Curriculum vitæ of Giada Franceschi, Ph.D.

Postdoctoral Researcher in Physics at the TU Wien, Vienna, Austria

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Inst. Appl. Phys., TU Wien, Wiedner Haupstr. 8-10/E134, 1040, Vienna (AT)

Research Interests and Areas of Expertise

Surface science of metal oxides (In_2O_3, Fe_2O_3, $SrTiO_3$, $La_{1-x}Sr_xMnO_3$) and aluminosilicates (muscovite mica, K-feldspars); atomically controlled growth of metal oxide thin films; mineral-water interactions; ice nucleation.

Ultra-high vacuum (UHV) based surface science methods, including scanning tunneling microscopy (STM), non-contact atomic force microscopy (nc-AFM), low-energy electron diffraction (LEED), X-ray photoelectron spectroscopy (XPS), low-energy ion scattering (LEIS).

Education and Employment

2021– Post-doc @ Inst. Appl. Phys., TU Wien (AT). Focus: Atomic-scale mineral-water interaction.

2020–2021 *(Covid)* Post-doc @ Dept. Phys, FU Berlin (DE) with Prof. Franke. Focus: Atomic-scale interplay between magnetism and superconductivity in 2D heterostructures.

2016–2020 Ph.D. in Physics (*with honors*) @ Inst. Appl. Phys., TU Wien (AT) with Prof. Diebold and Dr. Riva. Focus: Atomic-scale mechanisms ruling oxide pulsed laser deposition; atomic-scale details of complex oxide surfaces.

2017–2019 TU-D doctoral college @ TU Wien focused on low-dimensional materials.

2014–2016 M.Sc., Eng. Physics (Nanophysics and Nanotechnology) @ Politecnico di Milano (IT). *110/110 cum laude.* Thesis abroad @ Inst. Appl. Phys., TU Wien (AT).

2011–2014 B.Sc., Eng. Physics @ Politecnico di Milano (IT). *110/110*.

Grants and Honors

2023 Peter Varga Poster Prize at the 35th Symposium on Surface Science.

2021 Humboldt Research Fellowship for post-doc researchers with the proposal: "*Proximity effects in magnetic/superconducting 2D heterostructures*" (*not assumed*).

2020 Finalist for the Nottingham Prize at the Annual Physical Electronics Conference.

2020 Poster prize at the 12th International Workshop on Oxide Surfaces.

2016 Scholarship for Thesis abroad (offered by Politecnico di Milano, IT).

Publications

Total (since 2018): 25 publications (14 first author, 6 corresponding* author), incl. 3 book chapters.

Published:

25. G. Franceschi, M. Riva, M. Schmid, and U. Diebold,
Scanning Probe Microscopy
in "The World Scientific Materials Science Handbook of Thin Film Deposition by Molecular Beam Epitaxy: With Applications to Different Metals, Material Compounds and Groups", World Scientific Publishing (2023), *in press*
24. G. Franceschi*, A. Conti, L. Lezuo, R. Abart, F. Mittendorfer, M. Schmid, and U. Diebold
How water binds to microcline feldspar (001)
J. Phys. Chem. Lett. **15**, 15−22 (2024). Editor's choice
23. G. Franceschi*, R. Heller, M. Schmid, U. Diebold, and M. Riva,
Evolution of the surface atomic structure of multielement oxide films: curse or blessing?
Nanoscale Advances **5**, 7009−7017 (2023)
22. J. Redondo, J. Michalička, G. Franceschi, B. Šmid, N. Kumar, O. Man, M. Blatnik, D. Wrana, F. Kraushofer, B. Mallada, M. Švec, G. Parkinson, M. Setvin, M. Riva, U. Diebold, and J. Čechal,
Hematite α-Fe_2O_3(0001) in top and side view: resolving long-standing controversies about its surface structure
Adv. Mater. Interfaces 2300602 (2023)
21. S. M. Gericke, M. M. Kauppinen, M. Wagner, M. Riva, G. Franceschi, A. Posada-Borbon, L. Ramisch, S. Pfaff, E. Rheinfrank, A. M. Imre, A. B. Preobrajenski, S. Appelfeller, S. Blomberg, L. R. Merte, J. Zetterberg, U. Diebold, H. Gronbeck, and E. Lundgren
Effect of different In_2O_3(111) surface terminations on CO_2 adsorption
ACS Appl. Mater. Interfaces **15**, 45367−45377 (2023)
20. G. Franceschi*, S. Brandstetter, J. Balajka, J. Pavelec, I. Sokolovic, M. Setvin, M. Schmid, and U. Diebold,
Interaction of surface cations of cleaved mica with water in vapor and liquid form
Faraday Discussions (2023), *in press*
19. S. Trishin, C. Lotze, F. Lohss, G. Franceschi, L. I. Glazman, F. von Oppen, and K. J. Franke,
Tuning a two-impurity Kondo system by a moirè superstructure
Phys. Rev. Lett. **130**, 176201 (2023). Editor's suggestion
18. G. Franceschi, U. Diebold, and J. Balajka,
Atomic structure of oxide surfaces in aqueous environment
in Encyclopedia of Solid-Liquid Interfaces, Elsevier (2023)
17. G. Franceschi*, P. Kocan, A. Conti, S. Brandstetter, J. Balajka, I. Sokolovic, M. Valtiner, F. Mittendorfer, M. Schmid, M. Setvin, and U. Diebold,
Resolving the intrinsic short-range ordering of K^+ ions on cleaved muscovite mica
Nat. Commun. **14**, 208 (2023)
16. G. Franceschi* and U. Diebold
Oxide surfaces
in Encyclopedia of Materials: Electronics **1**, 501−511, Elsevier (2023)
15. H. Chen, M. Blatnik, C. Ritterhoff, I. Sokolovic, F. Mirabella, G. Franceschi, M. Riva, M. Schmid, J. Cechal, B. Meyer, U. Diebold, and M. Wagner,
Water structures reveal local hydrophobicity on the In_2O_3(111) surface
ACS Nano, 16, 21163 (2023)
14. G. Franceschi*, M. Schmid, U. Diebold, and M. Riva
Reconstruction changes drive surface diffusion and determine the flatness of oxide surfaces
J. Vac. Sci. Technol. A **40**, 023206 (2022). Editor's pick, AIP Scilight collection

13. F. Kraushofer, L. Haager, M. Eder, A. Rafsanjani-Abbasi, Z. Jakub, G. Franceschi, M. Riva, M. Meier, M. Schmid, U. Diebold, G. S. Parkinson
Single Rh adatoms stabilized on α-Fe_2O_3(1-102) by coadsorbed water
ACS Energy Lett. **7**, 375 (2021)
12. G. Franceschi, M. Schmid, U. Diebold, and M. Riva
Two-dimensional surface phase diagram of a multicomponent perovskite oxide: $La_{0.8}Sr_{0.2}MnO_3$(110)
Phys. Rev. Mater. **5**, L092401 (2021)
11. I. Sokolovic, G. Franceschi, Z. Wang, J. Xu, J. Pavelec, M. Riva, M. Schmid, U. Diebold, M. Setvin
Quest for a pristine unreconstructed $SrTiO_3$(001) surface: An atomically resolved study via noncontact atomic force microscopy
Phys. Rev. B **103**, L241406 (2021)
10. F. Kraushofer, N. Resch, M. Eder, A. Rafsanjani-Abbasi, S. Tobisch, Z. Jakub, G. Franceschi, M. Riva, M. Meier, M. Schmid, U. Diebold, G. S. Parkinson
Surface reduction state determines stabilization and incorporation of Rh on α-Fe_2O_3(1-102)
Adv. Mater. Interfaces **8**, 2001908 (2021)
9. G. Franceschi, M. Schmid, U. Diebold, and M. Riva
Atomically resolved surface phases of $La_{0.8}Sr_{0.2}MnO_3$(110) thin films
J. Mater. Chem. A **8**, 22947 (2020)
8. G. Franceschi,
Pulsed laser deposition of functional oxides with atomic scale control
Ph.D. dissertation (2020)
7. G. Franceschi, M. Schmid, U. Diebold, and M. Riva
Movable holder for a quartz crystal microbalance for exact growth rates in pulsed laser deposition
Rev. Sci. Instrum. **91**, 065003 (2020)
6. G. Franceschi, F. Kraushofer, M. Meier, G. Parkinson, M. Schmid, U. Diebold, and M. Riva
A model system for photocatalysis: Ti-doped single-crystalline Fe_2O_3(1-102) films
Chem. Mater. **32**, 3753 (2020)
5. G. Franceschi, M. Wagner, J. Hofinger, T. Krajnák, M. Schmid, U. Diebold, and M. Riva
Growth of In_2O_3(111) thin films with optimized surfaces
Phys. Rev. Mater. **3**, 103403 (2019)
4. M. Riva, G. Franceschi, M. Schmid, and U. Diebold
Epitaxial growth of complex oxide films: Role of surface reconstructions
Phys. Rev. Research **1**, 033059 (2019)
3. M. Riva, G. Franceschi, Q. Lu, M. Schmid, B. Yildiz, and U. Diebold
Pushing the detection of cation nonstoichiometry to the limit
Phys. Rev. Mater. **3**, 043802 (2019). Editor's pick
2. M. Riva, M. Kubicek, X. Hao, G. Franceschi, S. Gerhold, M. Schmid, H. Hutter, J. Fleig, C. Franchini, B. Yildiz, and U. Diebold
Influence of surface atomic structure demonstrated on oxygen incorporation mechanism at a model perovskite oxide
Nat. Commun. **9**, 3710 (2018)

Submitted:

1. J. Redondo, F. Ellinger, V. Gabriel, D. Wrana, M. Riva, G. Franceschi, E. Rheinfrank, I. Sokolovic, Z. Jakub, F. Kraushofer, A. Alexander, L. Patera, J. Repp, M. Schmid, U. Diebold, G. S. Parkinson, C. Franchini, M. Reticcioli, P. Kocan, M. Setvin
Real-space investigation of polarons in hematite Fe_2O_3

Presentations

Total (since 2017): 35 contributed talks and posters at (inter)national conferences, workshops, and scientific institutions, of which 9 invited.

Legend: *FOXSI: Functional Oxide Surfaces and Interfaces; DPG: Deutsche Physikalische Gesellschaft; ECOSS: European Conference on Surface Science; TU-D: Unravelling Advanced 2D Materials doctoral school; 3S: Symposium on Surface Science; IWOX: International Workshop on Oxide Surfaces; TACO: Taming Complexity in Materials Modeling; OPG: Österreische Physikalische Gesellschaft; GRC: Gordon Research Conference. ICSOS: International Conference on the Structure of Surfaces.*

2024

- IWOX-XIV, Schladming (AT). Invited talk: "How water anchors on K-feldspars"

2023

- Invited seminar @ Space Research Institute, Graz (AT): "**A**tomically resolved insights into the condensation of water on K-feldspars"
- Kick-off meeting ICEFELD (FWF project about feldspars and ice nucleation, joint between Uni Wien and KIT), Vienna (AT). Invited talk: "How water binds on defect-free K-feldspars"
- TACO conference, Vienna (AT). Poster: "Imaging feldspar microcline and the first stages of ice nucleation at the atomic scale"
- Faraday Discussions – Water at Interfaces (UK). Poster: "Imaging feldspar microcline and the first stages of ice nucleation at the atomic scale"
- ICSOS13, Badersee (DE). *Prize talk*: "Categorizing, tuning, and exploiting the structural richness of a complex oxide"
- DPG2023, Dresden (DE). Talk: "Atomic-scale imaging of muscovite mica and its interaction with water"
- 3S*23, Courmayeour (IT). Poster: "Atomic-scale insights on clean and water-exposed muscovite mica by nc-AFM". *Poster prize winner*
- 2023GRC Chemical Reactions at Surfaces, Lucca (IT). Poster: "Atomic scale imaging of common minerals and their interaction with water"
- Lüscher-Wassermann Seminar, Klosters (CH). Invited talk: "Atomic-scale insights on the mineral-water interaction using nc-AFM"

2022

- 11th STM/AFM Workshop, Zakopane (PL). Invited talk: "Model mineral surfaces and their interaction with water investigated with nc-AFM"
- Invited seminar @ Physics Dept., Politecnico di Milano (IT): "Nc-AFM studies of pristine mineral surfaces and their interaction with water"
- Invited seminar @ Physics Dept., Università Statale di Milano (IT): "Nc-AFM studies of pristine mineral surfaces and their interaction with water"
- 71st ÖPG meeting, Leoben (AT). Talk: "Resolving intrinsic K^+ adatoms on muscovite mica and their interaction with water"
- 1st TACO Ph.D. retreat, Frankenfels (AT). Poster: "Nc-AFM studies of pristine mineral surfaces and their interaction with water"
- Invited seminar @ Charles University, Prague (CZ): "Resolving intrinsic K^+ adatoms on muscovite mica and their interaction with water"
- Invited seminar @ Inst. for Microelectronics, TU Wien (AT): "Resolving intrinsic K^+ adatoms on muscovite mica and their interaction with water"
- 3S*22, St. Christoph am Arlberg (AT). Talk: "nc-AFM and XPS studies of UHV-cleaved and hydrated mica"

- IWOX-XIII, Phoenix Pyeongchang (KOR, attended virtually). Poster: "The link between surface diffusion and surface reconstructions on oxides"

2021

- Kick-off meeting TACO, TU Wien (AT). Poster: "The surface structures of $La_{0.8}Sr_{0.2}MnO_3(110)$: an STM overview"

2020

- 80th Physical Electronics Conference 2020, *Prize Talk* (Nottingham Prize finalist): "Pulsed laser deposition of functional oxides with atomic scale control"
- 3S*20, St. Christoph am Arlberg (AT). Poster: "Movable holder for a quartz crystal microbalance for exact doses in pulsed laser deposition"
- IWOX-XII, Lake Placid, NY (US). Poster: "Surface structure of Ti-doped hematite α-Fe_2O_3 single-crystalline films". *Poster prize winner*

2019

- 3rd TU-D retreat, Langenlois (AT). Talk: "Perovskite oxides and their reactivity to oxygen: an STM overview"
- DPG2019, Regensburg (DE). Talk: "The surface phase diagram of lanthanum-strontium manganite(110): An STM overview"
- 6th FOXSI PhD meeting, Haus im Ennstal (AT). Talk: "The surface phase diagram of lanthanum-strontium manganite(110): An STM overview"

2018

- 2nd TU-D retreat, Langenlois (AT). Talk: "STM studies of $La_{(1-x)}Sr_xMnO_3$ films"
- ECOSS34, Aarhus (DK). Talk: "In-situ studies of $La_{1-x}Sr_xMnO_3$ films grown by PLD"
- DPG 2018, Berlin (DE). Talk: "In-situ investigations of thin pulsed-laser-deposited $Sr_{0.2}La_{0.8}MnO_3$ films"
- 3S*18, St. Cristoph am Arlberg (AT). Poster: "In-situ investigations of thin pulsed-laser-deposited $Sr_{0.2}La_{0.8}MnO_3$ films"
- 7th FOXSI PhD meeting, Haus im Ennstal (AT). Talk: "In-situ investigations of thin pulsed-laser-deposited $Sr_{0.2}La_{0.8}MnO_3$ films"

2017

- 1st TU-D retreat, Langenlois (AT). Talk: "Pulsed laser deposition of complex oxides with atomic scale control"
- ECOSS33, Szeged (HU). Talk: "The influence of surface atomic structure on solid state electrochemistry: oxygen exchange on $SrTiO_3(110)$ surfaces"
- DPG2017, Dresden (DE). Poster: "First stages of PLD growth of $Sr_xLa_{1-x}MnO_3$ on $SrTiO_3(110)$"
- 6th FOXSI PhD meeting, Haus im Ennstal (AT). Poster: "First stages of growth of $Sr_xLa_{1-x}MnO_3$ on $SrTiO_3(110)$ by PLD"

(Co-) Mentoring

Graduate students

2022– Andrea Conti, *"Theoretical investigations of model mineral surfaces"*
2021– Luca Lezuo, *"Atomic-scale insights into ice nucleation on feldspar surfaces"*
2020 Erik Rheinfrank *"Pulsed laser deposition and surface characterization of LSMO(001) thin films"*

Master students

2022 Andrea Conti, "*Experimental and theoretical investigations of model mineral surfaces*"

2021 Ali Yazdani (FU Berlin), "*Growth investigation and magnetic characterization of monolayer VS_2 and TaS_2 islands on superconducting 2H-$NbSe_2$ substrate*"

2018 Jakob Hofinger, "*Pulsed-laser growth of In_2O_3 thin films on YSZ(111) substrates*"

2017 Sebastian Moser, "*Homoepitaxial growth experiments of $SrTiO_3$(110)*"

Bachelor and project students

2023 Alexander Hoheneder, "*Benzene adsorption on muscovite mica*"

2020 Nora Hackstock, "*Pulsed-laser growth of Al_2O_3 thin films on (110)- and (001)-oriented $SrTiO_3$ substrates*"

2018 Rosi Schöfbeck, "*Pulsed-laser growth of In_2O_3 thin films on YTO(111) substrates*"

2017 Sebastian Moser, "*Growth of anatase TiO_2(001) on $SrTiO_3$(001) using pulsed laser deposition*"

Teaching

2022 Exercise course for Basic Physics 1a+1b for Physics undergraduates (TU Wien)

2021 Advanced Physics lab course for Physics undergraduates (FU Berlin)

2020 Advanced Physics lab course for Physics undergraduates (FU Berlin)

2006–13 Physics and mathematics tutor for middle- and high-school, and university students

Organization

2022 Organizing an ImageJ Workshop to share and discuss imaging processing tips in the group

2020 Co-organizing the surface science division program of the Deutsche Physikalische Gesellschaft (DPG) meeting 2020 (later cancelled due to the Corona pandemic)—Co-sorting and allocating ≈ 800 abstracts

Personal Information

Born in Italy on 19/04/1992; Italian citizenship; permanent residence in Vienna, Austria. Languages: Italian (mother tongue); English (proficient user); German (independent user).

As of January 2023