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CURRICULUM VITAE

September 1987 - July 1993: Joint undergraduate studies in Electronic engineering at Politecnico di Milano and ENSTA (*Ecole Nationale Supérieure des Techniques Avancées*) in Paris. Master Thesis in experimental spectroscopy of solids: “Inverse Photoemission Spectroscopy and Instrumentation for Synchrotron Radiation”, supervised by prof. Lucio Braicovich.

September 1992: *Diplôme d'ingénieur* at ENSTA (mark A/A).

July 1993: Laurea at the Politecnico di Milano (mark 100/100 'cum laude').

September-October 1993: grant from Italian National Institute for Matter Physics (INFM).

November 1993-July 1997: Work towards PhD in experimental Solid State Physics at Physics Department of the Politecnico di Milano. My supervisor was prof. Lucio Braicovich.

November 1993 - October 1994: construction, commissioning and tests of the Advanced X-ray emission spectrograph AXES at the Department of Physics at Politecnico di Milano.

November 1994 - December 1996: Experimental activity at ESRF soft X-ray beamline ID12B (local supervisor Dr. Nicholas B. Brookes).

July 1997: PhD in Experimental Solid State Physics. Thesis: “Inelastic X-ray Scattering excited by Synchrotron Radiation”.

November-December 1996: grant from Italian National Institute for Matter Physics (INFM).

January 1997-November 1997: Postdoctoral contract at ESRF (Grenoble) on beamline ID12A (beamline responsible: Dr. José Goulon). Experiments of inelastic X-ray scattering. Construction of a crystal spectrometer for scattering experiments in the hard X-ray energy range.

December 1997-May 1999: Information Technology architect at IBM (Italy).

June - September 1999: Patent examiner (in the field of telecommunication) at the European Patent Office in Munich (Germany).

September 1999- September 2004: permanent research position at the Department of Physics of the Politecnico di Milano.

Since September 2004: associate professor at the Department of Physics of the Politecnico di Milano.

Since July 2021: full professor at the Department of Physics of the Politecnico di Milano.

Academic and scientific duties at Politecnico di Milano

1. Responsible for international exchange programs for students of Engineering Physics from 2001 (foundation year of Engineering Physics) until the end of year 2019.
2. Responsible for tutoring facilities for students of Engineering Physics in the years 2004 until 2006.
3. President of the Committee in charge of delivering the Bachelor and Master Degrees in Engineering Physics in the years 2006 until 2020, now vice-President of the same Committee (“Commissione di Laurea”).
4. Member of the Board of Doctorate in Physics (“Collegio di Dottorato”) of Politecnico di Milano for Academic Years from 2015-2016 until present (and renewed for Academic Year 2021-2022).
5. Since 2004 responsible of the UPhOS-ULTRAS Research Laboratory of the Department of Physics for time-resolved experiments.

Academic and scientific duties outside Politecnico di Milano

1. Visiting scientist contract at the European Synchrotron Radiation Facility from January 2000 until December 2009. The total period effectively spent at ESRF is of about one year and consisted in beamtime for officially allocated experiments, beamtime in collaboration with the beamline staff for instrumental commissioning, instrumental maintenance and participation to meetings and workshops.
2. Visiting scientist at the Department of Physics of Ecole Polytechnique Fédérale de Lausanne in August 2002.
3. Visiting professor at Ecole Polytechnique Fédérale de Lausanne - Université de Fribourg Suisse, October to November 2003 as a lecturer for the doctoral course “Troisième Cycle”. The overall title of the lectures was "Resonant Spectroscopies with Synchrotron Radiation".
4. February 2003 to September 2006: Vice President of the User Organization Community of the ESRF.
5. Chairperson of the committee for the designation of the “ESRF Young Scientist Award 2009”.
6. Since June 2011 coordinator of the CNISM (Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia) Research Unit at Politecnico di Milano.
7. Since October 2012: Member of the referee committee of the “Materia” project evaluating the evolution of the project for the X-ray Thompson backscattering facility of Arcavacata di Rende (Cosenza, Italy).
8. Since October 2012 and until January 2015: Member of the CNR Committee coordinating the Italian research activities with X-rays and neutrons.

Teaching experience at Politecnico

At the Politecnico I have taught first and second years engineering students in Mechanics, Thermodynamics, Electromagnetism, in the academic years from 2000/2001 to present. I am currently teaching fourth year students of Physical Engineering in Solid State Physics. My teaching activity has included laboratory tutorials for first and second year students, and the tutoring of the 2-monthly laboratory activity of students towards their bachelor degree.

- Academic years 2000-2001 until 2003-2004: course of “Fisica Sperimentale A” (5 ECTS credits) given in the first semester of the first year of bachelor study of Bioengineering. The subject of the course is Mechanics.
- Academic years 2000-2001 until 2002-2003: course of “Fisica Sperimentale 2” (10 ECTS credits) given in the second semester of the first year of bachelor study of Electronic Engineering. The subject of the course is Electromagnetism.
- Academic years 2004-2005 until 2007-2008: course of “Fisica Sperimentale B+C” (10 ECTS credits) given in the second semester of the first year of bachelor study of Engineering Physics and Engineering Mathematics. The subjects of the course are Continuum Mechanics, Thermodynamics and Electromagnetism.
- Academic years 2004-2005 until 2005-2006: exercises for the course of “Fisica dei Solidi” (10 ECTS credits) given in the first semester of the first year of master study of Engineering Physics.
- Since academic year 2008-2009: course of “Fisica Sperimentale 1” (10 ECTS credits) given in the second semester of the first year of bachelor study of Engineering Physics. The subjects of the course are Mechanics, Continuum Mechanics and Thermodynamics.

Teaching experience outside Politecnico

I have given in October-November 2003 invited lectures for the “*Cours de Troisième Cycle*” at the Ecole Polytechnique Fédérale de Lausanne (EPFL) on “Resonant Spectroscopies with Synchrotron Radiation”. The lectures of this program were aimed at post-doctoral as well as senior researchers, and the cycle consisted of 3 lectures for a total of 9 hours.

PhD thesis under my supervision

As a professor at Politecnico I had the scientific responsibility of the following students (in brackets the year of the thesis discussion).

1. Emilia Annese: “Applications of resonant inelastic scattering in the soft and hard X-ray ranges” (2005).
2. Ricardo Berlasso: “Spectroscopy of solids with ultra short laser pulses” (2006).
3. Eduardo Mancini: “Photoemission Spectroscopy with Time of Flight Analyzers: a new Instrument for Time-resolved Studies with Femtosecond Laser pulses, and Spin-resolved Measurements with Synchrotron Radiation” (2010).
4. Christian Piovera: “Ultrafast laser-induced dynamics in ferromagnets” (2013).

5. Fabio Boschini: “Ultrafast Electron Dynamics in Three-dimensional Topological Insulators Investigated by Time- and Angle-Resolved Photoemission Spectroscopy” (2015).
6. Hamoon Hedayat: “Ultrafast Magneto-optic Spectroscopic Ellipsometry: Genuine Magnetization Dynamics in Half-metallic and Metallic Systems upon Laser Excitation” (2015).
7. Arianna Ceraso: “Investigations of photo-excited two-dimensional materials by combined ultrafast spectroscopy techniques” (2022).
8. Narges Tarakameh Samani: Ph.D. thesis started December 2022 in the UPhOS laboratory on Ultrafast Time-resolved ARPES experiments on bidimensional materials.

I have supervised several Master Degree students during their activity of about 8 months towards the “Laurea Magistrale” in Engineering Physics.

I have supervised every year, since the third year of foundation of Engineering Physics at Politecnico di Milano, i.e. since Academic Year 2003-2004, a group of 4 students during two weeks of activity in our laboratories at the Department of Physics.

Organization of Conferences

1. Member of the Program Committee of the 2nd International Workshop on "Hard X-ray Photoelectron Spectroscopy" held at SPring-8 (Sayo, Hyogo, Japan) on 19-20 September, 2006.
2. Member of the Program Committee of the 6th International Conference on Inelastic X-ray Scattering (IXS2007) held from May 7 through 11, 2007 in Awaji, Japan.
3. Chairperson of the international conference on Inelastic X-ray Scattering IXS2010 held at ESRF (Grenoble, France) in Grenoble, 11-14 October 2010.
4. Organizer of the symposium on “Advanced experimental techniques for magnetic materials” at the international conference Joint European Magnetic Symposia JEMS2012 held in Parma, Italy, 9-14 September 2012.
5. Member of the organizing committee of the CMD30 – FISMAT conference held at Politecnico di Milano, Italy, 4-8 September 2023.

Invited seminars and talks at conferences

1. Invited talk at *HaXPES (Hard X-ray PhotoEmission Spectroscopy) Workshop*, held 11-12 September 2003 at ESRF. The title of the talk was: “Looking 100 Å deep into spatially inhomogeneous dilute systems with Hard X-ray photoemission”.
2. Invited seminar at the Swiss Light Source (hosted by Dr. R. Abela), 18 June 2004. The title of the talk was: “Looking deep into solids by high energy X-ray spectroscopies”.
3. Invited talk at the *Second International Symposium on "Physics of Solids Under High Pressure Using Nuclear Probes"* (HPNP' 04), 20-24 July 2004 in Köln, Germany. The title of the talk is: “Intermediate valence behavior under pressure: how precisely can we probe it by resonant inelastic X-ray scattering?”.

4. Invited talk at the *Gordon Conference on Charge Densities and Bonding* in the session entitled “Many-electron effects” (Mount Holyoke College, South Hadley, MA, USA, 4-9 July, 2004). The title of the talk was: “Resonant Inelastic X-ray scattering investigation of many electron systems”.
5. Invited talk at the *Fourth Conference on Synchrotron Radiation in Materials Science* (SRMS-4), 23-25 August 2004 in Grenoble, France. The title of the talk was: “Hard X-ray Photoemission: a tool for depth-resolved chemical information”.
6. Invited talk at the *5th International Conference on Inelastic X-ray Scattering* (IXS2004), at Argonne National Laboratory, 19-24 September 2004. The title of the talk was: “High-energy photoemission: bulk sensitivity and non-destructive depth profiling”.
7. Invited talk at the *Workshop on Surface and Interface Science at the ESRF*, September 30 – October 1 2004, to be held at ESRF. The title of the talk was “State of the art of XPS and Hard X-ray Photoemission Spectroscopy”.
8. Invited lecture at the *Osaka-Grenoble summer school on Heavy Fermions*, CEA, Grenoble 19-23 July 2005. The title of the lecture was “High energy spectroscopy studies of heavy fermion compounds”.
9. Invited talk at *SOLEIL Workshop “Magnétisme à SOLEIL”*, January 16th 2006, title of the talk: “Electronic and magnetic excitations in strongly correlated materials”
10. Invited Colloquium at Warwick University February 22nd 2006, title of the talk: “High-energy spectroscopy for the study of strongly correlated materials”.
11. Invited talk at Sagamore XV conference on “ELECTRON CHARGE SPIN AND MOMENTUM DENSITIES”, 13-18 August 2006, Bosworth Hall. Title of the talk: “High-Energy Photoemission Studies of Rare Earths”.
12. Invited talk at the 6th International Conference on Synchrotron Radiation in Materials Science (Campinas, Brazil) [not attended due to maternity leave].
13. Invited talk at the Workshop IXS2008 in Uppsala Sweden [not attended due to maternity leave].
14. Contributed talk at Ultrafast laser control of spins in nanomagnets EU FR7 Networks FANTOMAS and Ultramagnetron International school/workshop, October 25-30 2009, Nijmegen, the Netherlands. Title of the talk: “Ultrafast Magnetization Dynamics seen by MagnetoOptical Kerr Effect”.
15. Invited talk at “2011 Nanoscience and Nanotechnology”, Frascati, September 19th 2011, title of the talk: “Optical Control of the Magnetization in Ferromagnetic films”.
16. Invited talk at Workshop “Magnetic Order in Nanostructures and Spectroscopy 2012” at University Roma III, September 15th 2012, title of the talk: “Optical Control of the Magnetization in Ferromagnetic films”.
17. Invited talk at Conference SMEC2013 “Study of matter at extreme conditions” (Miami - Eastern Caribbean. March 23 to March 30 2013), High pressure studies on strongly correlated electron systems organized by Ravhi S. Kumar (High Pressure Science and Engineering Center, Department of Physics University of Nevada Las

Vegas, USA) and James Hamlin (University of Florida, Gainesville, USA) (not attended due to maternity leave).

Fundings

1. **May 2000**: holder of a research funding (15 k€) from INFM for the feasibility study of photoemission spectroscopy in the several keV energy range.
2. Responsible of the project **PRIN 2006**: “Disclosing the ultrafast electronic and spin dynamics in strongly correlated systems through femtosecond time-resolved photoemission, optical spectroscopies and magneto-optical Kerr effect”. The project was funded for 54 k€ and lasted 2 years, from March 2007 until February 2009.
3. Responsible of the project “Dynamical characterization of novel materials for ultrafast devices” (Project number 2008-2470) financed by Fondazione Cariplo on the **2008** call for "Scientific and Technological Research on Advanced Materials", project number 2008-2470. The project was funded for 157 k€ and lasted from April 2009 to December 2012.
4. Responsible of the project “Magnetization Control by Means of Ultrafast Optical Excitations in Materials for Fast Devices” (Project number 2011-0389) financed by Fondazione Cariplo on the **2011** call for "Scientific and Technological Research on Advanced Materials", project number 2008-2470. The project was funded for 150 k€ and lasted from May 2012 to September 2015. The project was in partnership with the CNR Milano unit (responsible Dr. Ettore Carpane).
5. Scientific responsible of the Interdepartmental Research Laboratory “UPhOS” (“Ultrafast Photoemission and Optical Spectroscopy”). The Laboratory was funded by Politecnico di Milano in January **2016** for a time duration of 3 years. The funding of 144.789 euro is devoted to the purchase of a hemispherical photoelectron analyzer for angle- and time-resolved photoemission experiments, initially on topological insulators and other systems both of applied and fundamental interest. The project is in collaboration with the DEIB Department of Politecnico, where prof. Daniele Ielmini will perform transport measurements on the same systems.
6. Responsible of the industrial consulting contract with “Società Gilardoni”, March **2015** until May **2016**. The project title is "Material recognition through X ray analysis by solid state detectors". The project cost was 30.000 euros.
7. Participant to project PRIN **2017**: “Tuning and understanding Quantum phases in 2D materials - Quantum2D”. The project was funded for 263.000 euros for the Research Unit of Milano Politecnico (the total funding of the project amounts to 1.2 Meuros). The project started in August 2018 and will last for 3.5 years.
8. Participant to project PRIN 2020: “Quantum Transition-metal FLUOrides (QT-FLUO)”. The project was funded for 150.000 euros for the Research Unit of Milano Politecnico (the total funding of the project amounts to 902.000 euros). The project started in 2021 and will last for 3 years.

Honors

1. **May 1990:** Prize by the "Banca Popolare di Luino e Varese" (awarded to the 4 best students of the Politecnico).
2. **February 2003:** *ESRF Young Scientist Award*, yearly award given to one scientist younger than 35 for excellent results in the field of Synchrotron Radiation at ESRF. I was awarded the prize for my results in the field of Resonant Inelastic X-ray Scattering and High-Energy Photoemission Spectroscopy obtained at ESRF.

Resumé of Research Activity

(references in brackets are made to the article listed at the end of the document).

My research interests concern the electronic properties of strongly correlated materials and magnetic materials. I am deeply involved in the development of new spectroscopic techniques and instrumentation for advanced synchrotron radiation experiments and time-resolved experiments that exploit ultra-fast laser pulses. My research activity is summarized hereafter by subdividing it in its two main lines, **spectroscopy excited by synchrotron radiation** and **time-resolved spectroscopy excited by ultrafast laser pulses**.

Spectroscopy excited by synchrotron radiation

Since the early beginning of my career, already as a student, I have been involved in instrumental development and experiments with Synchrotron Radiation, mainly at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France. The largest part of my time was dedicated to Resonant Inelastic X-ray Scattering, but a consistent portion of my activity was devoted to Photoemission Spectroscopy in the High Energy X-ray range.

1. Resonant Inelastic X-ray Scattering: with the group to which I initially belonged, led by prof. Lucio Braicovich, I performed experiments in the soft and hard X-ray energy range. In the *soft X-ray* range the experiments were done by using the Advanced Spectrometer for soft X-ray Emission Spectroscopy AXES that we had built at the Department of Physics at Politecnico during my master thesis and PhD period [2,3,4]. The spectrometer was permanently installed on the soft X-ray beamline of ESRF (ID12B and then ID8) and regularly upgraded (until 2014 when it was dismissed and followed by a new spectrograph ERIXS). The first experiments addressed lineshape effects in the emission process[1,9,11,15,24], spin-flip excitations in NiO and Gd₃Ga₅O₁₂ [7,8,44,56] and thanks to the available full polarization control of the X-ray beam, dichroic effects in the emission process from magnetic alloys [5,6,12,13,32,59]. After a considerable resolution improvement associated with the new CCD detector [57], our activity concentrated on the study of the electronic ligand field effects in cuprates, manganates and vanadium compounds (as a function of electronic doping and strain conditions among others). [29,39,48,55,61,62,64,66,68,73,80,102] One notable achievement was the measurement of the low-energy crystal-field excitations in cuprate

compounds, thanks to the world-record resolution of the soft X-ray spectrometer. We also investigated hybridization effects in cerium compounds and configuration interaction effects e.g. in rare earth compounds [14,17,18,21,26,30]. Through the technique of Resonant X-ray Emission we succeeded in detecting sub-femtosecond dynamics in magnetic elements Fe, Co and Ni. I would also like to mention that during the years of intense activity in the RIXS experiments, in which we had strong collaboration with theoretical groups, I led the computational activity that led to the implementation of the Atomic Multiplet Calculation program by Robert D. Cowan. With the PhD student Riccardo Gusmeroli we developed a user-friendly interface that is still publicly available from the ESRF Website [<https://www.esrf.fr/computing/scientific/MISSING/>]. Our work allowed also experimentalist to perform the simple calculations that are sometimes needed to get insight into experimental results.

I have further pursued my X-ray emission activity in the soft X-ray range at the ESRF and at the Swiss Light Source, as part of the team in charge of building the X-ray emission spectrometer with record resolving power of 10000, now installed at the beamline ADRESS. [45, 54, 60, 69, 70].

In the *hard X-ray* range I started a productive study of the electronic structure of intermediate valence compounds and of their changes as a function of temperature, pressure, composition. All experiments were performed with the X-ray emission spectrometer that I built during my postdoctoral activity at ESRF, at beamline ID26 of the ESRF, and on an identical instrument on ID16 of the ESRF [16,20]. The focus was in the beginning on Ytterbium and its compounds (YbInCu₄, YbAgCu₄, YbAl₂, YbS). The experiment we performed on YbInCu₄ and YbAgCu₄, in collaboration with prof. Marco Grioni of the Ecole Polytechnique Fédérale de Lausanne, gave the first spectroscopic evidence of the temperature induced changes in the *4f* occupation number (predicted by the Kondo model but never observed). These experiments established Resonant Inelastic X-ray Scattering as a powerful and bulk-sensitive probe of the electronic structure [22,23,25,27,28,31,33,34,37,52,58], also on other compounds like nickelates [49,74]. An experiment on the pressure induced valence transition of SmS demonstrated the unprecedented sensitivity of RIXS to changes in the electronic valence [51]. I also coordinated, in collaboration with the High-Pressure group of the Université Pierre et Marie Curie in Paris, efforts to develop an experimental sample environment enabling the exploration of the Pressure-Temperature phase diagram in a broad parameter range. This has set the premises for a subsequent and still ongoing activity of investigation, by X-ray emission spectroscopy, of electronic properties of novel compounds characterized by strongly correlated behavior, with the advantage of chemical and bulk sensitivity provided by this resonant technique [82,90].

2. Hard X-ray photoemission spectroscopy: I started this activity as a PhD student by setting up the experimental facility for performing photoemission experiments in the high energy regime. The first pioneering experiment took place on beamline ID12A of the ESRF and investigated the different hybridization in the bulk and at the surface of

cerium compounds. It exploited the increase of the probing depth with increasing photon energy, from 1 to 4 keV [10]. Further experiments performed at the ESRF beamline ID32, at photon energies from 3 to 7 keV and detecting photoelectrons with kinetic energies between 2 and 6 keV, addressed compounds of samarium and other rare earths compounds [19,40-43,46,47]. We proved that at the highest photon energy of 7 keV we achieved a bulk sensitivity as large as ~ 100 Å. This result was obtained on a nanostructured sample with a buried layer of AlAs in GaAs [36]. We have then exploited the unique energy dependence of photoelectrons escape depth to perform a non-destructive depth-profile analysis of systems of technological interest in semiconductor industry (high-k dielectric oxides and their interface to a silicon substrate) [53].

Beside these main lines of research, I have carried out other complementary experiments at ESRF, namely:

- High-energy angular resolved photoemission on high-temperature superconductors. [35, 38, 67].
- Circular magnetic dichroism in X-ray absorption to probe magnetism in nanostructures (like cobalt adatoms deposited on silver). We have obtained evidence of a strong reduction of orbital momentum *quenching* of single atoms.
- Linear magnetic dichroism in X-ray absorption to determine the microscopic contribution to the magnetocrystalline anisotropy (as in Cu/Ni surface alloys).

Time-resolved spectroscopy excited by ultrafast laser pulses

Starting from approximately year 2004 my experimental activity has been devoted to on campus time-resolved spectroscopy of solids. The first rather pioneering experiments were performed with the existing UV and soft X-ray source based on high-harmonic generation of a Titanium:Sapphire laser with few femtoseconds resolution, in the laboratory of prof. Mauro Nisoli. We succeeded in measuring absorption spectra through thin transition metal films, demonstrating the possibility of using higher order laser harmonics to perform spectroscopic experiments [50]. Although we could not reveal time-resolved effects, this experiment was the starting point of a long-sought collaboration between the two “souls” of the Physics Department, the Laser group and the Solid State Physics group. The next step of the collaboration was the design and construction of a photoelectron analyzer based on the *Time Of Flight* principle to perform time-resolved photoemission experiments with femtosecond resolution in the then recently founded ULTRAS (Ultrafast Science) laboratory at the Department. The laboratory was based on a Ti:Sapphire laser source providing pulses of 1.5 eV with 50 fs duration at 1 kHz repetition rate at 2 J energy that fed several experiments. The Time of Flight analyzer was entirely in-house built, mainly by myself and by Dr. Ettore Carpene who joined the group as a CNR researcher [71]. The optical beamline needed to multiply the photon frequency was designed and built by us in close collaboration with

Dr. Cristian Manzoni and prof. Giulio Cerullo of the Department. This experimental setup demonstrated the feasibility of the technique but the repetition rate of the laser source was too low for efficient time-resolved photoemission experiments.

In parallel to this activity we developed a set up for experiments [86] of time-resolved reflectivity and time-resolved magnetooptical Kerr effect to study the magnetization dynamics. This was done in close collaboration with prof. Ezio Puppini who had started in the nineties the experimental activity of magnetooptical Kerr effect in the Physics Department. The main achievements in the field of time-resolved optical experiments have been (i) the disentanglement of magnetic and optical effects in pump-probe magnetooptical Kerr effect experiments, which represents an important contribution to the still debated interpretation of time-resolved MOKE; and (ii) the observation of the magnetization dynamics of Fe and the identification of electron-magnon scattering as the driving mechanism of demagnetization. This result has been a milestone in the explanation of the ultrafast demagnetization process. In several other experiments we have investigated the ultrafast demagnetization times and pathways. [63,65,72,75-79,81,83,84,87,88,89]. More recently, we have upgraded our experimental setup with a spectrograph that allows us to perform optical experiments at different wavelengths. We have collaborated with the group of prof. Markus Münzenberg of the Universität Greifswald in Germany and with the group of dott. Giancarlo Panaccione of the Sincrotrone Elettra. [91,92,93,99].

The time and angle resolved photoemission activity was boosted by the acquisition, thanks to collaboration with the group of prof. Giulio Cerullo, of an Ytterbium laser whose repetition rate of 100 kHz has largely improved the feasibility of the photoemission experiments [85]. Another crucial step forward for the experimental activity has been the purchase of a hemispherical photoelectron analyzer, that greatly improved the efficiency of the setup and allowed us to measure angular resolved spectra. The acquisition of the hemispherical analyzer was possible thanks to the funding received in year 2016 from Politecnico di Milano in the frame of the “Laboratorio Interdipartimentale di Ateneo UPhOS (Ultrafast Photoemission and Optical Spectroscopy)”. We have performed the time and angular resolved photoemission study of topological insulators (Bi_2Se_3 , Bi_2Te_3 and $\text{Bi}_{2-x}\text{Sb}_x\text{Se}_{3-y}\text{Te}_y$), obtained in collaboration with the Institute of Physics of the Chinese Academy of Science (group of prof. Xingjiang Zhou), to reveal the dynamics of the surface and bulk electronic states and in particular of the Dirac cone of these novel compounds [94-97,104]. We have since several years an important collaboration with the group of Enrico Da Como at the University of Bath. In the frame of this cooperation we have performed experiments on topological insulators of the $\text{Bi}_2\text{Se}_{3-x}\text{Te}_x$ family and on the Charge Density Wave material 1T-TaSe₂ and 1T-TiSe₂ [98,100,103,105]. Another ongoing collaboration is with the group of prof. A.C. Ferrari of the Cambridge Graphene Centre, with whom we investigated the ultrafast behavior of black phosphorus [106]. We have open collaboration with dott. Fabio Boschini [101], with the group of prof. Marco Grioni of the Ecole Polytechnique Fédérale de Lausanne (again on the

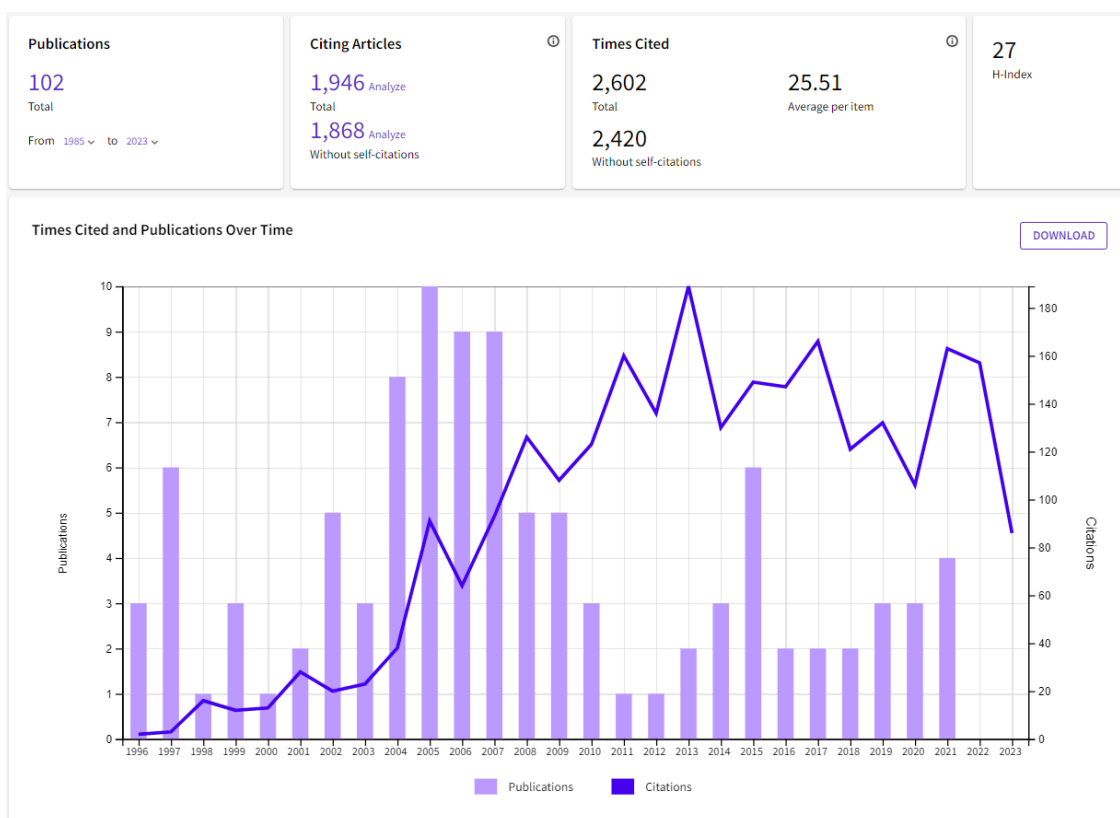
family of topological insulators) and of prof. Cesare Soci of the Nanyang Technological University di Singapore (on heterostructures of technological interest).

The described activity in the field of time-resolved experiments has been performed from the beginning together with dott. Ettore Carpane, a CNR researcher who has been together with myself the backbone of all projects. Another person that I want to name for his long period of activity with our group is dott. Hamoon Hedayat, who did his PhD thesis in our group and worked with us until December 2020.

As a final remark I want to mention that time and angle resolved photoemission experiments are performed at very few laboratories around the world, due to the difficulty of having in the same group expertise both in the field of ultrashort pulses and of photoemission technique, and I consider the realization of the necessary collaboration and the success of the corresponding experiments as my main recent achievement.

Milano, September 1st 2023

PUBLICATIONS OF CLAUDIA DALLERA



1. C. Dallera, B. De Michelis, E. Puppini, L. Braicovich, and N.B. Brookes, "The electronic states of the θ' phase in Cu-Al alloys as compared to CuAl_2 : Cu L_α emission excited directly by undulator radiation", *Physical Review B* 53, 965 (15 January 1996).
2. N.B. Brookes, J.B. Goedkoop, J. Goulon, L. Braicovich, C. Dallera, G. Ghiringhelli, "The AXES Project at BL26", *ESRF Newsletters*, 24, 26 (June 1995).
3. C. Dallera, G. Ghiringhelli and L. Braicovich, "A magnetizing system for dichroism measurements in soft X-ray emission excited by synchrotron radiation", *Review of Scientific Instruments* 67 (2), 355 (February 1996).
4. C. Dallera, E. Puppini, A. Fasana, G. Trezzi, N. Incorvaia, L. Braicovich, N.B. Brookes and J.B. Goedkoop, "Soft X-ray emission spectroscopy at ESRF Beam Line 26 based on a helical undulator", *Journal of Synchrotron Radiation* 3, 231 (1996).
5. L. Braicovich, N.B. Brookes, C. Dallera, G. Ghiringhelli, J.B. Goedkoop, "Resonant Inelastic Scattering using Circularly Polarized Soft X-rays", *ESRF Newsletters*, 26, 12 (July 1996).
6. L. Braicovich, C. Dallera, G. Ghiringhelli, N.B. Brookes, and J.B. Goedkoop, "Magnetic circular dichroism in L_3 resonant soft-X-ray inelastic scattering of disordered Fe-Co alloys", *Physical Review B Rapid Communications* 55, R14729 (1 June 1997).

7. L. Braicovich, C. Dallera, G. Ghiringhelli, N.B. Brookes, J.B. Goedkoop, and M.A. van Veenendaal, "X-ray $L_{2,3}$ resonant Raman scattering from NiO: Spin flip and intermediate-state relaxation", *Physical Review B Rapid Communications* 55, R15989 (15 June 1997).
8. C. Dallera, L. Braicovich, G. Ghiringhelli, M.A. van Veenendaal, J.B. Goedkoop, and N.B. Brookes, "Resonant Soft X-ray Inelastic Scattering from Gd in the $Gd_3Ga_5O_{12}$ Garnet with Excitation across the M_5 edge", *Physical Review B* 56, 1279 (15 July 1997).
9. L. Braicovich, C. Dallera, G. Ghiringhelli, and N.B. Brookes, "Inelastic X-ray Scattering at the L_3 Threshold of Cobalt", *Solid State Communications* 102, 709 (1997).
10. L. Braicovich, N.B. Brookes, C. Dallera, M. Salvietti, and G.L. Olcese, "High Energy Ce-3d Photoemission: Bulk Properties of $CeTM_2$ (TM= Fe, Co, Ni) and Ce_7Ni_3 ", *Physical Review B* 56, 15047 (15 December 1997).
11. L. Braicovich, C. Dallera, G. Ghiringhelli, N.B. Brookes, "Electronic $2p-3d-3s^1$ Resonant Raman scattering in 3d Transition Metals systems", Abstract in the *Proceedings of the 9th International Conference on X-ray Absorption Fine Structure*, 26-31 August 1996, Grenoble (France), article in *Journal de Physique IV FRANCE 7 Colloque C2*, p. 357 (1997).
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