

Adonai R. da Cruz
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EDUCATION

- 2017 – 2022 **Ph.D. in Physics**
Department of Applied Physics, Eindhoven University of Technology,
Netherlands
Advisor: Dr. Michael Flatté;
Thesis: “*Theory of nanoscale currents and effects from spin-orbit coupling in semiconductors*”
- 2015 - 2017 **Ms.C. in Physics**
Institute of Physics of Sao Carlos, University of Sao Paulo, Brazil
Advisor: Dr. Carlos Egues;
Thesis: “*Fusing Majorana modes in quantum dots*”
- 2009 – 2013 **B.S. in Physics**
Department of Physics, Federal University of Mato Grosso do Sul, Brazil
“*Computational modelling of non-linear electrical lattices*”

TEACHING & ADVISING EXPERIENCE

- Open Quantum Initiative Mentoring** 2023
- *Chicago Quantum Exchange*
 - The program offers undergraduate students the opportunity to gain research experiences working in a quantum science laboratory or research group.
 - Instructed and trained undergrad interns in quantum physics and simulation software.
- Master’s Thesis Co-Advisor** 2020-2021
- *Department of Applied Physics, Eindhoven University of Technology*
 - Co-advised Niels R.S. van Venrooij in his master thesis project entitled “Theoretical study of the impact of etch pits on the exchange splitting in *InAs/InP* quantum dots.”
- Physics Teaching Assistant** 2018 - 2020
Department of Applied Physics, Eindhoven University of Technology
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| <u>Course:</u> | <u>Semester:</u> |
| Applied natural sciences conceptual (3NAB0) | SP20 |
| Introductory conceptual Applied Physics for bachelors. | |
| Signals and Systems (3BYX0) | FA18, SP19 |
| DBL (design-based learning) group assignment in systems and control. | |

RESEARCH EXPERIENCE

Postdoctoral Research Scholar

2023 – Present

Department of Physics, University of Iowa

- Experience with multiple theoretical formalisms: density functional theory, tight-binding, stochastic master equations and multiple-scattering Green's functions.
- Modeling electronic structure and spin-dependent transport in semiconductors and device structures. Skilled in C++ and Python programming for scientific calculations and visualization including for density-matrix evolutions and electric-field-induced spin dynamics.

Principal Scientist

2022 - 2023

QuantCAD, LLC

- Responsible for research, project supervision and grant writing
- Principal investigator on two NASA SBIR grants (Phase I and Phase II) to develop all-electrical quantum sensors for magnetic field.
- Principal investigator on DARPA award "MagHITS" to develop high-temperature (500C) magnetic field sensors.
- Development of Lindblad density-matrix solvers on top of QuTiP for simulating the dynamics of open quantum systems. Incorporated Monte Carlo device simulation and calculations of spin dephasing and decoherence of NV-center sensors varying environmental conditions.

GRANTS & AWARDS

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|---|-----------|
| • DARPA Magnetic High Temperature Sensors (MagHITS) | 2023 |
| • NASA SBIR Phase I | 2023 |
| • NASA SBIR Phase II | 2022 |
| • Marie Skłodowska-Curie PhD Fellowship (4PHOTON ITN) | 2017-2022 |

PUBLICATIONS

A.R. Da Cruz, and M.E. Flatté. Dissipationless Circulating Currents and Fringe Magnetic Fields Near a Single Spin Embedded in a Two-Dimensional Electron Gas. *Physical Review Letters*, **131**, 086301. (2023)

N. R. S. van Venrooij, **A. R. da Cruz**, R. S. R. Gajjella, and P. M. Koenraad, C. E. Pryor, M.E. Flatté. Fine Structure Splitting Cancellation in Highly Asymmetric InAs/InP Droplet Epitaxy Quantum Dots. *arXiv:2309.15062*. Currently Under Review. (2023)

S.E. Ter Huurne, **A.R. Da Cruz**, N. Van Hoof, and R. H. Godiksen, S.A. Elrafei, A. G. Curto, M. E. Flatté, J. G. Rivas. High-Frequency Sheet Conductance of Nanolayered WS₂ Crystals for Two-Dimensional Nanodevices. *ACS Applied Nano Materials*, **5** 10 15557-15562. (2022)

R.S. Gajjela , N. R. S. Van Venrooij , **A.R. da Cruz** , and J. Skiba-Szymanska, R.M. Stevenson, A. J. Shields, C. E. Pryor, P. M. Koenraad. Study of Size, Shape, and Etch Pit Formation in InAs/InP Droplet Epitaxy Quantum Dots. *Nanotechnology*, **33** 30 305705. (2022)

C.M. Krammel , **A.R. Da Cruz** , M.E Flatté , and M. Roy, P.A. Maksym, L.Y. Zhang, K. Wang, Y.Y Li, S.M. Wang, P.M Koenraad. Probing the Local Electronic Structure of Isovalent Bi Atoms in InP. *Physical Review B*. **101** 2 024113. (2020)

CONFERENCE PRESENTATIONS

- (invited) **SPIE Optics + Photonics**, A.R. Da Cruz, Dissipationless circulating currents and fringe magnetic fields near a spin embedded in a 2DEG, San Diego, CA, United States (2022).
- **Les Houches School of Physics on Green's functions**. A.R. da Cruz, Circulating currents and magnetic fields near a single spin embedded in a 2DEG. Les Houches, France (2021).
- **APS March Meeting 2021**, A.R. da Cruz and M.E. Flatté. Nanoscale features of magnetic dopants in 2D systems with spin-orbit interaction. Online (2021).
- **MRS Fall Meeting 2021**, A.R. da Cruz and M.E. Flatté. Circulating currents and magnetic fields near a single spin embedded in a two-dimensional gas. Boston, United States (2021).
- **4PHOTHON Workshop at Attocube A.G.**, A.R. da Cruz. Theory of nanoscale control of quantum nanostructures. Munich, Germany (2019)
- **SpintechX 2019**, A.R. da Cruz and M.E. Flatté. Theory of the circulating current of a single magnetic impurity in a semiconductor. Chicago, United States (2019).
- **APS March Meeting 2019**, A.R. da Cruz and M.E. Flatté. Nanoscale structure of the orbital magnetic moment of a single dopant spin in a semiconductor. Online (2019).
- **4PHOTHON Workshop Quantum Optical Devices and Circuits**, A.R. da Cruz. Theory of nanoscale control of quantum nanostructures, Eindhoven, The Netherlands (2018).
- **APS March Meeting 2018**, A.R. da Cruz and M.E. Flatté. Nanoscale structure of the orbital magnetic moment of a single dopant spin in a semiconductor. Online (2018).
- **47th International School and Conference on the Physics of Semiconductors - Jaszowiec**, A.R. da Cruz and M.E. Flatté. Single isovalent impurity calculations: Bi in InP. Szczyrk, Poland (2018).
- **4PHOTHON School Introduction to Quantum Information**, A.R. da Cruz. Theory of nanoscale control of quantum nanostructures. Basel, Switzerland (2018)