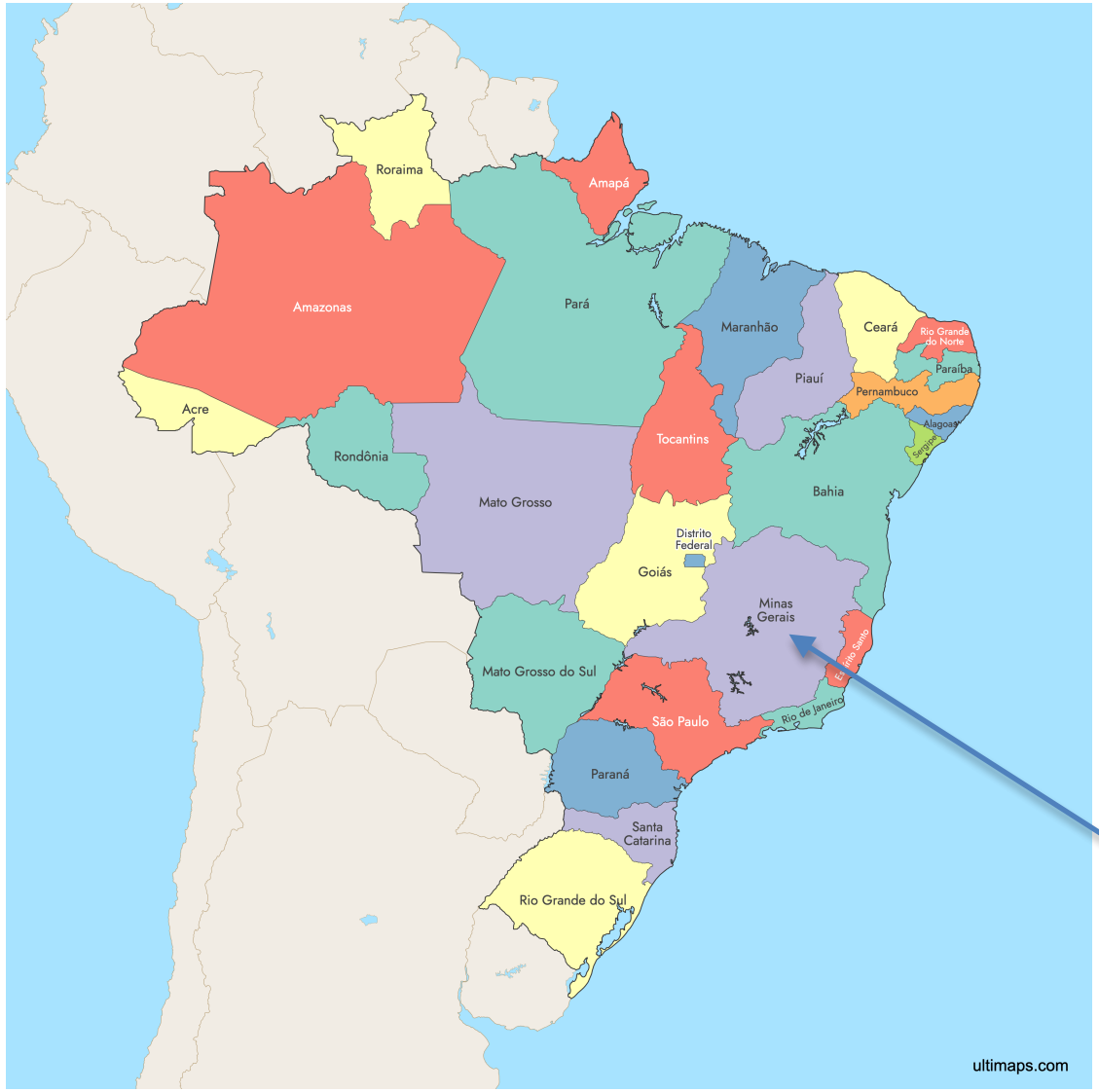
Rafael Mendes Francisco

Postdoctoral Researcher

Journée Nouveaux Entrants
2026

Country: Brazil
State: Minas Gerais (MG)
City: Varginha

Varginha is known as the “Princess of Coffee” and is famous for an alleged UFO/alien sighting in 1996.



MG

Academic Journey

2008-2012

Bachelor's Degree in Mechanical Engineering

Young Talents Program, Phillips Walita

(Full tuition coverage)

Southern Minas Gerais University Center (MG). Brazil

2013–2016: High School Teacher and Musician

2017–2019

Master's — Physics and Chemistry of Materials

Ashkin–Teller Model Applied to a Two-Layer Hexagonal Nanotube

Universidade Federal de São João del-Rei Advisor: Dr. Jander Pereira dos Santos

Academic Journey

2019–2023

PhD — Physics and Chemistry of Materials (Theoretical Physics)

New Identity of Effective Field Theory for the Study of Phase Transitions in Semi-Classical Spin Models

Universidade Federal de São João del-Rei Advisor: Dr. Jander Pereira dos Santos

2023–now

Postdoctoral Researcher — Quantum Few-Body Physics

Discrete and continuous scale invariance in the quantum few-body problem

Instituto Tecnológico de Aeronáutica Supervisor: Dr. Tobias Frederico

One year on IJClab (2026 - 2027)

Postdoctoral Researcher (BEPE fellowship) — Quantum Few-Body Physics

Confined cold few-atoms and neutron-halo nuclei close to unitarity

Laboratoire de Physique des 2 Infinis Irène Joliot-Curie Supervisor: Dr. Guillaume Hupin

My current work on physics

Efimov Physics

For resonant two-body interactions, three-body systems can support a geometric tower of bound states with discrete scale invariance.

Feshbach resonances allow the interaction between ultracold atoms to be tuned experimentally.

Finite scattering length and finite-range effects introduce corrections to universal observables.

Non-integer Dimensions

Model dimensional crossover in trapped atomic systems through a continuously tunable effective spatial dimension.

Study how confinement modifies few-body spectra and universal scaling laws.

Mixtures

Atomic and molecular mixtures realize different interaction strengths.

Mass-imbalanced systems provide controlled settings to test universal few-body physics.

Extreme mass imbalance enhances Efimov effects and clarifies the role of mass asymmetry.

Halo-nuclei

Treat halo nuclei as few-body systems with a compact core and weakly bound valence nucleons.

Compute corrections due to non-universal scales such as finite scattering length, finite range, and separation energies.

Confinement-induced unatomic trimer states in mass-imbalanced systems, **R. M. Francisco**, D. S. Rosa, T. Frederico, G. Krein and M. T. Yamashita, Physical Review A 112 (3), 033315

Confinement-induced unatomic trimer states, DS Rosa, **RM Francisco**, T Frederico, G Krein, MT Yamashita, Physical Review A 110 (4), 042803

Two heavy impurities immersed in light few-boson systems with noninteger dimensions, **RM Francisco**, DS Rosa, T Frederico, Physical Review A 106 (6), 063305

My Project at IJCLab

Study the geometry of three-body systems under confinement using the noninteger-dimension method to mimic deformed atomic traps.

Analytically incorporate finite scattering length and effective range corrections for Efimov states with two-body contact interactions.

Propose a four-body halo model, where each particle pair occupies a distinct shell around the rigid core: establish the wave function and study its geometric properties, including inter-particle distances and opening angles.

♟ Chess

Always up for a match!

Animes

TV Series


MR. ROBOT


OZARK


NO SMOKING
DUNDER MIFFLIN
ALL HANDS MEETING
SATURDAY

Music

Vocalist · Guitarist · Composer

My solo album

Thank you!