

Marina Gomes Rachid

Leiden – The Netherlands

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ID 0000-0001-5874-1838 • R⁺ Marina-Gomes-Rachid

Experience

University of Amsterdam (UvA)

Amsterdam, the Netherlands

Postdoctoral researcher

04/2023–current

- Design and testing a device to measure the ultraviolet spectrum and diffusion properties of molecules and nanoparticles
- Planning and performing laboratory experiments with samples from different laboratories
- Modeling diffusion of molecules in nanoparticles in different solvents
- Assessment of potential customers' needs
- Pipeline development (Python and Matlab)

Education

Laboratory for Astrophysics - Leiden University

Leiden, The Netherlands

Ph.D. candidate

09/2018–05/2023

Promotors: Prof. dr. Harold Linnartz and Prof. dr. Ewine van Dishoeck

- Development of an ultra-high vacuum system to grow solid samples at cryogenic temperatures
- Fourier Transform InfraRed (FTIR) spectroscopy of thin films containing organic molecules ($4000 - 500 \text{ cm}^{-1}$)
- Ultraviolet-visible refractive index of solid samples
- Mass spectroscopy measurements using a Quadrupole Mass Spectrometer
- Characterization of morphological changes in frozen H_2O , CO , CO_2 , N_2 , and CH_3OH using optical interference
- Pipeline development for automating the spectral data analysis
- Interpretation of astronomical infrared observations of interstellar ice using laboratory data
- Part of the Leiden Ice Database team, led by Dr. Will Rocha
- Part of the Ice Age JWST ERS team (PI: Dr. Melissa McClure)

University of Vale do Paraíba

São Jose dos Campos, Brazil

Master in Physics and Astronomy

09/2016–08/2018

Supervisor: Prof. dr. Sergio Pilling

- Mid-infrared characterization of thin films containing H_2O , CO_2 , CH_4 , and NH_3 irradiated with oxygen ions
- Mid-infrared characterization of thin films containing acetic acid and glycolaldehyde irradiated with soft X-rays

University of São Paulo

São Paulo, Brazil

Bachelor in Physics

02/2012–02/2016

Bachelor project: Determination of spectral signatures of biomolecules essential to life

Supervisor: Prof. dr. Eduardo Janot Pacheco

University of São Paulo

São Carlos, Brazil

Bachelor in Chemistry

02/2008–12/2011

Bachelor project: Study of the electronic structure of diatomic systems containing elements from groups 14 and 16

Supervisor: Prof. dr. Roberto Luiz Andrade Haiduke

Internships

GANIL (Grand Accélérateur National d'Ions Lourds)

Caen, France

09/2017–03/2018

Project title: Processing of warm ices by low energy ions: Probing the effects of solar wind and low energy magnetospheric ions on frozen solar system bodies

Supervisor: Prof. dr. Phillipe Boduch

Leiden Observatory

Leiden, the Netherlands

LEAPS Summer School 2017

06/2017–08/2017

Project title: Characterizing the largest interstellar molecules

Supervisor: Dr. Alessandra Candian

Awards and grants

Humboldt fellowship

Germany

"Unveiling the interstellar sulfur chemistry"

2023

Awarded with the prestigious Humboldt fellowship to perform experimental research at the Max Plank Institute for Astrophysics, in Heidelberg. The project focuses on studying the sulfur chemistry of surfaces under cryogenic and vacuum conditions that simulate interstellar environments

Young Research Awards for outstanding research

Katwijk, The Netherlands

"Processing of cometary surface by swift ions"

12/2017

Poster presentation in the 51st Eslab Symposium "Extreme Habitable Worlds" - ESA

FAPESP scholarship for internship abroad of Brazil

Caen, France

Prestigious scholarship awarded for developing research projects outside of Brazil

09/2017-03/2018

Full project description

FAPESP fellowship master students

S J dos Campos, Brazil

Prestigious scholarship awarded to master research projects in the State of São Paulo

09/2016-08/2018

Full project description (in Portuguese)

FAPESP fellowship for undergraduate students

São Paulo, Brazil

Prestigious scholarship awarded to bachelor research projects in the State of São Paulo

08/2014-07/2015

Full project description (in Portuguese)

Observing programs

Co-I of the JWST Cycle 1 GO program: It's COMplicated: Disentangling the formation pathways of complex organic molecules from molecular clouds to comets, 1854, 17.7 hours, PI: Prof. dr. Melissa McClure.

Teaching experience

Leiden University

Teaching assistant of several courses of Experimental Optics & Electromagnetism

2020–2022

Students supervision

- "Wavelength dependent refractive index measurements of CO₂ ice in the UV-vis regime", **Thesis for Bachelor of Science in Astronomy, 2022**, Rastko Hadži-Cenić.
- "Preparing for JWST: the infrared spectrum of frozen glycolaldehyde", **Thesis for Bachelor of Science in Astronomy, 2021**, Casper Spijker.
- "Wavelength dependent refractive index measurements of interstellar ice analogs", **Thesis for the graduation internship - The Hague University of Applied Sciences, 2020**, Pien Vinke.
- "High-resolution infrared spectroscopy of interstellar ice analogs", **Thesis for Bachelor of Science in Astronomy, 2019**, Dani de Boe & Nashanty Brunken.

Computer skills

- Programming languages: Python
- Microsoft Office
- Labview (basic)
- Origin
- Linux
- L^AT_EX

Languages

- Portuguese - Mother tongue
- English - Fluent
- Spanish - Advanced
- Dutch - Intermediate
- French - Basic

Selected conference attendance and presentations

- "Laboratory Spectroscopy of Organic Molecules in the JWST era" Poster presentation - CNRS Thematic School - Laboratory Astrophysics: Tracking the Evolution of Cosmic Matter towards Molecular Complexity - Les Houches, France 2023

- “From laboratory to space: JWST observations of interstellar ices” – Oral presentation - European Science Open Forum (ESOF) - Leiden, The Netherlands 2022
- “Providing essential laboratory data to detect complex organic molecules in JWST observations of interstellar ices” - Oral presentation - European Astronomical Society (EAS) - Valencia, Spain 2022
- “Infrared spectra of methylamine in astronomically relevant ice mixtures” - Poster presentation - European Conference on Laboratory Astrophysics (ECLA) – Anacapri - Italy, 2021.
- “Laboratory data in support of JWST observations of interstellar ices” - Poster presentation at Torun Astrophysics, Spectroscopy, and Quantum Chemistry School (TASQ), Torun – Poland, 2019. **Awarded with a full sponsor for attendance)**
- “Laboratory data in support of JWST observations of interstellar ices” - Poster presentation - IAU Symposium S350— Laboratory Astrophysics: From observations to interpretation - Cambridge, UK, 2019.
- “Processing of cometary surface by swift ions”, poster presentation in 51st EsLab Symposium “Extreme Habitable Worlds”, European Space Agency ESA/ESTEC - The Netherlands, 2017 .
- “Destruction of C₂H₄O₂ isomers in ice-phase by X-rays and implication on their abundance in the ISM”, Oral presentation in AbGradCon - 2017- Charlottesville – USA, 2017. **Awarded with a full sponsor for attendance)**
- “Destruction of C₂H₄O₂ isomers in ice-phase by x-rays and implication on their abundance in the ISM”, poster presentation at IAU Symposia 332: Astrochemistry VII – Through the Cosmos from Galaxies to Planets, Puerto Varas, Chile, 2017. **(Awarded with a partial sponsor for attendance)**
- “Processing of Cometary Surfaces by Swift Ions”, Poster presentation - ESA Conference “Ices in the Solar System”, Madrid - Spain - 2017. **(Awarded with a partial sponsor for attendance)**
- “Peering on biomolecules spectral fingerprints with FRACS”, Poster presentation - First Astrobiology School at Observatório Nacional- Rio de Janeiro, Brazil - 2014
- “Semi classical orbits and antidots lattices in Hall systems” - Oral presentation - 22^o International symposium of undergraduate research at USP - 2014

Publications

- Rocha W., **Rachid, M. G.**, McClure, M., He, J., & Linnartz, H., (2023) Water ice: temperature-dependent refractive indexes and their astrophysical implications, *Astronomy & Astrophysics*, accepted.
- Slavicinska, K., **Rachid, M. G.**, Rocha, W., Chuang, K.-J, van Dishoeck, E.F. & Linnartz, H., (2023) The hunt for formamide in interstellar ices: A toolkit of laboratory infrared spectra in astronomically relevant ice mixtures and comparisons to ISO, Spitzer, and JWST observations, *Astrochemistry, Astronomy & Astrophysics*, accepted.
- Y. Chen, M. L. van Gelder, P. Nazari, C. L. Brogan, E. F. van Dishoeck, H. Linnartz, J. K. Jørgensen, T. R. Hunter, O. H. Wilkins, G. A. Blake, P. Caselli, K.-J. Chuang, C. Codella, I. Cooke, M. N. Drozdovskaya, R. T. Garrod, S. Ioppolo, M. Jin, B. M. Kulterer, N. F. W. Ligterink, A. Lipnicky, R. Loomis, **M. G. Rachid**, S. Spezzano, B. A. McGuire (2023), CoCCoA: Complex Chemistry in hot Cores with ALMA. Selected oxygen-bearing species, *Astronomy & Astrophysics*, accepted.
- McClure, M., Rocha, W.R.M., Pontoppidan, K., Crouzet, N., Chu, L., Dartois, E., Lamberts, T., Noble, J., Pendleton, Y., Perotti, G., Qasim, D., **Rachid, M. G.**, et al., (2023) An Ice Age JWST inventory of dense molecular cloud ices. *Nature Astronomy*, 1-13
- Rocha, W., **Rachid, M. G.**, B. Olsthoorn, E. F. van Dishoeck, M. K. McClure, H. Linnartz (2022). LIDA - The Leiden Ice Database for Astrochemistry, *Astronomy & Astrophysics*, 668, A63.
- **Rachid, M. G.**, Rocha W., Linnartz, H., (2022). Infrared spectra of complex organic molecules in astronomically relevant ice mixtures - V. Methyl cyanide (acetonitrile), *Astronomy & Astrophysics*, 665, A89.
- He, J., Diamant, S. J., Wang, S., Yu, H., Rocha, W. R., **Rachid, M. G.**, & Linnartz, H. (2022). Refractive Index and Extinction Coefficient of Vapor-deposited Water Ice in the UV–Vis Range. *The Astrophysical Journal*, 925(2), 179.
- **Rachid, M. G.**, Brunken, N., De Boe, D., Fedoseev, G., Boogert, A. C. A., & Linnartz, H. (2021). Infrared spectra of complex organic molecules in astronomically relevant ice mixtures - IV. Methylamine. *Astronomy & Astrophysics*, 653, A116.
- **Rachid, M. G.**, van Scheltinga, J. T., Koletzki, D., & Linnartz, H. (2020). Infrared spectra of complex organic molecules in astronomically relevant ice mixtures - II. Acetone. *Astronomy & Astrophysics*, 639, A4.
- **Rachid, M. G.**, Pilling, S., Rocha, W. R. M., Agnihotri, A., Rothard, H., & Boduch, P. (2020). Processing of 72-K water-rich ices by keV and MeV oxygen ions: implications for the Saturnian moon Enceladus. *Monthly Notices of the Royal Astronomical Society*, 494(2), 2396-2409.

- Candian, A., **Gomes Rachid, M.**, Maclsaac, H., Staroverov, V. N., Peeters, E., & Cami, J. (2019). Searching for stable fullerenes in space with computational chemistry. *Monthly Notices of the Royal Astronomical Society*, 485(1), 1137-1146.
- **Rachid, M. G.**, Faquine, K., & Pilling, S. (2017). Destruction of C₂H₄O₂ isomers in ice-phase by X-rays: Implication on the abundance of acetic acid and methyl formate in the interstellar medium. *Planetary and Space Science*, 149, 83-93.
- Terrabuio, L. A., Teodoro, T. Q., **Rachid, M. G.** & Haiduke, R. L. (2013). Systematic theoretical study of non-nuclear electron density maxima in some diatomic molecules. *The Journal of Physical Chemistry A*, 117(40), 10489-10496.

Other activities

Organization of the Ph.D. seminars at the Leiden Observatory, 2019.

Talks to the general public at the Observatory of Universidade do Vale do Paraíba - São José dos Campos - SP, Brazil, 02/2017 - 08/2017.

References

The following faculty members and collaborators can attest to my professional experience:

- Prof. dr. Harold Linnartz - Head of the Laboratory for Astrophysics at Leiden University - Leiden, the Netherlands.
- Dr. Jiao He - Head of the Origins of Life laboratory at Max Planck Institute for Astronomy - Heidelberg, Germany.
- Dr. Danna Qasim - Research Scientist Space Science at Southwest Research Institute - San Antonio - Texas, United States.
- Dr. Will Rocha - Postdoc at Leiden Observatory - Leiden University - Leiden, the Netherlands.