox for quantum channels and their decompositions and simulability using dynamical maps.", May of 2021. This was given for PhD students and postdocs.

At the National Autonomous University of Mexico (UNAM):

- Lecturer of "Quantum Mechanics", First semester of 2020.
- Lecturer assistant of "Introduction to quantum physics", Second semester of 2019.
- Lecturer assistant of "Selected topics of mathematical and theoretical physics III", First semester of 2019.
- Lecturer of "Computational physics", second semester of 2017.
- Lecturer assistant of "Selected topics of mathematical and theoretical physics II", Second semester of 2016.
- Lecturer assistant of "Selected topics of mathematical and theoretical physics III", Second semester of 2015.
- Lecturer assistant of "Selected topics of mathematical and theoretical phsycis II", First semester 2015.
- Lecturer assistant of "Selected topics of mathematical and theoretical phsycis I", First semester of 2014.

Organization of scientific activities

- *Classical and Quantum Dynamics of Complex Systems and Applications*, (via zoom) March 22nd - April 1st, 2021. Click to jump to the webpage.

Recent attendance to conferences, given talks and posters

- Conference *Quantum Information and Probability: from Foundations to Engineering (QIP22)* at Linnaeus University, Växjö, Sweden. June 14th-17th of 2022. Presented the talk titled "Quantum dynamics is not strictly bidivisible".
- Conference/Meeting of the *Division of Quantum Information of the Mexican Academy of Sciences (DICU)* at Puebla, Puebla, Mexico, September 4th-6th of 2019. Presented the talk titled "Divisibility of qubit channels and dynamical maps".
- Conference/Meeting *QMath2019* at Aarhus, Denmark, August 12th-16th 2019. Presented the poster titled "Divisibility of quantum channels".
- Conference/poster: *Quantum Optics IX* at Cartagena, Colombia, October 21th-27th of 2018. Presented the poster titled "Characterization of singular Gaussian quantum channels".
- Conference/Talk: *Statistical techniques for correlation analysis: Quantum Many-Body Systems and more* at Cuernavaca, Mexico, July 8th to August 4th of 2018. Presented the talk titled "Divisibilidad de canales cuánticos, markovianidad y entrelazamiento".

Academic references

- Mario Ziman
  Research Center for Quantum Information, Slovak Academy of Sciences.
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