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**Nationality:** ITALIAN



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### EDUCATION

**2001 PhD in Physics**, Title “Resonant spectroscopies with circularly polarised soft x-rays”, U. Joseph Fourier, Grenoble (F)

**1995 MS (Laurea)** Nuclear Engineering, Politecnico di Milano (I)

**1995 MS (Diplôme d’Ingénieur)**, Ecole Nationale Supérieure de Techniques Avancées (ENSTA), Paris (I)

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### CURRENT POSITION

**2017 - Professor**, Physics Department, Politecnico di Milano (I)

**2001 - Visiting Scientist**, European Synchrotron Radiation Facility, Grenoble (F)

2005 - Associate Researcher, SPIN Institute, CNR, Napoli (I)

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### PREVIOUS POSITIONS

**2005 – 2017 Associate Professor**, Physics Department, Politecnico di Milano (I)

**2001 – 2005 Assistant Professor (Ricercatore Universitario)**, Physics Department, Politecnico di Milano (I)

**2011 (4 months) Visiting Scholar**, Stanford Linear Accelerator Center (SLAC) and Stanford University (US)

**2006 – 2009 Visiting Scientist**, Paul Scherrer Institut, Villigen (CH)

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### FELLOWSHIPS AND AWARDS

**2018 EPS CMD Europhysics Prize**, 13th March 2018, Berlin (Germany), “for the development and scientific exploration of high-resolution Resonant Inelastic X-ray Scattering (RIXS)”, together with Lucio Braicovich. The EPS CMD Europhysics Prize is awarded every 2 years for a recent work by one or more individuals in the area of physics of condensed matter, specifically work leading to advances in the fields of electronic, electrical and materials engineering which, in the opinion of the Society's selection committee, represents scientific excellence.

**2015 Kai Siegbahn Prize**, 14th September 2015, Uppsala (Sweden), “for his outstanding, innovative work in the experimental development and scientific exploitation of Resonant Inelastic X-ray Scattering [...] as a new and key tool to understand magnetic and electronic excitations in highly correlated transition metal compounds”.

**2013 Vacuum Ultraviolet and X-ray physics (VUVX2013) International Conference Award**, Hefei (China) for “For his contributions to the development of new soft X-ray techniques and their application to correlated electron materials. Of particular note are studies of magnetic excitations in superconducting cuprates and contributions to development of advanced instruments for resonant inelastic scattering (RIXS).”

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### SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

**2005 – 2018 2 Postdocs, 6 PhD, 39 Master Students**, Physics Department, Politecnico di Milano, Italy. In particular:

Valentina Bisogni (PhD 2007-2010) is now Assistant Physicist at Brookhaven National Lab (USA). Marco Moretti Sala

(PhD 2008-2011) beam line responsible at ESRF (France) until Dec 2017, now Associate Professor at Politecnico di Milano. Matteo Minola (PhD 2010-2013) now Head of group and von Humboldt grant at max Planck Institute for Solid State Research Stuttgart (Germany)

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## TEACHING ACTIVITIES

**2017** – Lecturer School on UV and X-ray spectroscopies of strongly correlated systems (**SUCCESS-2017**), **Les Houches (F)**  
**2016 and 2018** – Lecturer School on Synchrotron and FEL Based Methods| (smr 2812), **ICTP, Trieste (I)**  
**2015 and 2017** – Lecturer, **RACIRI summer school**, DESY, Hamburg (D); **HERCULES Specialized Course**, ESRF, Grenoble (F);  
**SILS school on Synchrotron Radiation**, Grado and Muggia (I)  
**2012 – 2017** Professor, **Spectroscopy of Solids (PhD, 20 students)**, Politecnico di Milano (I)  
**2011** Lecturer, **Summer School, Max-Planck-UBC Centre for Quantum Materials**, University of British Columbia (CA)  
**2010 – 2018** Professor, **Physics of low dimensional physics (MS 1<sup>st</sup> year, 20-30 students)**, Politecnico di Milano (I)  
**2001 – 2018** Professor, **Basic Physics for Engineering (Mechanics, Thermodynamics, Electromagnetism, BS 1<sup>nd</sup> year, 100-250 students)**, Politecnico di Milano (I)

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## SCIENTIFIC LEADERSHIP

2011 – Main non-German partner of the **hRIXS consortium** (lead by A. Fölich) for the construction of a high resolution RIXS endstation at the XFEL (EU). Responsible for the optical design  
2007 – 2015 Co-proposer, with N.B. Brookes and L. Braicovich of the **ERIXS (European RIXS facility) project for the ESRF**. Responsible for the design of the ERIXS spectrometer  
2005 – 2009 Executive manager of the **SAXES project** jointly developed with the SLS/PSI  
2003 – 2013 Executive manager of the **AXES project** of the INFM/CNR at the ESRF

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## INSTITUTIONAL RESPONSIBILITIES

2011 – 2018 **Faculty member of PhD School in Physics**, Politecnico di Milano (I)  
2008 – 2018 **Member the MS in Engineering Physics admission Committee**, Politecnico di Milano (I)

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## COMMISSIONS OF TRUST

**2015 - 2020** Member, **Scientific Advisory Council, ESRF**, Grenoble (F)  
**2012 – 2015** Member, **Scientific Advisory Council, Diamond Light Source (UK)**  
**2016 – 2018** Chair of “Working group on large scale facilities” of the Dipartimento “Fisica” (DSFTM) of **CNR (I)**  
**2013 – 2015** Chair of the “Advisory committee for the research made with neutrons and synchrotron radiation” of the Consiglio Nazionale delle Ricerche (**CNR**, Italy)  
**2013** – Member **Magnetism-Spectroscopy Panel** ELETTRA Trieste for the review of 3 beam lines  
**2010 – 2012** Member, **HE proposal Review Committee** of the ESRF

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## PUBLICATIONS, INVITED TALKS, SYNCHROTRON BEAM TIME

**150+ publications** listed in the ISI Web of Science, **43 in high impact journals (Science, Nature Group, Phys. Rev. Lett.)** all with international collaborators, 4720+ citations, **h=38**.  
**50+ invited presentations** at international conferences and workshops in the last 10 years.  
**50+ official experiments** at ESRF and SLS/PSI in the last 10 years, of whom **15+ as PI**

## TEN YEARS TRACK-RECORD

## NARRATIVE SUMMARY

Since the PhD (1997-2001) I have been working in advanced resonant x-ray spectroscopy. I have combined my background as engineer, my inclination for practical realizations, my curiosity for advanced technology and my profound interest for basic science to the advancement of **high resolution RIXS** in all its aspects. The principle of the method had been demonstrated in the early nineties, but for several years the inadequacy of the instrumentation had impeded its full development. In the last 10 years I have been the main actor in the transformation of RIXS from a niche spectroscopy to a mainstream technique that every prestigious synchrotron and free electron laser (FEL) facility worldwide is planning to have as a key tool for the most advanced studies of strongly correlated materials. RIXS end-stations have been built at Diamond Light Source, NSLS II, MAX IV, TPS, BESSY II.

I have always been working with Lucio Braicovich, who had started the RIXS activity of our group at the European Synchrotron Radiation Facility (ESRF) in 1994 and retired as professor of the Politecnico di Milano in 2009 but still active in research. I have worked first to the improvement of the resolution of the AXES spectrometer at ID08 of the ESRF, reduced by almost a factor 10 in 15 years [2,9]. Then I have led the design and construction of the SAXES instrument [10] for the SLS/PSI in Switzerland, which, from 2007 to 2015, has been by far the best high resolution soft x-ray RIXS spectrometer in the world [5,6,7,10]. Convinced by the success of SAXES, with Nick Brookes I have proposed and designed the ERIXS instrument for the new ID32 very long beam line of the ESRF: preliminary spectra (from April 2015) have immediately scored a new record in resolution (2x better than SAXES, 4x since 2017). In the first 3 years of operations ERIXS has set the new standard for RIXS, with resolution as good as 30 meV at Cu L<sub>3</sub>. The first experiments have led to publications in Nature Physics [2], Nature Materials [1], PNAS. Finally, I have been working in the last year to the design of the hRIXS instrument to be installed at the SCS beam line of the European XFEL in Hamburg, allowing RIXS to be used for time-resolved experiments and to explore non-linear phenomena in the soft x-ray regime.

**It must be noted that almost 100% of the high resolution RIXS results published worldwide in the last 10 years have been obtained with AXES, SAXES or ERIXS.**

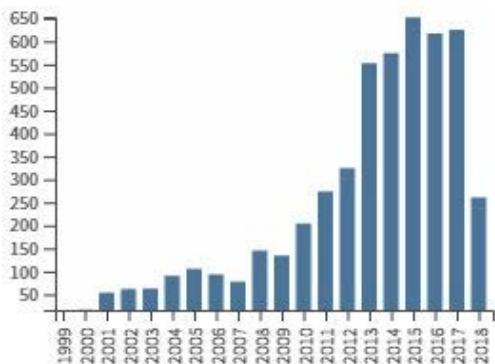
The success of RIXS is not due to mere technical achievements. In fact my group, in collaboration first with **Jeroen van den Brink** (IFW Dresden) and, more recently, with **Tom Devereaux** (Stanford) for the theory of RIXS, and with **Bernhard Keimer and Mathieu Le Tacon** (Max Planck Stuttgart) and several other groups for the experiments, has demonstrated the exceptional usefulness of RIXS for the **study of orbital, magnetic and charge excitations of high Tc cuprate superconductors (HTS) [3,5,7,8]**. RIXS is seen today the only alternative to inelastic neutron scattering. Moreover with RIXS we have discovered the bulk charge density waves in YBCO [4] and, recently, in overdoped Bi2201 [1], a phenomenon predicted by theory but very difficult to observe. Resonant soft x-ray scattering is currently revolutionizing the field of high Tc superconductivity.

## 10 MOST RELEVANT PUBLICATIONS

- [1] Peng YY, Fumagalli R, Ding Y, Minola M, Caprara S, Betto D, De Luca GM, Kummer K, Lefrançois E, Salluzzo M, Suzuki H, Le Tacon M, Zhou XJ, Brookes NB, Keimer B, Braicovich L, Grilli M, **Ghiringhelli G**, *Re-entrant charge order in overdoped (Bi,Pb)2.12Sr1.88CuO6+δ outside the pseudogap regime*, Nature Materials, DOI: 10.1038/s41563-018-0108-3; just published on line, experiment made with ERIXS
- [2] Peng YY, Dellea G, Minola M, Conni M, Amorese A, Di Castro D, De Luca GM, Kummer K, Salluzzo M, Sun X, Zhou XJ, Balestrino G, Le Tacon M, Keimer B, Braicovich L, Brookes NB, and **Ghiringhelli G**, *Influence of apical oxygen on the extent of in-plane exchange interaction in cuprate superconductors*, Nature Physics **13**, 1201 (2017); 3 citations, very first user experiment of ERIXS.

- [3] Dean MPM, Dellea G, Springell RS, Yakhou-Harris F, Kummer K, Brookes NB, Liu X, Sun Y-, Strle J, Schmitt T, Braicovich L, **Ghiringhelli G**, Bozovic I, and Hill JP. , *Persistence of magnetic excitations in  $La_{2-x}Sr_xCuO_4$  from the undoped insulator to the heavily overdoped non-superconducting metal*, Nature Materials **12**,(11) 1018-1022 (2013); **98 citations**; experiment made with AXES.
- [4] **Ghiringhelli G**, Le Tacon M, Minola M, Blanco-Canosa S, Mazzoli C, Brookes NB, De Luca GM, Frano A, Hawthorn DG, He F, Loew T, Sala MM, Peets DC, Salluzzo M, Schierle E, Sutarto R, Sawatzky GA, Weschke E, Keimer B, and Braicovich L. , *Long-Range Incommensurate Charge Fluctuations in  $(Y,Nd)Ba_2Cu_3O_{6+x}$* , Science **337**,(6096) 821-825 (2012); **529 citations**; experiment made with SAXES, AXES and a diffractometer at Bessy II.
- [5] Le Tacon M, **Ghiringhelli G**, Chaloupka J, Sala MM, Hinkov V, Haverkort MW, Minola M, Bakr M, Zhou KJ, Blanco-Canosa S, Monney C, Song YT, Sun GL, Lin CT, De Luca GM, Salluzzo M, Khaliullin G, Schmitt T, Braicovich L, and Keimer B. , *Intense paramagnon excitations in a large family of high-temperature superconductors RID D-2319-2009*, Nature Physics **7**,(9) 725-730 (2011); **193 citations**; experiment made with SAXES.
- [6] Moretti Sala M, Bisogni V, Aruta C, Balestrino G, Berger H, Brookes NB, de Luca GM, Di Castro D, Grioni M, Guarise M, Medaglia PG, Granozio FM, Minola M, Perna P, Radovic M, Salluzzo M, Schmitt T, Zhou KJ, Braicovich L, and **Ghiringhelli G**. , *Energy and symmetry of dd excitations in undoped layered cuprates measured by Cu L-3 resonant inelastic x-ray scattering*, New Journal of Physics **13**, 043026 (2011); **47 citations**; experiment made with SAXES.
- [7] Braicovich L, van den Brink J, Bisogni V, Sala MM, Ament LJP, Brookes NB, De Luca GM, Salluzzo M, Schmitt T, Strocov VN, and **Ghiringhelli G**. , *Magnetic Excitations and Phase Separation in the Underdoped  $La_{2-x}Sr_xCuO_4$  Superconductor Measured by Resonant Inelastic X-Ray Scattering*, Phys Rev Lett **104**,(7) 077002 (2010) ; **150 citations**; experiment made with SAXES.
- [8] Ament LJP, **Ghiringhelli G**, Sala MM, Braicovich L, and van den Brink J. , *Theoretical Demonstration of How the Dispersion of Magnetic Excitations in Cuprate Compounds can be Determined Using Resonant Inelastic X-Ray Scattering*, Phys Rev Lett **103**,(11) 117003 (2009); **90 citations**; theoretical work.
- [9] Braicovich L, Ament LJP, Bisogni V, Forte F, Aruta C, Balestrino G, Brookes NB, De Luca GM, Medaglia PG, Miletto Granozio F, Radovic M, Salluzzo M, van dB, and **Ghiringhelli G**. , *Dispersion of Magnetic Excitations in the Cuprate  $La_2CuO_4$  and  $CaCuO_2$  Compounds Measured Using Resonant X-Ray Scattering*, Phys Rev Lett **102**, 167401 (4p) (2009); **93 citations**, experiment made with AXES.
- [10] **Ghiringhelli G**, Piazzalunga A, Dallera C, Trezzi G, Braicovich L, Schmitt T, Strocov VN, Betemps R, Patthey L, Wang X, and Grioni M. , *SAXES, a high resolution spectrometer for resonant x-ray emission in the 400-1600 eV energy range*, Rev Sci Instrum **77**,(11) 113108 (2006); **160 citations**; description of the SAXES instrument.

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 STATISTICAL FACTS FROM ISI WEB OF SCIENCE (JUNE 20, 2018):


In total

153 publications in Journals listed in the ISI WoS

4955 citations (4419 without self-citations),

**h-index: 38**

In the last 10 years,

**76 publications, 3200 citations, h-index=27.**

**1 Science, 4 Nature Physics, 3 Nature Materials, 3 Nature Communications, 17 Phy Rev Lett, 29 Phys Rev B**