

Curriculum vitae

Sergio D'Addato

Personal data

Place and date of birth: Pesaro, 9 August 1960.

Domicile: Calle di Luca 18, 41121 Modena.

Current job position: Associate Professor, disciplinary scientific sector FIS/01-Experimental Physics at the Department of Physics, Computer Science and Mathematics (FIM), University of Modena and Reggio Emilia (UNIMORE).

Place of work: FIM Department, University of Modena and Reggio Emilia, via G. Campi 213/a, 41125 Modena. Telephone 059/2058391; email daddato@unimore.it.

Training

1987-1990: PhD scholarship in Physics at the University "La Sapienza" of Rome. PhD title obtained on 11/21/1991. Thesis title: "Study of surface and interface electronic properties using electron spectroscopy techniques".

1987: Scholarship at the Fritz-Haber-Institut der Max-Planck-Gesellschaft in Berlin (Ge).

June-August 1985: Scholarship at the Center d'Etudes Nucleaires in Saclay (France).

1985: Degree in Physics obtained on April 19 at the University "La Sapienza" of Rome, with the score of 110/110 cum laude. Thesis title: "Excitation of surface and interface plasmons by electron spectroscopy".

Schools:

- "Photoemission and Absorption Spectroscopy of Solids and Interfaces with Synchrotron Radiation", International School of physics "Enrico Fermi" Varenna, July 1988.

- "Rayonnement de Synchrotron Polarisé, Electron Polarisés et Magnétisme", Mittelwihr (Fr) March 1989.

- "Earlier and Recent Aspects of Superconductivity", International Schols of Materials Science and Technology, Erice, July 1989.

Appointments

April 2005- present: Associate Professor SSD Fis01/Experimental Physics at the Faculty of Engineering and the Department of Physics, UNIMORE. Subsequently Associate Professor at the FIM, UNIMORE. Achievement of the qualification as Full Professor, competition sector 02/B1, Experimental physics of matter, on 02/07/2023.

September 1993-April 2005: university researcher at UNIMORE, Faculty of Engineering and pertaining to the Department of Physics, UNIMORE.

1991-1993: Senior Experimental Officer (SEO) at the Interdisciplinary Research Center of Surface Science (IRCSS) of the University of Liverpool (UK), responsible for the synchrotron light beamline at Synchrotron Radiation Source (SRS), Daresbury Laboratory (UK).

1985-1986: Military Service as Complementary Officer in the Air Force in the Aeronautical Engineers Role Physics, with duties of meteorological service officer at the military airport of Istrana (TV).

Leave as Visiting Scientist: In 1998 I took a leave for study purposes during which I worked at the IRCSS and at SRS Daresbury.

Languages: English and French.

User of the following Synchrotron Light facilities: ADONE (Frascati), BESSY (Berlin), SRS (Daresbury), ESRF (Grenoble), ELETTRA (Trieste), FERMI (Trieste).

Associate researcher at the National Institute of Physics of Matter (1993-2002).

Member of the S3 laboratory of the INFN, then NANO institute of the CNR.

Associate researcher at the Institute of Nanosciences of the CNR (2003-present).

Member of the Interdepartmental Center of the University H2-MORE.

Member of the Italian Physical Society.

Member of the Italian Synchrotron Radiation Society.

-Member of the Editorial Board of the open access journal Materials MDPI, section "Optics and Photonics", indexed on SCOPUS and WOS

(https://www.mdpi.com/journal/materials/sectioneditors/optics_photonics)

Participation in academic governing bodies

2005-present: Member of the Academic Board of the PhD in Physics, UNIMORE, which later became Academic Board of the PhD School "Physics and Nanoscience", UNIMORE.

2011-2016: Member of the "Space and Safety" Department Commission.

2016-present: Member of the Didactic Commission of the Department.

2021-present: Sport contact person for the department.

Member of the Scientific Council of the EN&TECH Interdepartmental Center of the University.

Research experience

Associate Professor, Modena, 2005-present:

Responsible of a laboratory of physical synthesis of ultrathin films and nanoparticles.

Research activity:

Within the SESAMO group located at UNIMORE, I developed a metal nanoparticle deposition system consisting of a nanocluster source for gas aggregation assisted by a DC magnetron, a filter for mass selection of the particles themselves and an ultra high vacuum chamber for deposition on substrates, as well as an X-ray Photoelectron Spectroscopy analysis apparatus. The studied systems are mainly:

magnetic nanoparticles, reducible oxide nanoparticles, plasmonic nanoparticles, metal-fluoride and metal-oxide core-shell nanoparticles. Techniques used: XPS spectroscopy and optical spectroscopy, electron microscopy (TEM, SEM, STEM) and scanning microscopy (STM, AFM).

Fields of application: stabilization of magnetic memories, photocatalysis and implementation of photovoltaic cells.

Other activities: studies on nanoparticles, ultrathin films and surfaces using spectroscopy techniques with synchrotron light and Free Electron Laser. Techniques used: X-ray Absorption Spectroscopy, soft X-ray pump-probe experiments, Surface X-ray Diffraction, X-ray Magnetic Circular Dichroism, Angle Resolved Photoelectron Spectroscopy.

University researcher, Modena, 1993-2005

Research activity:

1. Physical-chemical characterization of alkali metal adsorption on semiconductor surfaces by core level spectroscopies.
2. Growth and characterization of films and multilayers of magnetic interest.
3. Electronic properties of Rare Earth Silicide films studied by means of de-excitation techniques of metastable helium atoms.
4. Growth of transition metal nanostructures and clusters.
5. Study of ultrathin films of MgO and NiO by Extended X-ray Absorption Fine Structures.

Senior Experimental Officer, Liverpool, 1991-1993.

Research topics

1. Construction, setup and characterization of two beamlines of synchrotron light for surface science studies (X-ray Absorption and Angle-Resolved Photoemission

In January 1991 I was hired as SEO at the IRCSS, with the task of building and developing, under the supervision of Prof. G. Thornton and with the help of another SEO and a laboratory technician, two beamlines for synchrotron light that could allow IRCSS scientists to carry out experiments at the Daresbury SRS. More specifically the beamlines had the following characteristics:

- an X-ray beamline (photon energy range 2000-10000 eV) for XAS and X-ray Standing Waves (XSW) experiments on surfaces;
 - a beamline for Vacuum Ultra Violet rays (VUV, operating range 20-200 eV) for photoemission experiments.
2. Study and characterization of electronic properties of interfaces, compounds and alloys with synchrotron light.
 3. Physico-chemical characterization of alkali metal adsorption on semiconductor surfaces by core level spectroscopies.

PhD, Rome, 1987-1990.

Research topics

1. Electronic properties and anisotropies on semiconductor surfaces studied with the EELS technique.
2. Setting up of an experimental system for electron spectroscopy on surfaces and interfaces.
3. Study of full and empty electronic states of metal-semiconductor interfaces.
4. Study and characterization of electronic properties of interfaces, compounds and alloys with synchrotron light.

Scholarship in Berlin, 1987.

Research topic: Determination of the chemisorption geometries of Oxygen and other chemisorbed species on metal surfaces using the X-ray Absorption Spectroscopy (XAS) technique.

Degree thesis, 1984-1985.

Research topic: Collective electronic excitations in surfaces and interfaces.

Research projects

Research Projects Funded by the EU

Participant in the COST Action CM1104 project "Reducible oxide chemistry, structure and functions", 2012.

National Research Projects

- Participant in the COFIN 1997 project "GROWTH AND CHARACTERIZATION OF LOW DIMENSIONAL SYSTEMS: SURFACES, INTERFACES, MULTILAYERS"

- Participant in the PRIN 1999 project "THIN FILMS OF TRANSITION METALS IN METASTABLE PHASES, AND THEIR OXIDES: GROWTH AND CHARACTERIZATION.

- Head of the Project for the Utilization of Synchrotron Radiation 2000 DEEP3 funded by INFN for the study of the correlation electronic properties of clusters and nanowires of 3d transition metals.

- Participant in the PRIN 2000 project "Spectroscopies of electronic states in quantum dots: theoretical study of correlation and photoemission effects at high resolution and low temperature".

- Head of the NANOMASK project funded by INFN within the framework of the establishment of the S3 Research and Development Center (2001).

- Participant in the PRIN 2003 project "Coupling between ferromagnetic and antiferromagnetic materials in nanostructured epitaxial layers by means of a focused ion beam".

- Participant in the PRIN 2008 project "Exchange-spring magnetic nanostructures with lateral coupling".

- Head of the Modena Research Unit since 2017 of the PRIN 2015 project "NEWLI: NEW Light on transient states in condensed matter by advanced photon – electron spectroscopies".

- Participant in the PRIN 2022 project "PETRA: Pulsed electron deposition of transition metal dichalcogenides for scalable electronics: static versus in-operando properties".

- Head of the Modena Research Unit PRIN PNRR 2022 project "HyBORON: Metal clusters decoration of Borophene nanostructures with enhanced Hydrogen adsorption and release properties".

Regional Research Projects

- Responsible of the POR FESR "MAGMOVE" project funded by Emilia Romagna 2023.
- Participant in the POR FESR "HEGOS" project funded by Emilia Romagna, 2016.
- Participant in the POR FESR "IMPRESA" project funded by Emilia Romagna, 2019.
- Participant in the "Landi Renzo" project funded by Emilia Romagna, 2019.
- Participant in the PNRR project "Ecosystem for sustainable transition in Emilia Romagna", 2022.

University Research Projects

Responsible for the project "Manufacture and properties of nanometallic materials", co-financed by the Fondazione delle Casse di Risparmio di Modena and the University of Modena and Reggio Emilia, (2008).

Participant in the interdisciplinary FAR project "Innovative (oxide-based) materials and methods for fuel cell electrodes implementation." (2016)

Participant in the interdisciplinary FAR project "FLuoride Ultrathin Dielectric films for 2D electronics (FLUID)". (2022)

Responsible for the following experiments at the Synchrotron Light facilities

1. "Controlling exchange bias in Ni/CoO core shell nanoparticles: an XMCD investigation." From 19/4/2015 to 26/4/2015. Facility: Elettra (Trieste). Beamline: Circular Polarization.
2. "Structure and electronic properties of NiO clusters generated with a gas aggregation source." From 11/22/2004 to 11/29/2004. Facility: Elettra (Trieste). Beamline: ALOISA.
3. "Electron correlation properties of Fe islands grown on HOPG" From 12/16/2003 to 12/24/2003. Facility: Elettra. Beamline: ALOISA.
4. "XMCD study of self-assembled Fe nano-structures on N pre-covered Cu(100)" From 8/10/2003 to 14/10/2003. Facility: Elettra. Beamline: Circular Polarization.
5. "O K-edge X-ray Absorption study on NiO ultrathin films" From 20/05/2003 to 26/05/2003. Facility: Elettra. Beamline: ALOISA.
6. "Determination on chemisorption geometry of self assembled MBO on Cu(100) with sulfur K edge XAFS", June 2003. Facility: SRS (Daresbury), beamline 4.2.
7. "Electronic properties of self-organized Ag nano-structures on Cu(100)." From 11/19/2002 to 11/26/2002. Facility: Elettra. Beamtime: VUV Photoemission.
8. "O K edge XAS on MgO and NiO ultrathin films", 14-20 October 2002. Facility: SRS (Daresbury), beamline 1.1.

Reviewer/evaluator activity

- Evaluator of research projects FP7-NMP-2012-LARGE-6 FP7-NMP-2012-LARGE-6 NANOSCIENCES, NANOTECHNOLOGIES, MATERIALS AND NEW PRODUCTION TECHNOLOGIES funded by the European Commission (2012).
- Evaluator of FLAG-ERA JTC 2021 projects.
- Evaluator of SIR (Scientific Independence of young Researchers) 2014 projects funded by MIUR.
- Reviewer of VQR research products 2011-2014.

-Reviewer of VQR research products 2015-2019.

-Referee of international journals (selection): Physical Review Letters, Physical Review B, Physical Review Materials, Surface Science, Journal of Physics: Condensed Matter, Nanotechnology, Applied Surface Science, Journal of Magnetism and Magnetic Materials, Journal of Physical Chemistry C, Nanomaterials MDPI, Materials MDPI.

Conferences

Organization of international symposia and conferences

-"Stress, Structure and Stoichiometry effects on the properties of nano materials", Symposium V, E-MRS Fall Meeting, Warsaw 15th-18th Sept. 2015.

-"Oxide and chalcogenide_based thin films and nanostructures", Symposium NT", MRS Spring Meeting, Phoenix (AZ) 8th March-1st April 2016.

-"Synthesis of nanoparticles: applications and new perspectives" CMD2020-GEFES Minicolloquium, Madrid (online) 31st August-4th September 2019.

-"Recent developments in Gas Phase Synthesis of Nanoparticles and applications"-CMD 29 Online series, 15th September 2021.

-"Gas Phase Synthesis of Nanoparticles: Properties, Developments and Applications" CMD29-IOP Conference, Manchester, 21-26 August 2022.

Invited talks at international conferences

-"Stress, structure and stoichiometry effect on the properties of nano materials II", Symposium B, EMRS Fall Meeting, Warsaw, 16th-20th September 2013. Title: "Controlled Growth of metal-oxide core-shell nanoparticles: structure, morphology and tuning of magnetic properties".

-"Nanostructures, Thin Films and Bulk Oxides-Synthesis Characterization and Applications", Symposium K, MRS Spring Meeting, S. Francisco (Ca), April 21-25, 2014. Title: "Controlled growth of Metal-Oxide Core-shell nanoparticles , Structure, Morphology and Functional properties".

-5th International conference on NANO-structures SELF-Assembly, NANOSEA 2014, Marseille, 7-11 July 2014. Title: "Growth and functional properties of metal@oxide nanoparticles assemblies obtained by co-deposition." (Keynote Speaker)

-7th International Conference NANOSEA, Carqueiranne (FR), July 2-6th, 2018. Title: "Gas phase synthesis of metal@oxide, core@shell nanoparticles: a bottom-up approach for new material functionalities."

-Cluster Surface Interaction Workshop 2022, Santa Margherita Ligure, April 1-4 2022. Title: "Plasmonic metal@oxide, core@shell nanoparticles: interaction with reducible oxides and applications in photovoltaic materials".

-PIERS 2023, Prague, July 5-9 2023:" "Plasmonic core@shell nanoparticles: applications in perovskite photovoltaic materials and interaction dynamics with oxides " .

Talks at recent conferences (2011-2022)

- "Stress, structure and stoichiometry effect on the properties of nano materials ", Symposium A, EMRS Fall Meeting, Warsaw, 19th-23th September 2011. Title: "Assembly and structure of Ni/NiO and Ni/MgO core-shell nanoparticles" .

- International Meeting on Nanoalloys IMN 2019, Genova, 4-7 June 2019. Title: "Structure, morphology and optical characterization of Gas phase synthesis of plasmonic, core@shell Ag@CaF₂ nanoparticle assemblies".
- Advanced Nano Materials Conference 2021, Aveiro, 22-24 July 2021. Title: "Adhesion, mobility and aggregation of Ag and Ni nanoparticles on Si, HOPG and Graphene"
- 102nd National Congress of the Italian Physical Society, Padua, 26-30 September 2016. Title: "Physical synthesis of Ni@CoO core@shell nanoparticles: fine analysis and tuning of magnetic properties".
- FISMAT 2017, October 1-5, 2017. Title: "Physical synthesis of metal@oxide, core@shell nanoparticles: two case studies" .
- Italian National Conference on Materials Science and Technology, Bologna, October 22-26, 2018. Title: "Gas phase synthesis of plasmonic, core@shell Ag@CaF₂ nanoparticle films: structure, morphology and optical characterization".

Teaching Experience

University courses.

-During the seven academic years from 1993 to 1998 I carried out the problem solving lectures for the courses of Physics II and Physics I for the Faculty of Engineering, at the Degree Courses of Materials Engineering, Mechanical Engineering and Computer Engineering.

-Academic year 1999-2000: assignment of the teaching of the Physics II course for the degree course in Mechanical Engineering and Materials Engineering.

-In 2000-2001 I obtained an incentive for the organization of the General Physics Laboratory course A for Engineering (new system). The organization of this course involved the restructuring of a pre-existing room in our Department to be used as a laboratory with basic physics experiences for a large number of students.

-Teacher of the following courses:

1. General Physics A Degree in Materials and Environmental Engineering (DM 509/99) from A.Y. 2000-2001 at the Academic Year 2003-2004.
2. General Physics A/Lab CdL Engineering of Materials and the Environment (DM 509/99) from A.Y. 2000-2001 at the Academic Year 2003-2004.
3. General Physics A CdL. Mechanical Engineering (DM 509/99) from the A.Y. 2004-2005 at the Academic Year 2008-2009.
4. General Physics A/Lab CdL Mechanical Engineering, Materials Engineering (DM 509/99) from A.Y. 2005-2006 at the Academic Year 2008-2009.
5. General Physics CdL Mechanical Engineering (DM 270/04) from A.Y. 2009-2010 at the Academic Year 2020-2021.
6. General Physics CdL Civil and Environmental Engineering (DM 270/04) from A.Y. 2009-2010 at the Academic Year 2014-2015.
7. Physics B Degree in Mechanical Engineering (DM 270/04) A.Y. 2011-2012.
8. Physics CdL Electronic Engineering (DM 270/04) from A.Y. 2021-2022 to the current year (2022-2023).
9. Semiconductor Physics Degree course in Physics (DM509/99) from A.Y. 2006-2007 at the Academic Year 2007-2008.

10. Properties of semiconductor and magnetic materials (co-ownership) Master Degree in Physics (DM509/99) and Master Degree in Physics (DM 270/04) from A.Y. 2008-2009 at the Academic Year 2011-2012.
11. Semiconductor Physics Master's degree in Physics (DM 270/04) from A.Y. 2012-2013 at the Academic Year 2014-2015.
12. Physics of Semiconductors Master's degree in Fisica-Physics (DM 270/04) A.Y. 2015-2016.
13. Synchrotron Radiation: Basics and Applications Master's degree in Fisica-Physics (DM 270/04) from A.Y. 2016-2017 to the current year (2022-2023).

The average teaching load per academic year was found to be 15 credits, for approximately 129 hours of frontal teaching. The total number of exams recorded since the introduction of electronic exam recordings (2007) is equal to more than 2000.

PhD teaching activity

3 courses:

Physics of Semiconductors in 2007 and 2012.

Basics of Synchrotron Radiation in 2021.

PhD Thesis. Supervisor of 7 PhD theses in Physics and in Physics and Nanoscience: M.C. Spadaro, Avinash Vikatakavi, Matteo Caleffi, Eleonora Spurio (in progress), Riccardo Magrin Maffei (in progress), Samuele Belotti (in progress), Gabriele Bonano (in progress).

Thesis. Supervisor of 1 degree theses in Mechanical Engineering, 4 Master's degree theses in Physics, 4 three-year degree theses in Physics, 1 three-year degree theses in Mechanical Engineering. Co-supervisor of 4 degree theses in Physics (supervisors Prof. S. Nannarone, Prof. S. Valeri).

Translation of the books "Physics I" and "Physics II" by D.C. Giancoli, CEA Publisher, 2009.

Third mission

- Popular conferences entitled "Precious light: synchrotron radiation" at the "Wiligelmo" Scientific High School of Modena in 2007 and 2008.
- Participation in laboratory internships open to students of local high schools in the years 2011-2015 organized by the FIM department.
- Involvement and interaction activities with the school world "A week as a scientist" organized by the FIM 2019 department, 2021.
- Popular conference entitled "There is a lot of space down there" on nanotechnologies aimed at students of the "Gullace" scientific high schools in Rome and "Falcone Borsellino" in Zagarolo (Rome), 14 April 2021.
- MOOC video course "Physical synthesis of nanoparticles: a bottom-up approach", present on the EDUOPEN platform, https://learn.eduopen.org/eduopenv2/course_details.php?courseid=164, registered in 2016.

Modena, 08/07/2024

