

## ALLEGATO B

### **UNIVERSITÀ DEGLI STUDI DI MILANO**

**selezione pubblica per n. 1 posto di Ricercatore a tempo determinato in tenure track (RTT)  
per il settore concorsuale 02/B1 - FISICA SPERIMENTALE DELLA MATERIA,  
settore scientifico-disciplinare FIS/03 - FISICA DELLA MATERIA  
presso il Dipartimento di Fisica Aldo Pontremoli  
(avviso bando pubblicato sulla G.U. n. 49 del 18-6-2024 Codice concorso 5578**

**Federico Mazzola**

### **CURRICULUM VITAE**

#### **INFORMAZIONI PERSONALI**

<b>SURNAME</b>	<b>MAZZOLA</b>
<b>NAME</b>	<b>FEDERICO</b>

#### **TITOLI**

##### **TITOLO DI STUDIO**

##### **Laurea di Primo livello in Fisica**

L-509 Ord. 2007

Università di Roma, La Sapienza 02/11/2010

“Synchrotron studies for Adrontherapy” – Supervisor: Riccardo Faccini

110 cum Laude / 110

##### **Laurea Magistrale in Fisica**

LM-17 Ord. 2011

Università di Roma, La Sapienza 31/10/2012

“Electronic Structure and Many Body effects in quasi-freestanding Graphene” – Supervisors: Carlo Mariani (La Sapienza) and Philip Hofmann (Aarhus University)

110 / 110

##### **TITOLO DI DOTTORE DI RICERCA**

##### **Dottorato di Ricerca (PhD) in Fisica**

“The Norwegian University of Science and Technology” (NTNU, Trondheim), 25/04/2016

“Photoemission Spectroscopies and their application in solid state and material Physics”

N.B. The thesis has been awarded with the Best Faculty thesis prize in 2016.

##### **CONTRATTI DI RICERCA, ASSEGNI DI RICERCA O EQUIVALENTI**

**From 01/07/2024 – “Primo Ricercatore di secondo Livello” (Spin-CNR)**

This position is fixed-termed and has been won under competitive recruitment of the framework NFFA-DI, MUR IR0000015 (contract signed, funding won, starting in days from this application)

**2022-2024 – Ricercatore (RTDA), Università Ca' Foscari, Venezia**

This position has been obtained after winning the Funding Action PNRR SoE Marie Skłodowska-Curie (**150 000 Euro**), SoE\_00068 Mur

**2020 – 2022: Postdoctoral Researcher at IOM-CNR (Trieste, IT)**

Postdoc in the NFFA laboratories in Trieste with leading role in building a Pulsed Laser Deposition (PLD) for the growth and characterization of ultrathin nano materials.

**2016 – 2020: Postdoctoral Fellow, University of St Andrews, UK (King's group)**

Winner of a postdoctoral fellowship for the study of the electronic properties of oxides. Lead role in commissioning a 4HG Laser source for photoemission and design and construction of micro focussing (5  $\mu\text{m}^2$  spot within a variable UV energy range)

**ATTIVITÀ DIDATTICA A LIVELLO UNIVERSITARIO IN ITALIA O ALL'ESTERO**

**2023 (Current) Responsible of the course “Modern Condensed Matter Physics”**

University of Venice Ca' Foscari – Degree of Physical Engineering CM0607

*Currently, as a responsible of a course, I have the duty to organize the pedagogical material, lessons, exercises section, and to give timeslots for the students to ask questions out of front-lectures time. I created an online repository of the didactic material which I upload beforehand, to help the students to look at the notes in the case they want to deepen the subject. I use both whiteboard and slides, depending on the specific lesson, and all the material needed for examination is uploaded in the form of notes. The exam is both written and oral. The course is 6 CFU per semester (48 h + 12 h of exercises).*

*Note that as a member of Venice Ca' Foscari, we are required to attend to pedagogical courses periodically (<https://www.unive.it>). So far, I attended the following documented courses:*

- *Continuous formation for teachers*
- *Tools for integrating the teaching*

**Teaching in St. Andrews:** Note that at the University of St Andrews the teaching must be done by contract unless one is in a permanent position, from the lecturer rank, and is paid as such like in Italian “Insegnamento a contratto”. In this regard, all the teaching have been done equivalently in terms of tasks to what I did in Italy as RTDA in Venice (where I have titularity of the course).

**2020** Laboratory coordinator: table-top techniques for condensed matter physics (St-Andrews)

*Total hours spent: 30*

*CFU= 15*

*Code= PH4105*

**2018-2020** Laboratory: X-Ray diffraction laboratory (St-Andrews, from 2019 coordinator)

*Total hours spent: 140*

*CFU= 15*

*Code= PH4105*

**2018-2020** Teacher of “Modern methods in Condensed Matter Physics” (St-Andrews)

*Total hours spent: 30*

*CFU=15*

*Code= PH5024*

**2018-2020** Lecturer and demonstrator of 1<sup>st</sup> and 2<sup>nd</sup> year laboratory

*Total hours spent: 100*

*CFU= 15*

*Code=PH3101*

**2017-2019** Laboratory demonstrator: Phase-Transition laboratory (St-Andrews)

*Total hours spent: 140*

*CFU= 15*

*Code= PH4105*

### *Teaching philosophy*

My current teaching philosophy is the result of my personal experience in science education in different places and teaching people with different background and origins. I believe that teaching should be student- and learning-focused. It is important to explain why a subject is both interesting and useful, why society should care, without losing contact with reality and without reducing a scientific course to an 'equation hunting' problem. I would articulate a course as follows:

- Treating the course as a unity and avoiding scattered notions: a subject does not have to be taught superficially, but in depth.
- Linking an abstract concept to 'real life' situations. The students must be aware of the big picture behind a course which should be a dynamic process. The topic treated should not be obsolete and related to problems of the past only, but it should be timely.
- Trying to find connections with ongoing activities in the Department: In the past years, I invited students to lab-tours whose research was relevant to the course program. I have received extremely positive feedback about this strategy and students have requested on their own initiative more lab-tours, as these motivated them, raised their curiosity and helped them understand the specific topic.
- Helping the students by giving them my personal notes of the courses beforehand.

I firmly believe that the responsibility of a teacher is to identify weaknesses and strengths of the students and to understand the differences in their learning skills. It is crucial to be available to meet the students during extra-courses hours and to develop and to modify my methods of teaching such that the course is more accessible to everyone in the class. In preparing the class, I always reserve a small amount of time to review the main concepts of the previous lesson (through concept map on the board for example). This has a twofold aim: the equally spaced repetition of a certain concept is supposed to help the recall on the concept itself [1] and it will be a support for students who could not attend the previous lesson. Review activity will be also carried out in the form of pre-exams demonstrations and class exercises. Moreover, I would like to promote the students to create a safe space to share the knowledge acquired during the course [2].

I think that peer-mentoring is a fundamental aspect of teaching. Colleagues have surely faced the same problems before, and their experience might be key for me to access more effectively various students in a class which have different attitudes and personalities. Using colleagues as sparring partners to improve my teaching practice is of paramount importance. I found myself many times asking my colleagues for advice about the program of the course and the accessibility, and in general for feedback. Thus, I feel that a friendly environment with open communication is beneficial, both for my learning skills, but especially for the students. Finally, to become a better teacher, one must be reflective about the own teaching practice, and one must engage in peer-mentoring with colleagues.

[1] de Winstanley, P. A. and Bjork, R. A. Successful lecturing: Presenting information in ways that engage effective processing. *New Directions for Teaching and Learning* 19,31 (2002)

[2] Biggs and Tang, *Teaching for quality learning at university*, McGraw-Hill Education (UK), 2022

#### **Member of thesis defence committees**

- **Bachelor's committee in Ca' Foscari**
- **Master's committee in NTNU**
- **Master's committee in Aarhus University**
- **Member of evaluation for PhD program**
- **Member of Bessy-II scientific committee**

#### **DOCUMENTATA ATTIVITÀ DI FORMAZIONE O DI RICERCA PRESSO QUALIFICATI ISTITUTI ITALIANI O STRANIERI**

**From 01/07/2024 – “Primo Ricercatore di secondo Livello” (Spin-CNR)**

**2022-2024 – Ricercatore (RTDA), Università Ca' Foscari, Venezia**

**2020 – 2022: Postdoctoral Researcher at IOM-CNR (Trieste, IT)**

**2016 – 2020: Postdoctoral Fellow, University of St Andrews, UK (King's group)**

#### **REALIZZAZIONE DI ATTIVITÀ PROGETTUALE**

**Funding Action PNRR SoE Marie Skłodowska-Curie (150 000 euro), SoE\_00068 Mur**

As part of this project, I developed methodology to understand the hidden spin polarization of thin materials, and the hidden magnetism in thin films. The project is particularly relevant in the context of nanoscale devices and has been successfully completed.

Building and installing a **4HG Laser source** (as part of the QUEDSTO ERC starting grant, King).  
The project made possible the realization of a photoemission design with micro focussing ( $5\text{ }\mu\text{m}^2$  spot within a variable UV energy range)

Building **PLD** dedicated to the growth of two-dimensional (2D) materials (IOM-CNR)  
I successfully realize a PLD system which is now in use at Elettra. This is dedicated to grow transition metal dichalcogenides.

## **ORGANIZZAZIONE, DIREZIONE E COORDINAMENTO DI CENTRI O GRUPPI DI RICERCA NAZIONALI E INTERNAZIONALI O PARTECIPAZIONE AGLI STESSI**

*“Graphene and weakly coupled bands, role of electron-phonon coupling” (from 2017)*

Leading the research project with Prof. Thomas Frederiksen (San Sebastian) dedicated at the investigation of the role of electron-phonon coupling in determining the transport in graphemic systems. From the collaborations (*Physical Review B* 95, 075430, 2017, *Physical Review Letters*, 111:216806, 2013)

*“Ultra-shallow doping profiles in Si computers architecture” (from 2014)*

Leading role in the spectroscopy for a project with Prof. Michelle Simmons (University of New South Wales). The project is dedicated at investigating the properties of confined silicon/P structures for their use in computation (*ACS Nano*, 2014, 8-10, 10223-10228, 2014, *Applied Physics Letter*, 104:173108, 2014, *Physical Review Letters* 120, 046403, 2018, *npj Quantum materials* 5, 34, 2020)

*“Hidden Spin Polarization in Solids” (from 2014)*

Leader in the spin-resolved spectroscopy in the collaboration with Prof. P.D.C King (St Andrews university). The work is devoted at understanding the local magnetism of various systems to tailor this into targeted applications (*Nature Physics*, 10-11, 835-839, 2014, *Nature Physics* 19, 1135-1142, 2023 and *Nature* 626, 752-758, 2024)

*“Effect of surface termination for functionalization of nanoscale systems” (from 2014)*

Collaboration involving many partners, including Prof. P.D.C. King and Prof. Stuart Parkin (St Andrews university and Halle Max Plank Institute). The aim is to investigate the electronic and spin properties of topological materials which might offer an astounding resource for technology, including spintronics and neuromorphic applications. For many of the produced works I had a lead role (*Physical Review B* 99 (4), 045438, 2019, *Nature Communications*, 10, 5485 2020, *Phys. Rev. Materials*, 4, 014003 2020, *Nature Communications* 15, 1, 3720, 2024, and *Nano Letters* 23, 17, 8035-8042, 2023, *PNAS* 115, 51, 12956-12960, 2018)

*“Oxides with magnetic properties and hidden spin texture” (from 2018)*

I was leader in the study of the electronic properties of these systems, called delafossite oxides. The works here were done as a collaboration with the MPI of Dresden, with the Director Prof. A. Mackenzie (*PNAS* 115 (51), 12956-12960, 2018, *Science Advances* 6 (6), eaaz0611, 2020, *Nature* 549, 7673, 492-496, 2017)

*“Thin magnets” (from 2024)*

I am leader of a project which has the aim of studying and tailoring low-dimensional magnets. This is done in collaboration with Dr. Pasquale Orgiani (*Nano Letters* 2024, doi: <https://doi.org/10.1021/acs.nanolett.4c01005>)

## **ATTIVITÀ DI RELATORE A CONGRESSI E CONVEGNI NAZIONALI E INTERNAZIONALI**

*Invited speaker at conferences*

**2024** “International Conference on Magnetism ICM2024” – Bologna (30 June- 5 July)

**2024** “ECOSS37” – Harrogate, UK (17-21 June)  
**2024** “Italian Physics Society FIS – plenary speaker” – Bologna (September)  
**2024** “CMD31”- Braga, Portugal (2-7 September)  
**2024** Grenoble, Journées surfaces et interfaces (JSI) conference  
**2024** “Workshop on physics and electronics of 2D doped materials” Italy/Japan -online  
**2023** “FISMAT 2023” – Milano, Italy  
**2021** “Brilliant and Promising Junior Physicists forum – strategic platform to foster new collaborations” - Youth Forum for Physics at Shanghai Jiao Tong University  
**2019** “The 19th International Conference on Solid Films and Surfaces (ICSFS)” – Hiroshima, Japan  
**2018** Lund (Sweden). MAX-IV synchrotron user meeting

*Invited speaker at seminars*

**2024** SPIN seminar organized by Salerno University (IT)  
**2024** QMAT seminar organized by Prof. Y. Maeno (JAP)  
**2024** Politecnico di Milano (IT)  
**2024** Niels Bohr Institute (DK)  
**2024** University of Rennes 1 (FR)  
**2023** Birmingham University (UK)  
**2023** Salerno University (IT)  
**2022** Lund University (SE)  
**2022** University of Utrecht (NL)  
**2022** University of Rennes 1 (FR)  
**2022** Technical University of Munich, Ilmenau (D)  
**2022** Institute Jean Lamour (FR)  
**2021** DTU (DK)  
**2020** CNR Institute of Materials (IT)  
**2020** University of the Basque Country (ES)  
**2020** Niels Bohr institute (DK)  
**2019** University of Rennes 1 (FR)  
**2017** University of St-Andrews (UK)  
**2016** University of the Basque Country (ES)

*Participation at other international conferences (either with poster or oral contribution)*

- CORPES (Hamburg 2013)
- CORPES (Paris 2015)
- CORPES (Oxford 2019)– winner of SPECS prize)
- DPG meeting organised by the German Physical society (Dresden 2017)
- DPG meeting organised by the German Physical society (Berlin 2016).
- March Meeting of the American Physical Society (Los Angeles 2018)

- ICESS 14 (Shanghai 2018)

## **CONSEGUIMENTO DI PREMI E RICONOSCIMENTI NAZIONALI E INTERNAZIONALI PER ATTIVITÀ DI RICERCA**

### **2024 Winner of PNNR competitive grant for “NFFA – infrastructures” code MUR IR0000015**

→ *This competitive call comes with the position and title of “First researcher of level 2”, which is a position of the Nation Research Centre (CNR) comparable to the University Associate Professor position. (Contract signed, funding won, starting in days from this application)*

### **2023 Pathfinder Seal of Excellence on Project “Berrytronics”**

→ *Pathfinder call organized from the EU.*

*This project is devoted at the development of nanostructured materials with low-volatility applications and neuromorphic architectures.*

The project is an extension of the initial “New Exploratory Research Discovery” of the Novo Nordisk Foundations and was devoted to the study of the electronic properties for neuromorphic device. The previous project for which I was the PI is reported for completeness.

### ***inSPEC - “In-operando Spin and Electronic Control for Neuromorphic Device Architectures”***

*The goal of this project is to investigate and manipulate the in-operando electronic proprieties in bio-inspired quantum devices, with particular focus on the role of the electron spin. The idea is to establish the basis for the creation of ultrahigh density networks, which might be exploited in neuromorphic applications.*

*The development of quantum computation and its need for materials with novel functionalities constitute one of the major scientific endeavors in multiple areas of science, including solid-state physics, information/quantum technology, materials science, and bioscience/biotechnology. Conventionally, memory, sensors, and information technology work by exploiting the motion of electrons to produce currents. This mechanism creates scattering which reduces the lifetime, speed, and energy efficiency of devices. By exploiting the spins, instead, it would be possible to enable technology with a reduced number of interactions. Therefore, spin-devices could operate with dramatically lower energy costs and heat generation, while the electronic properties and the spin information would be robust against disorder and the responses to external stimuli faster.*

*Despite the experimental efforts, not only is the control over the electron spins elusive for several materials, but its complexity and entanglement with the orbitals can be used to stabilize phases which have not been experimentally demonstrated. Spins control and phase-switching are particularly relevant for bio-inspired hardware, neuromorphic computing, and non-volatile devices: For these applications the fabrication of tunable and multifunctional units, with the ability of the single unit to quickly change configuration when put into different operating conditions, is fundamental.*

*The target of this project will be the study of spin-orbit coupled and magnetic materials embedded in the form of devices. We aim to study their magnetic and electrical proprieties and their responses to external stimuli. We will examine which materials are the most suitable for the implementation of neuromorphic computing and we will develop strategies leading to the manipulation of their spin textures. The goal is to implement devices which mimic artificial neurons and that can work in multiple environmental conditions.*

### **2023 Winner of Research Prize 2023 from the University Venice Ca' Foscari**



→ Prize attributed by an evaluation committee for the best research achievement in the year 2023 in the department

**2022 Winner of PNNR funding action SoE Marie Skłodowska-Curie SoE\_00068 Mur**

**2022 National Scientific Qualification for Associate Professor level (ASN)**

→ This achievement is awarded after an international competitive process based on evaluation of scientific track record and impact of the research outputs. It certifies that the holder is at the level of Associate Professor according to the Italian system.

**2021 Marie Skłodowska-Curie Action Seal of Excellence**

→ Proposal “CIAO”: Creation and Investigation of alternative oxides

**2021 Nomination for Wallenberg Academy prize** by the Royal Institute of Technology (KTH)

→ KTH selects nominees for this prize based on a competitive process which evaluates a scientific proposal on excellence and impact both scientifically and in society.

**2020 Appointed member of the Scientific Selection Panel** of the synchrotron Bessy-II

**2019 CORPES** (International workshop of Correlations and Angle-resolved photoemission spectroscopy), **SPECS prize** (SPECS is one of the major companies for ARPES instruments and vacuum technology)

→ SPECS prize awarded at the main international conference for the study of correlated oxides by the photoemission community

**2017 Marie Skłodowska-Curie Action Seal of Excellence** (Proposal “ATMOS”)

→ Proposal “ATMOS”: Atomic-scale synthesis and control of transition metal oxides

**2016 Best PhD Thesis Prize.** Best Thesis of the faculty of Science, Norwegian University of Science and technology (NTNU)

→ The thesis with a better readability and scientific impact was awarded by NTNU among natural sciences.

**TITOLI DI CUI ALL'ARTICOLO 24 COMMA 3 LETTERA A) E B) DELLA LEGGE 30 DICEMBRE 2010, N. 240**

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**2022-2024 – Ricercatore (RTDA), Università Ca' Foscari, Venezia**

This position has been obtained after winning the Funding Action PNRR SoE Marie Skłodowska-Curie (150 000 Euro), SoE\_00068 Mur

→ I obtained the Italian Habilitation as Associate professor in FIS/01, with expiration year 2033. (ASN in FIS/01)

**TERZA MISSIONE**



As part of my research and education, I am involved in several outreach activities which have the aim of communicating the outcome of my work not only to students but to the public and industry. On a monthly basis, for example, I am the organizer of laboratories tours for families and industrial partners. Such tours are developed in the context of the NFFA-Trieste facilities (<https://www.trieste.nffa.eu>) and with help of the private company which runs the Elettra synchrotron (<https://www.elettra.eu>).

As part of my job, I also engage in popular divulgation activity as a curator, and I am often in the frontline to bridge the gap between scientists and society. Examples are:

- **2024** Science Highlight for Promoting discoveries  
<https://www.elettra.eu/comunicazione/news/scoperto-a-elettra-un-nuovo-stato-quantistico-della-materia-caratterizzato-da-correnti-chirali.html>  
(With video)
- **2024** Highlight on Quantum Materials published in local newspaper “Il Piccolo” (2<sup>nd</sup> of March)
- **2022** Speaker at Trieste Next (<https://nffa.eu/news/events/nffa-triestenext2022/>)  
Popular talk about life in laboratories and importance of open access
- **2022** Speaker at the Italian Quantum week (<https://www.youtube.com/watch?v=E75i4bfregg>)  
Divulgation talk about quantum technology
- **2022** Science discovery Day Trieste  
Building a toy levitating train with kids
- **2021** FameLab (finalist, <https://www.youtube.com/watch?v=5WzqKtJZaoo&t=131s>)  
(With video)

### **Organizational contribution**

Since the beginning of my PhD studies, I have been involved in organising and participating to social activities, both of scientific and team-building character. In particular: I was responsible for organizing the “lunch seminar” at the Norwegian University of Science and Technology (NTNU) between 2013-2016 each Thursday every two weeks; I have been in charge in 2015 for the organization of the Christmas party at NTNU, including dinner and gathering of the whole section. At the University of St Andrews, I was responsible (in 2019) for coordinating the monthly group meetings. At the University of Venice, from 2023 I am the organizer of the event “Bay of Science” a forum which deals with climate change and involves the presence of students, University members, and families, to promote awareness about the problems of climate changes. This forum takes place every year in the location of Forte Marghera. Finally, I have been organizer of the section of “kagome metals” in the FISMAT 2023 conference in Milan, together with Prof. D. di Sante and G. Sangiovanni.

## PRODUZIONE SCIENTIFICA

As in the ORCID (0000-0002-5380-4374) I authored several publications (more than 2400 citations), of which I am PI for a large portion of them. Several of my publications are in high impact journals such as Nature, Nature Physics, Nature Materials, Nature Communications, PNAS, Nano Letters, Physical Review Letters, and Science Advances.

A full list of publications is available at: <https://scholar.google.com/citations?user=1QFp0OoAAAAJ&hl=it> and at the end as part of this cv in the section “All Publications”. For the evaluation only the 12 presented in the next section and in the dedicated attached file, as requested.

## **PUBBLICAZIONI SCIENTIFICHE PRESENTATE (Max 12)**

### **1. Nature 626, 752–758 (2024)**

“Signatures of a surface spin-orbital chiral metal”

**DOI:** <https://doi.org/10.1038/s41586-024-07033-8>

*F. Mazzola, W. Brzezicki, M. T. Mercaldo, A. Guarino, C. Bigi, J. A. Miwa, D. De Fazio, D. Crepaldi, J. Fujii, G. Rossi, P. Orgiani, S. K. Chaluvadi, S. P. Chalil, G. Panaccione, A. Jana, V. Polewczyk, I. Vobornik, C. Kim, F. Miletto-Granozio, R. Fittipaldi, C. Ortix, M. Cuoco, A. Vecchione*

**Contribution:** First and corresponding. Responsible for designing the project and all the experimental aspects of the work. Coordinator of the work.

### **2. Nature Physics 19, 1135–1142 (2023)**

“Flat band separation and resilient spin-Berry curvature in bilayer kagome metals”

**DOI:** <https://doi.org/10.1038/s41567-023-02053-z>

*D. Di Sante, C. Bigi, P. Eck, S. Enzner, A. Consiglio, G. Pokharel, P. Carrara, P. Orgiani, V. Polewczyk, J. Fujii, P. D. C. King, I. Vobornik, G. Rossi, I. Zeljkovic, S. D. Wilson, R. Thomale, G. Sangiovanni, G. Panaccione, F. Mazzola*

**Contribution:** Last and corresponding. Responsible for designing the project and all the experimental aspects of the work. Coordinator of the work.

### **3. Communications Materials, 4, 103 (2023)**

“Dynamics and Resilience of the Charge Density Wave in a bilayer kagome metal”

**DOI:** <https://doi.org/10.1038/s43246-023-00430-y>

*M. Tuniz, A. Consiglio, D. Puntel, C. Bigi, S. Enzner, G. Pokharel, P. Orgiani, W. Bronsch, F. Parmigiani, V. Polewczyk, P. D. C. King, J. W. Wells, I. Zeljkovic, P. Carrara, G. Rossi, J. Fujii, I. Vobornik, S. D. Wilson, R. Thomale, T. Wehling, G. Sangiovanni, G. Panaccione, F. Cilento, D. Di Sante, F. Mazzola*

**Contribution:** Last and corresponding. Responsible for designing the project and all the experimental aspects of the work. Coordinator of the work.

### **4. Science Advances 6 (6), eaaz0611 (2020)**

“Probing spin correlations using angle resolved photoemission in a coupled metallic/Mott insulator system”

**DOI:** [10.1126/sciadv.aaz0611](https://doi.org/10.1126/sciadv.aaz0611)

*V. Sunko\*, F. Mazzola\*, S. Kitamura, S. Khim, P. Kushwaha, O. J Clark, M. D Watson, I. Marković, D. Biswas, L. Pourovskii, T K Kim, T-L Lee, P. K. Thakur, H. Rosner, A. Georges, R. Moessner, T. Oka, A P Mackenzie, P D C King*

**Contribution:** Main Author (\*), responsible for the experiment, analysis, designing and writing aspects of the project.

### **5. Proceedings of the National Academy of Sciences (PNAS) 115, 51 12956-12960 (2018)**

“Itinerant ferromagnetism of the Pd-terminated polar surface of PdCoO<sub>2</sub>”

**DOI:** <https://doi.org/10.1073/pnas.1811873115>

*F. Mazzola, V. Sunko, S. Khim, H. Rosner, P. Kushwaha, O. J Clark, L. Bawden, I. Marković, T. K Kim,*

*M. Hoesch, A P Mackenzie, P D C King*

**Contribution:** First author. Responsible for designing the project and all the experimental aspects of the work.

6. **Nano Letters** 22 (14), 5990-5996 (2022)

“Disentangling Structural and Electronic Properties in  $V_2O_3$  Thin Films: A Genuine Non-Symmetry Breaking Mott Transition”

**DOI:** <https://doi.org/10.1021/acs.nanolett.2c02288>

*F. Mazzola, S. K. Chaluvadi, V. Polewczyk, D. Mondal, J. Fujii, P. Rajak, M. Islam, R. Ciancio, L. Barba, M. Fabrizio, G. Rossi, P. Orgiani, I. Vobornik*

**Contribution:** First and corresponding. Responsible for designing the project and all the experimental aspects of the work. Coordinator of the work.

7. **Physical review letters** 122 (7), 076404 (2019)

“Orbital- and  $k_z$ -Selective Hybridization of Se  $4p$  and Ti  $3d$  States in the Charge Density Wave Phase of  $TiSe_2$ ”

**DOI:** <https://doi.org/10.1103/PhysRevLett.122.076404>

*M. D. Watson, O. J. Clark, F. Mazzola, I. Marković, V. Sunko, T. K. Kim, K. Rossnagel, and P. D. C. King*

**Contribution:** Responsible for the ARPES part of the project and the experimental aspects related to this.

8. **Nature** 549, 492–496 (2017)

“Maximal Rashba-like spin splitting via kinetic-energy-coupled inversion-symmetry breaking”  
**DOI:** <https://doi.org/10.1038/nature23898> **V.**

*Sunko, H Rosner, P Kushwaha, S Khim, F Mazzola, L Bawden, OJ Clark, JM Riley, D Kasinathan, MW Haverkort, TK Kim, M Hoesch, J Fujii, I Vobornik, AP Mackenzie, PDC King*

**Contribution:** Responsible for the spin-ARPES part of the project and the experimental aspects related to this.

9. **Nano Letters** 23, 3, 902-907 (2023)

“Discovery of a Magnetic Dirac System with a Large Intrinsic Nonlinear Hall Effect”

**DOI:** <https://doi.org/10.1021/acs.nanolett.2c04194>

*F. Mazzola, B. Ghosh, J. Fujii, G. Acharya, D. Mondal, G. Rossi, A. Bansil, D. Farias, J. Hu, A. Agarwal, A. Politano, I. Vobornik*

**Contribution:** First and corresponding. Responsible for designing the project and all the experimental aspects of the work. Coordinator of the work.

10. **Nature Communications** 7, 11711 (2016)

“Spin-valley locking in the normal state of a transition metal dichalcogenide superconductor”

**DOI:** [10.1038/ncomms11711](https://doi.org/10.1038/ncomms11711) (2016).

*L. Bawden, S. P. Cooil, F. Mazzola, J M Riley, L J Collins-McIntyre, V Sunko, K W B Hunvik, M Leandersson, C M Polley, T Balasubramanian, T K Kim, M Hoesch, J W Wells, G. Balakrishnan, M S Bahramy, PDC King*

**Contribution:** Responsible for the spin-ARPES part of the project and the experimental aspects related to this.

11. **Physical Review Letters** 120 (4), 046403 (2018)

“Simultaneous Conduction and Valence Band Quantization in Ultrashallow High-Density Doping Profiles in Semiconductors”

**DOI:** <https://doi.org/10.1103/PhysRevLett.120.046403>

*F Mazzola, JW Wells, AC Pakpour-Tabrizi, RB Jackman, B Thiagarajan, Ph Hofmann, JA Miwa*

**Contribution:** Responsible for designing the project and all the experimental aspects of the work.

Coordinator of the work and I made the theory and calculations.

12. **Nano Letters** 18, 7, 1193-4499 (2018)

“Electronic structure and enhanced charge density wave order of monolayer VSe<sub>2</sub>”

**DOI:** <https://doi.org/10.1021/acs.nanolett.8b01649>

*J. Feng, D. Biswas, A. Rajan, M. D Watson, **F Mazzola**, O J Clark, K Underwood, I Markovic, M McLaren, A Hunter, D M Burn, L B Duffy, S Barua, G Balakrishnan, F Bertran, P Le Fevre, T K Kim, G Van Der Laan, T Hesjedal, P Wahl, P DC King*

**Contribution:** Responsible for the in-house ARPES analysis and measurements.

2024

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"Signatures of a surface spin-orbital chiral metal"

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"Spin-Berry curvature enhanced orbital Zeeman effect in a Kagome metal"

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"Weyl spin-momentum locking in a chiral topological semimetal"

<https://doi.org/10.1038/s41467-024-47976-0>

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"Uncovering the lowest thickness limit for room temperature ferromagnetism of Cr<sub>1.6</sub>Te<sub>2</sub>

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**73. Physical Review Letters**

"Spin-dependent pi pi\* gap in graphene on a magnetic substrate"

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**72. npj Quantum Materials 9,14**

"Nanoscale visualization and spectral fingerprints of the charge order in ScV<sub>6</sub>Sn<sub>6</sub> distinct from other kagome metals"

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**71. npj Quantum Materials 9, 36**

"Charge transfer and spin-valley locking in 4Hb-TaS<sub>2</sub>"

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**70. Physical Review B 109, 035137**

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68. **Nano Letters** **23**, **17**, 8035–8042

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"Discovery of a Magnetic Dirac System with a Large Intrinsic Nonlinear Hall Effect"

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66. **Communications Materials**, **4**, 103

"Dynamics and Resilience of the Charge Density Wave in a bilayer kagome metal"

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"Anisotropic hybridization probed by polarization dependent X-ray absorption spectroscopy in VI<sub>3</sub> van der Waals Mott ferromagnet"

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"Dual pulsed laser deposition system for the growth of complex materials and heterostructures"

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"Covalency, correlations, and inter-layer interactions governing the magnetic and electronic structure of  $Mn_3Si_2Te_6$ "

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"Electronic structure of intertwined kagome, honeycomb, and triangular sublattices of the intermetallics  $MCo_2Al_9$  (M=Sr, Ba)"

<https://doi.org/10.1103/PhysRevB.108.075148>

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"Spin-orbit coupled spin-polarised hole gas at the CrSe<sub>2</sub>-terminated surface of AgCrSe<sub>2</sub>"

<https://doi.org/10.1038/s41535-023-00593-4>

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**52. Europhysics News 54, 5**

"Decentralising science: a moral duty and a huge opportunity"

[F. Mazzola](#)

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**51. Nano Letters 22 (14), 5990-5996**

"Disentangling Structural and Electronic Properties in  $V_2O_3$  Thin Films: A Genuine Non-symmetry Breaking Mott Transition"



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"Evidence of magnetism-induced topological protection in the axion insulator candidate EuSn<sub>2</sub>P<sub>2</sub>"

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"Improving the Efficiency of Gallium Telluride for Photocatalysis, Electrocatalysis, and Chemical Sensing through Defects Engineering and Interfacing with its Native Oxide"

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**47. Nano letters 22 (17), 7034-7041**

"Influence of Orbital Character on the Ground State Electronic Properties in the van Der Waals Transition Metal Iodides VI<sub>3</sub> and CrI<sub>3</sub>"

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**2021**

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**2020**

**44. npj Quantum Materials 5, 34**

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**43. Physical Review Materials, 4, 014003**

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equal contributions

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"Electronically driven spin-reorientation transition of the correlated polar metal  $\text{Ca}_3\text{Ru}_2\text{O}_7$ "

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"Surface and bulk electronic structure of aluminium diboride"

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**2019**

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**2018**

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"Photoemission Investigation of Oxygen Intercalated Epitaxial Graphene on  $\text{Ru}(0001)$ "

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"Strong electron-phonon coupling in the  $\sigma$  band of graphene"

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**2016**

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NTNU published thesis (My thesis)

[F. Mazzola](#)

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**2014**

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25/06/2024

Trieste