



**Universiteit
Leiden**
The Netherlands

Electrical and magnetic properties of ferritin: electron transport phenomena and electron paramagnetic resonance

Labra Muñoz, J.A.

Citation

Labra Muñoz, J. A. (2023, September 26). *Electrical and magnetic properties of ferritin: electron transport phenomena and electron paramagnetic resonance*. *Casimir PhD Series*. Retrieved from <https://hdl.handle.net/1887/3641953>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/3641953>

Note: To cite this publication please use the final published version (if applicable).

ACKNOWLEDGEMENTS

First, I would like to thank my promotors and supervisors Martina Huber and Herre van der Zant. **Martina**, thanks for offering me the job, for training me in all of the different EPR setups, and for providing feedback and guidance on how to learn about EPR, from which I had no previous experience. **Herre**, I thank you for giving me the freedom and responsibility in taking care of my projects since I was a master's student, for pushing me to work harder and do better, and for always being so simple and accessible, providing all kinds of crazy creative ideas.

My dissertation could not have been accomplished without the help of the staff of both universities: **Henriette** van Leeuwen (Leiden), **Yvonne** Kerkhof (Leiden), **Barry** Cats - Houdijk (Leiden), **Karin** Wilhelm (Delft), and **Ety** van der Leij (Delft). Thank you all for facilitating the paperwork related to my Ph.D. and for your assistance during these 4 years.

I want to give a special thanks to **Peter** Gast for your openness and natural talent to teach, I treasure how much you support me at the beginning of my Ph.D. and for your very much appreciated joviality! In addition, thanks **Jos** Disselhorst, **René** Overgaww, and **Harry** Visser for helping every single time we had problems with the setups. **Harmen** van der Meer, you saved us every time a waveguide or any crucial component in the EPR setups was broken. In the lab, thanks to **Lionel** Ndamba for always being willing to help and contribute in any possible form.

Another special thanks is given to **Eugene** Straver, for always helping me in my clean-room work. But especially, thanks for your kindness since my master time, I appreciate that very much. I also extend my acknowledgments for the clean room support to **Bas** van Asten, **Marinus** Fischer, **Anja** van Langen-Suurling, **Charles** de Boer, **Ewan** Hendriks, **Lodi** Schriek, and **Marc** Zuiddam.

To our collaborators, **Lucia** Bossoni, thank you for all of your feedback and creative ideas and for bringing a really proactive spirit to our work. Also, for facilitating samples and procedures that were needed in our project. **Ramon** Egli, thank you for accepting to be part of our ferritin-magnetic journey, your contributions are remarkable and with no doubt, I can say you brought our work to the next level. **Elene** Vroegindewei and **Janneke** Langendonk, thank you both for sharing your precious brain samples and knowledge with us. **Maria** Fittipaldi, thank you for the helpful scientific discussions.

Next, I would like to thank the van der Zant (Delft) and MoNOS (Leiden) labs members as well. **Tristan** and **Sebastiaan**, thank you for your friendship, your advice, and support in the difficult times, also, thanks for the very much-needed fancy coffee breaks. **Damian** and **Chunwei**, thank you both for your assistance in mounting the electronics

and your help with the setups for my experiments. Also, thanks for our interesting scientific discussions. **Sergii**, I was honored to be at your wedding, thank you for sharing that part of your life with me, you are an incredibly kind person. **Talieh** and **Joseph**, we couldn't have asked for better postdocs! Thank you both for your contributions to the van der Zant lab. **Jasper** and **Thomas** I really enjoyed our conversations at the group outings. I got to know you more and found out you are really fun people! **Luca**, I enjoyed our coffees, thank you for your help with the dissertation bureaucracy. **Maurits** and **Samuel**, our time together has been brief but enough to see how engaged you are with work, I have no doubt you will succeed! **Leonardo**, you are my only colleague from Huber's lab, thank you for our conversations, I appreciate them very much. **Jacco**, thank you for your friendship and support! **Nasrin** and **Zohre** thank you for the time we spent as office mates, you are both kind and honest women. **Subhasis** and **Deep**, thank you both for your advice, even though you were not my postdocs you were always willing to help. **Robert**, thank you for your patience and for never complaining about our struggles with the helium! **Priyanshi**, thank you for bringing up the group spirit with outside trips.

I thank my master students Vera, Arie, and Friso. **Vera** (Leiden), you are a bright student and person. Thank you for your contributions to the ferritin work, but more importantly, thank you for our friendship. **Arie** (Delft), you are a rockstar! thanks for bringing the ferritin devices to the next level. **Friso** (Delft), thank you for your joyfulness.

6

Also important to acknowledge are the people that had an impact on my research life before my Ph.D. studies. **Diana**, thanks to you I ended up in nanoelectronics. Thank you for all the opportunities you gave me, for your advice, and for forcing me to become independent. **Sabina**, during my master, without you, it would have taken me infinite time to learn about the design of devices and in general, clean room work, thank you for that, but also, thank you for your friendship!

Finally, I want to thank my family. Aunt Alicia, thank you for all of the advice concerning life as a researcher. Thanks, Daddy, you couldn't be here to see this moment, but I am sure you would have been proud. Mommy and Daddy, I owe you everything I am today, thanks both for supporting me unconditionally. Fabian, my love, thank you for reminding me every day that I am capable of doing this and more.

CURRICULUM VITÆ

Jacqueline Andrea LABRA MUÑOZ

03-Oct-1992 Born in Santiago, Chile.

EDUCATION

2007–2010

High School

Colegio Josefino Santísima Trinidad
Santiago, Chile

2012–2016

Bachelor of Science in Electrical Engineering (Graduated with honours)
University of Chile, Santiago, Chile

2013–2018

Electrical Engineer (*Suma cum laude*)

University of Chile, Santiago, Chile

Thesis: -Electrical characterization of protein networks and
inorganic nanoparticles

Advisors: -Prof. dr. D. Dulić
-Prof. dr. ir. H.S.J van der Zant

2016–2018

Master of Science in Electrical Engineering (*Suma cum laude*)

University of Chile, Santiago, Chile

Thesis: -Electrical characterization of protein networks and
inorganic nanoparticles

Advisors: -Prof. dr. D. Dulić
-Prof. dr. ir. H.S.J van der Zant

2017–2018

Guest researcher

Quantum Nanoscience department
Delft University of Technology, Delft, the Netherlands

2019–2023

Ph.D. in Physics

Leiden University / Delft University of Technology, Delft, the Netherlands

Thesis: -Electrical and Magnetic Properties of Ferritin: Elec-
tron Transport Phenomena and Electron Paramag-
netic Resonance

Promotors: -dr. M. Huber
-Prof. dr. ir. H.S.J van der Zant

LIST OF PUBLICATIONS

7. **J. A. Labra-Muñoz***, L. Bossoni*, H. S. J. van der Zant, V. Čaluković, A. Lefering, R. Egli, M. Huber. *In-depth magnetometry and EPR analysis of the spin structure of human-liver ferritin: from DC to 9 GHz*. Phys. Chem. Chem. Phys., accepted for publication.
6. **J. A. Labra-Muñoz**, A. de Reuver, F. Koeleman, M. Huber, H. S. J. van der Zant. *Ferritin-based single-electron devices*. *Biomolecules* **12**, 132 (2022).
5. E. Vroegindeweij, L. Bossoni, A. Boon, J. Wilson, M. Bulk, **J. Labra-Muñoz**, M. Huber, A. Webb, L. van der Weerd, J. Langendonk. *Quantification of different iron forms in the aceruloplasminemia brain to explore iron-related neurodegeneration*. *NeuroImage: Clinical* **30**, 102657 (2021).
4. D. Dulic, A. Rates, E. Castro, **J. Labra-Muñoz**, D. Aravena, A. Etcheverry-Berrios, D. Riba-Lopez, E. Ruiz, N. Aliaga-Alcalde, M. Soler, L. Echegoyen, H. S. J. van der Zant. *Single-Molecule Transport of Fullerene-Based Curcuminoids*. *J. Phys. Chem. C* **124**, 2698 (2020).
3. **J. A. Labra Muñoz**, Z. Konstantinović, L. Balcells, A. Pomar, H.S.J van der Zant, D. Dulić. *Trapping and electrical characterization of single core/shell iron-based nanoparticles in self-aligned nanogaps*. *Applied Physics Letters* **115**, 063104 (2019).
2. D. Stefani, M. Perrin, C. Gutiérrez-Cerón, A. C. Aragonès, **J. A. Labra Muñoz**, R. D. C. Carasco, Y. Matsushita, Z. Futera, J. Labuta, T. H. Ngo, K. Ariga, I. Díez-Pérez, H. S. J. van der Zant, D. Dulić, J. P. Hill. *Mechanical Tuning of Through-Molecule Conductance in a Conjugated Calix[4]pyrrole*. *Chemistry Select* **3**, 6473 (2018).
1. D. Stefani, C. A. Gutiérrez-Cerón, D. Aravena, **J. A. Labra Muñoz**, C. Suarez, S. Lui, M. Soler, L. Echegoyen, H. S. J. van der Zant, D. Dulić. *Charge Transport through a Single Molecule of trans-1-bis-Diazofluorene [60]fullerene*. *Chemistry of Materials* **29**, 7305 (2017).