

# Giovanni Onida

## CURRICULUM VITAE

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### PROFESSIONAL EXPERIENCE

- \* From 2001 to 2016: Associate Professor in Condensed Matter Physics at the Università degli Studi di Milano, Milan (Italy).
- \* From 1995 to 2001: Assistant Professor in Condensed Matter Physics at the Università di Roma Tor Vergata, Rome (Italy).
- \* 1993-1994: CNRS Researcher (*poste rouge*) at the Ecole Polytechnique (Paris, France).
- \* 1992: Post-doctoral fellow at the CECAM (Centre Européen de Calcul Atomique et Moléculaire, Université Paris XI, France) and at the Zurich IBM laboratory (Rueschlikon, Switzerland).

### EDUCATION

- \* 1991: PhD in Physics at the Università degli Studi di Milano, Milan (Italy);
- \* 1987: B.S. in Physics, Università degli Studi di Pavia (Pavia, Italy) (110/110 cum laude);
- \* 1982: High School Diploma (60/60) at the Liceo Scientifico Statale "S. Allende", Milan.

### MANAGEMENT ACTIVITIES / PROFESSIONAL SERVICE ACTIVITIES

- \* Director of the Physics Department of the University of Milan (mandate 2017-2020); Deputy-director from 17/5/2012 to 30/9/2017;
- \* Member of the Academic Senate of the University of Milan (since October 2017);
- \* *Chair* of the Management Board of the European Theoretical Spectroscopy Facility (ETSF) a stable research infrastructure stemming from the European Network of Excellence (NoE) "Nanoquanta" (<http://www.etsf.eu>), from 1.7.2013 to 22.9.2014. Member of the ETSF Steering Committee from 2012 to 2018.

## RESEARCH INTERESTS

My research work is devoted to the theoretical study of electronic and structural properties of condensed matter systems, in strong connection with experiments.

The focus is on the development of novel theoretical tools and computational codes, aimed at an improved understanding of the system's properties and response to external electromagnetic fields.

Besides methodological developments, I worked on several practical applications to real materials covering a wide range of systems, from bulk solids, to surfaces, clusters and molecules, to nanostructures. My research covers:

- \* **Vibrational properties** of solids, surfaces and clusters;
- \* First-Principles calculations of **ground state structural and electronic properties**;
- \* Theory developments and applications in the field of **excited state properties, electronic excitations and optical spectra**. The focus on **excited state properties** includes first-principles calculations of **many-body effects**, with theoretical developments and applications to real systems. The study of **optical and electronic properties** extends to structurally complex systems, such as **surfaces** with complex reconstructions, and/or in presence of adsorbates (in particular, reflection anisotropy spectra –RAS and differential reflectivity spectra –SDR), and to optical properties of atomic **clusters** and **nanostructures**.

## SELECTED SCIENTIFIC ACHIEVEMENTS

- \* Study of the effects of the electron-hole interaction on the optical properties of solids and clusters, through the development of a Bethe-Salpeter equation (BSE) approach (PRL 1995).
- \* Contribution to the first fully ab-initio calculation of excitonic effects in the optical spectra of solids (PRL 1998).
- \* Application of the ab-initio scheme to the study of the optical properties of more complex systems, including surfaces (e.g. Gallium Arsenide (110) (PRL, 1998), Germanium (111) (PRL, 2000), and other systems.
- \* Development and application of ab-initio methods for the study of electronic bandstructure and quasiparticle self-energy effects in semiconducting and metallic systems (PRB 2008; PRB 2010), including calculations beyond the “plasmon pole” approximation accessing also lifetime effects.
- \* Study of electronic and optical properties of surfaces, in tight collaboration with experimental groups (PRB 2004 → 2010).
- \* Contribution to theoretical developments within Time-Dependent Density Functional Theory (TDDFT), namely on the problem of finding better approximations for the Kernel (PRL 2002, RMP 2002, PRB 2004), and the problem of “double excitations” (which are crucial to preserve the correct symmetry in finite open shell system),(JCP 2009, JCP 2011).
- \* Work on the theoretical understanding of nanostructured carbon systems containing carbon linear chains: ab-initio results became the clue for the interpretation of Raman and IR spectroscopic data, anticipating the thermal stability and the unusual properties of sp<sup>2</sup>-terminated carbon chains (PRL 2009, JPC 2010, ACSNANO 2010)
- \* Study of bandstructure (PRB 2012) and vibrational (PRL 2015) properties of TiSe<sub>2</sub>, a nearly two-dimensional material of the Transition Metal Dichalcogenides (TMDC) class.
- \* Recent contributions to the validation of a non-empirical approach to hybrid DFT functionals, using the GW approach and a self-consistent determination of the dielectric screening, with application to total energy and defect states (PRB 2015, JCP 2015).

## SCIENTIFIC PRODUCTION

\* More than 130 papers published in international journals with referee (>11 in Physical Review Letters); 1 invited review paper on Reviews of Modern Physics, selected as one of the "hot papers in physics" in 2004 and 2008 by ISI Essential Science Indicators (<http://ScienceWatch.com>).

\* The total number of citations in November 2017 is about 7000 (6600 without self-citations), of which more than 4500 since 2010, according to Web of Science.

## FUNDED RESEARCH PROJECTS:

\* *Scientific Responsible for the Milan node* (node PI) In the European project **NFFA-Europe**, (CEE, **H2020 programme**, Grant Agreement n.654360). Duration: 1 September 2015 – 30 Aug 2019. (48 months)

\* *Scientific Responsible for the Milan node* (node PI) in the European project **e-I3-ETSF**, (CEE, **7<sup>th</sup> framework programme**, Grant Agreement n.211956). Duration: 1 January 2008 – 30 June 2011. (42 months).

\* *Scientific Responsible of the Research Unit* (node PI) in the project **MIUR-PRIN 2007** “Progettazione di nuovi materiali nanostrutturati per applicazioni elettroniche ed ottiche attraverso la teoria a principi primi e la simulazione”, years 2008-2010 (24 months).

\* *National Scientific Responsible* (PI) in the **CNISM** project “Innesco 2006”: "[Will nanostructured silicon be the lasing material of this century?](#)", (Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia), from May 2006 to May 2007, (12 months).

\* *Scientific Responsible of the Milan nodes* (node PI) in the European Network of Excellence (NoE) **NANOQUANTA**, (CEE, **6<sup>th</sup> framework programme**, contract n. NMP4-CT-2004-500198). GO was responsible for both the Milano Statale and Milano Bicocca nodes. The Nanoquanta project has led to the establishment of a stable infrastructure named ETSF (European Theoretical Spectroscopy Facility) described at <http://www.etsf.eu>. Duration: 1 June 2004 - 30 November 2008 (54 months). Funding: about 400.000 euros for the Milan nodes

\* *Scientific Responsible of the Research Unit* (node PI) in the project **MIUR-PRIN 2005** “Comprensione ab-initio delle proprietà strutturali, elettroniche, ottiche di sistemi di semiconduttori nanostrutturati e a bassa dimensionalità”, years 2006-2007 (24 months).

\* *Scientific Responsible of the Research Unit* (node PI) in the INFN project **PAIS-INFN** named “CELEX: Computing Electronic Excitations and Optical Spectra of Surfaces, Clusters and Interfaces from First Principles”, years 2002-2003. (24 months)

\* *Scientific Responsible of the Research Unit* (node PI) in the project **MIUR-PRIN (COFIN) 2002** “Calcolo da primi principi della struttura elettronica e delle proprietà di stato eccitato in clusters, superfici e nanostrutture”, years 2002-2003 (24 months).

\* *Partner Scientific Manager* (local PI) of the **INFN (Istituto Nazionale per la Fisica della Materia)** “Progetto di Ricerca Avanzata” (**PRA**) named “PRA1MESS - Organic and inorganic adsorbates at semiconductor surfaces and interfaces from first principles”, years 2000-2003. (36 months)

\* *Principal Investigator* (PI) in several “Supercomputing Projects” funded in terms of computing resources by **CINECA** through INFN (then CNR and CNISM) and selected by peer review, since 1999 (about 20000 CPU hours/year, in average).

## MENTORING AND SUPERVISING

\* Coordination of a research group composed, in average, by two Post-Docs, one/two PhD students, and a variable number of master and pre-doc students, with several international collaborations. Supervision of the research work of 8 Post-Docs between 2003 and 2015. Among those people, two have now permanent research positions (Matteo Gatti and Pina Romaniello, CNRS researchers in Paris and Toulouse, respectively), one is presently Fixed Term Researcher (RTD) at the Physics Department of the University of Milan (Guido Fratesi), one is Post-Doc at the Italian CNR (Marco Cazzaniga), and two are employed with permanent positions in the private sector (Andrei Incze and Katalin Gaal-Nagy). The group contributes to the development of some of the most widely-used Open-Source ab-initio electronic structure codes (ABINIT, Quantum-Espresso, Yambo).

\* Supervision and co-supervision of several PhD thesis.

\* Supervision of > 40 “Tesi di laurea” in the years 2005-2017.

## TEACHING

### Overall responsibilities and duties

\* Responsible for the Sector / Teaching coordinator (*Responsabile di Indirizzo/Coordinatore Didattico*) for all the “Physics of Matter” teaching curricula/ subset of courses, in the undergraduate courses in Physics of the University of Milan (Corso di Laurea Magistrale in Fisica), from the academic year 2005-2006 to 2013-2014 (9 academic years);

\* Member of the board of the PhD in Physics, Astrophysics and Applied Physics of the University of Milan (Cineca code: DOT0315178 and DOT1315144), from 2009 to present;

\* Member of the board of the National (CNISM) PhD course in “Scienze Fisiche della Materia”, University of Roma Tre and CNISM (Cineca code: DOT07A7520), from 2007 to 2010;

\* Local Coordinator of the “Doctorate in Physics and Chemistry of Advanced Materials” (PCAM), European Doctorate involving fifteen European academic institutions.

### Graduate courses

\* **Fisica delle Superfici 1** (6 CFU, 48h). for the laurea Magistrale in Fisica, Facoltà di Scienze, Università di Milano, a.y 2017/18, 2016/17, 2015/16, 2014/15, 2013/14, 2012/13, 2011/12, 2010/11 (8 years).

\* **Struttura della Materia 1** (9 CFU, 80h). for the laurea Triennale in Fisica, Facoltà di Scienze, Università di Milano, a.y: 2017/18, 2016/17, 2015/16, 2014/15, 2013/14, 2012/13, 2011/12, 2010/11, (8 years).

\* **Struttura della Materia 1** (7 CFU, 60 h). for the laurea Triennale in Fisica, Facoltà di Scienze dell'Università di Milano, a.y. 2009/2010 (F48027, Course delivered in english)

\* **Fisica dei solidi** (6 CFU, 48h), for the laurea Magistrale in Fisica, Facoltà di Scienze dell'Università di Milano, a.y. 2010-2011.

\* **Fisica delle Superfici 2** (6 CFU, 48h) for the laurea Magistrale in Fisica, Facoltà di Scienze dell'Università di Milano, a.y. 2009/2010.

\* **Fisica delle Superfici Modulo 2** (6 CFU, 40h). for the laurea Specialistica in Fisica, Facoltà di Scienze dell'Università di Milano, a.y. from 2004-2005, and 2008-2009 (5 years) Score in student's course evaluation larger than 9/10.

\* **Fisica delle Superfici Modulo 1** (6 CFU, 40h). for the laurea Specialistica in Fisica, Facoltà di Scienze dell'Università di Milano, a.y. from 2004-2005 and 2008-2009 (5 years) Score in student's course evaluation larger than 9/10.

- \* **Fisica delle Superfici** (80h) for the Laurea in Fisica, Facoltà di Scienze dell'Università di Milano a,y, 2002-2003 and 2003-2004 (2 years).
- \* **Struttura della Materia** (60 h) for the Laurea in Fisica, Facoltà di Scienze dell'Università di Milano a,y, 2001-2002
- \* **Aggregati Molecolari** (18h module) for the Laurea in Fisica, Facoltà di Scienze dell'Università di Milano a,y. from 2001-2002 to 2006-2007, and in 2008/09 (7 years).
- \* **Elementi e applicazioni di informatica** (40h) for the diploma di laurea in Scienza dei Materiali, Facoltà di Scienze dell'Università di Roma Tor Vergata (a.y. 2000/2001).

### Postgraduate courses

- \* “**Quantum Theory of Matter**” for the PhD school in Physics, Astrophysics, and Applied Physics of the Università di Milano, in collaboration with Alberto Parola and Nicola Manini, in the academic years: 2002/03, 2003/04, 2004/05, 2005/06, 2007/08, 2008/09, 2009/10, 2010/11, 2011/12, 2012/13, 2014/15, 2015/16, 2016/17, 2017/18 (14 years)
- \* “**Fisica dei Materiali**” (*Materials Physics*) for the “Scuola di Specializzazione in Fisica Medica” of the Università di Milano, in the academic years: 2012/13, 2013/14, 2014/15, 2015/16, 2016/17, 2017/18 (6 years).
- \* Invited teacher at international postgraduate Schools, in Italy and abroad.

### OTHER PROFESSIONAL ACTIVITIES

- \* Referee for the US National Science Foundations (**NSF**); the Israel Science Foundation (**ISF**); the French **ANR**; the Estonian Research Council; the Italian Ministry (MIUR) for **FIRB**, **SIR**, **VQR**; for high-performance computing projects (**CINECA-CNR –ISCRA**); The University of Modena; University of Rome Tor Vergata; University of Padova, Université Catholique de Louvain (UCL@Louvain-la-Neuve); KU Leuven University; Ikerbasque San Sebastian; Fondazione Cassa di Risparmio di Padova e Rovigo, Provincia di Trento.
- \* Member of the Editorial Board of European Physical Journal B; Referee for manuscripts submitted to Physical Review Letters, Physical Review B, Annalen der Physik, Applied Physics A, Applied Physics B, Europhysics Letters, Journal of Applied Physics, Journal of Chemical Physics, Journal of Computational Chemistry, Journal of Nanoparticle Research, Journal of NanoScience and Nanotechnology, Journal of Physical Chemistry, Journal of Physical Chemistry Letters, Journal of Physics A: Mathematical and Theoretical, Journal of Physics B: Atomic Molecular & Optical Physics, Journal of Physics D: Applied Physics, Journal of Physics: Condensed Matter, Journal of the American Chemical Society, Materials Chemistry and Physics, Physica E, Physica Scripta, Physical Chemistry Chemical Physics, Physical Review Applied, Physics Letters A, Solid State Communications, Superlattices and Microstructures, Surface Science.

### MAIN NATIONAL AND INTERNATIONAL COLLABORATIONS

- \* Prof. Rex W. Godby, University of York Department of physics Heslington, York YO15DD (UK).
- \* Dr. Lucia Reining, Ecole Polytechnique, UMR 7642 CEA (DSM), CNRS 91128 Palaiseau, France.
- \* Prof. Maurizia Palumbo, Università degli Studi di Roma Tor Vergata Dipart. di Fisica Roma (Italy).
- \* Dr. Fabio Finocchi, Université PMC, Paris (France)
- \* Dr. Valerio Olevano, Institut Neel, Grenoble (France)
- \* Prof. Xavier Gonze Université catholique de Louvain -Unité de Physico-Chimie et de Physique des Matériaux (PCPM) place Croix du Sud, 1 B-1348 Louvain-la-Neuve, Belgium
- \* Prof. Friedhelm Bechstedt Friedrich-Schiller-Universität - Institut für Festkörpertheorie und optik, Max-Wien-Platz 1, 07743 Jena, Germany
- \* Prof. Matthias Scheffler, Fritz-Haber-Institut der Max-Planck-Gesellschaft - Theory Department Faradayweg 4-6, 14195 Berlin, Germany

- \* Prof. Ulf Von Barth Lund Universitet - Department of Solid State Theory, Lund, Sweden.
- \* Prof. Gianfranco Pacchioni, Dipartimento di Scienza dei Materiali, Univ. di Milano Bicocca (Italy).
- \* Prof. Yves Borensztein, Institut des Nanosciences, Universite Pierre et Marie Curie, Paris (F)
- \* Prof. John McGilp, School of Physics, Trinity College Dublin, Dublin , Ireland.
- \* Prof. Paolo Milani, Dipartimento di Fisica, Universita' degli Studi di Milano (Italy)
- \* Dr. Daniel Paget, Laboratoire de Matiere Condensee, Ecole Polytechnique, Palaiseau (F)
- \* Dr. Fausto Sirotti, Synchrotron Soleil, 91192 GIF-sur-YVETTE (F)
- \* Prof. Philipp Aebi, Department of Physics, University of Fribourg CH-1700 Fribourg (CH)
- \* Dr. G. Monaco, Physics department, Universita' di Trento, via Sommarive, 14 Povo TN (Italy)

### AWARDS AND HONORS

- \* The work: *Electronic Excitations: Density-Functional versus Many-body Green's-Functions Approaches*, (Reviews of Modern Physics 74 601-659 (2002)) was selected in **2004** as one of the "hot papers in physics" by the ISI Essential Science Indicators (<http://ScienceWatch.com>); in **2008** it was further identified to be one of the "most cited papers" in the whole field of Physics: (<http://archive.sciencewatch.com/dr/erf/2008/08octerf/08octerfOnidET>).