laura d'alfonso

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Nationality: Italian

WORK EXPERIENCE

[01/10/2014 – Current] **Associate Professor in Applied Physics 02/D1 (FIS/07)**

Università degli Studi of Milano-Bicocca

Country: Italy

[12/2004 – 09/2014] **Researcher in Applied Physics 02/B3 (FIS/07)**

Università degli Studi of Milano-Bicocca

[04/2004 – 12/2004] **Temporary contract as Researcher FIS/07 reserved for winners of a researcher position at the Università degli Studi of Milano-Bicocca**

Università degli Studi of Milano-Bicocca

[01/12/2002 – 30/03/2004] **Post-doc fellowship**

MURST

[2001 – 2002] **Post-doc fellowship on the project Cofin 2000 on "Diffusive and internal dynamics of labelled proteins by means of time resolved fluorescence"**

MURST

[03/1997 – 10/1997] **Post graduation fellowship on "Dynamics, interactions and folding of transport proteins"**

INFM

EDUCATION AND TRAINING

[1997 – 2000] **PhD in Physics**

Università degli Studi di Milano

Thesis: Conformational changes of the BLG protein and role of the electrostatic interactions (supervisor Prof. G.Baldini)

[1997] **Physics Master's Degree**

Università degli Studi di Milano

Final grade: 110/110 cum laude
Thesis: Conformational changes of the BLG protein studied by fluorescence spectroscopy (supervisor Prof. G. Baldini)

SCIENTIFIC ACTIVITY

Research field (02/D1): Biophysics, Optical Microscopy, (Image) Correlation Spectroscopy, Non-linear Optical Microscopy, Nanoparticles for Biosensing.

The research activity of LD has mainly focused in molecular biophysics, and it has been devoted, in particular, to the application of spectroscopic techniques to the study of the structural and dynamic properties of proteins, and to the analysis of their interaction, by combining experimental and theoretical- simulative approaches.

Since 2001 LD collaborates to the development of a laboratory for advanced spectroscopy (LABS) at the Physics Department of the University of Milano- Bicocca under the supervision of first Prof. G.Baldini and later Prof. G.Chirico, where fluorescence techniques have been combined to non linear optical microscopy to perform experiments at high spatial (sub-micrometers) and temporal (nanoseconds) resolution on the stability of biomolecules and on their interactions, down to the single molecule level or in cells or tissues, for biological and medical applications.

As a member of the Biophysics group at the University of Milano-Bicocca, LD contributes to the development of a research line of the Master Degree in Physics of this university, by exploiting the state-of-the-art microscopy and advanced spectroscopy instrumentation to supervise Bachelor and Master degree thesis and PhD and post-doc positions.

LD has acquired experience in time resolved fluorescence spectroscopy (both lifetime and anisotropy decay) and in in-vitro and in-vivo (cells) single molecules fluorescence by studying the dynamics, the conformational changes, the folding process (denaturation) and the interactions of globular proteins, focusing, in particular, on the effects of charge on the biomolecules and of the ionic screening of the solvent.

Moreover, LD has acquired expertise on advanced fluorescence techniques by employing non linear excitation to perform experiments of fluorescence correlation spectroscopy (FCS), fluorescence lifetime imaging (FLIM) and resonant energy transfer (FRET) in solutions and in cells, studying, for instance, chimeras of different green fluorescent protein (GFP) mutants.

hot spots I

In the last years, hot spots of LD's research have been 1) the investigation of the internal photodynamic of particular photo-switchable mutants of fluorescence proteins (GFP) with a recently developed pump & probe modulated FCS technique, 2) the characterization of newly synthesized metallic or hybrid metal- organic fluorescent probes, having long lifetimes upon one- or two-photon excitation and displaying interesting and promising cell penetration properties, or an efficient photothermal response upon infrared laser excitation, inducing local hyperthermia effects, and 3) the development of nano-biosensors based on the lifetime changes of particular fluorophores, with several possible applications, such as the determination of proteins concentration in solution or cellular extracts, the measurements of the local temperature, photo-induced drug-delivery and photo-thermal treatments. In particular, via antigen-antibody recognition a picomolar sensitivity has been reached for the determination of the concentration of the tumor marker p53 protein. Moreover, sensors based on metallic anisotropic or branched nanoparticles, whose cellular uptake has been followed with imaging, tracking and correlation experiments, allow the local and real-time measurements of the temperature with a 0.03 ns/C sensitivity.

At the moment, LD research focuses on the development of non linear excitation techniques to perform high spatial and temporal resolution imaging and correlation experiments, for applications to studies at the single molecule level, in cells or in tissues, or in-vivo on model organism (zebrafish, xenopus). To this aim LD has both modified, improved and optimized the LABS instrumentation to perform in-vivo multispot correlation experiments, with possible single plane excitation (to determine, for instance blood flow velocity in zebrafish embryos, or to evaluate the leakage of the circulatory system in healthy and pathological zebrafish embryo samples), and exploited the features of a STED (Stimulated Emission Depletion) nanoscope to study biological system by means of super- resolved (down to 60 nm) microscopy experiments.

hot spots II

Particular attention has been focused on the peculiar properties of anisotropic (non spherically symmetric) gold nanoparticles (rods or stars), to exploit them as probes for cellular imaging thanks to their unique luminescent properties primed by non linear excitation. Fluorescence correlation techniques have been applied to characterize their diffusion coefficient and their aggregation properties both in solution and in cells in vivo, where their diffusion mechanisms have been studied in detail. Standard image correlation spectroscopy techniques (RICS, raster image correlation spectroscopy, TICS, temporal image correlation spectroscopy, SLIC, scanning laser image correlation) are currently devoted to study nanoparticles-cell interactions and the hemodynamics on model organisms (zebrafish), together with new correlative approaches derived by combining fluorescence correlation spectroscopy and confocal and TPE scanning imaging. The most recent research interests in the non-linear intravital optical microscopy concern the investigation of cellular morphology and tissue structure on healthy and pathological samples by combining the fluorescence and second harmonic generation signals. To this aim, a new image analysis method has been developed, based on the phasor technique combined to a clustering approach. An adaptive optic setup has been developed to correct light aberrations to study in depth in vivo tick samples, to investigate the response of a model animal system (chicken embryo) to the implant of a miniaturized chip containing biomaterials or tumor cells.

Finally, new PVA based films containing different kind of metallic nanoparticles have been developed and characterized, in order to attain an efficient antibacterial action by remotely activated photo-thermal effects.

The results of the scientific activity of LD have been presented in more than 70 papers on international peer reviewed journals, in 9 book chapters and in more than 90 communications to national and international meetings and congresses.**h-index**=20 (Scopus), **total citations**>1100 (Scopus).

MANAGEMENT AND LEADERSHIP SKILLS

institutional commitments

Since 2018,
Chairman of the Commissione Bandi for the Physics Department.
Member of the Commissione Paritetica Docenti/Studenti (CPDS) for the Physics Department.

dissemination activity

since 2015, supervisor of the **Piano Lauree Scientifiche** (Scientific Degrees Plan) promoted by the MIUR, Ministry for Education, University and Research, for the degree in Physics and of the Laboratory **LABEX**, aimed to high school students within the Scientific Degrees Plan, hosting more than 1000 students per year.

since 2016, supervisor of the “Alternanza Scuola Lavoro” then "PCTO: Percorsi per le Competenze Trasversali e per l'Orientamento" activities (School-work project for high school students organised by the education ministry) for the LABEX Laboratory for experimental physics.

since 2017, coordinator of the “Alternanza Scuola Lavoro” then "PCTO: Percorsi per le Competenze Trasversali e per l'Orientamento" activities for the Physics Department.

Scientific dissemination events:
MeetMeTonight, The European researchers night (2014, 2018, 2019).
Science Corner for EXPO2015 Milano.

activity as reviewer and referee,

since 2007, reviewer for the following peer reviewed scientific journals: Acta Biomaterialia, Agricolture, Antibiotics, Applied Science, Biophysical Journal, Cancers, Coatings, Frontiers in Bioengineering and Biotechnology, Frontiers in Materials, Frontiers in Molecular Bioscience, International Journal of Biological Macromolecules, International Journal of Molecular Science, Materials, Nanomaterials, Optik, Pharmaceuticals, Pharmaceutics, Plose One, Scientific Reports, Sensors.

since 2013, referee and rapporteur for FIR (Future in Research) and SIR (Scientific Independence of young Researchers) projects on behalf of the MIUR, Ministry for Education, University and Research.

since 2017, referee for the appointment of post-doc positions for the Università degli Studi dell’Insubria.

since 2019, review editor for Frontiers in Bioengineering and Biotechnology, Frontiers in Materials, Frontiers in Molecular Bioscience.
since 2019, member of the Editorial Board of Nanobiotechnology.
since 2020, member of the Editorial Board and Topic Editor for Nanomaterials.

ORGANISATIONAL SKILLS

Organization of workshops and schools

- XVI Scuola di Biofisica Pura e Applicata “Multimodal Methods for Cell Imaging and Tracking”, Campo Santo Stefano, Venezia, 30th January – 3rd February, 2012.
- Theoretical-practical workshop on novel probes and methodologies in biomedical imaging “Visualizing Biological Function: Confocal Spectroscopy- Microscopy”, 10th-12th March 2009.
- Theoretical-practical workshop on confocal and non linear microscopy “Visualizing Biological Function: Confocal Spectroscopy-Microscopy”, Milano, 24th-25th October, 2007.

PROJECTS

FET 2020 "IN2SIGHT An in vivo bioengineered chip as a smart intravital multiphoton imaging window for new validation protocols of biomaterials"

PI G.Chirico (3.5 M€)

STEM2020: “SVELAMIB – SVolgere Esperimenti nel LAboratori di MIlano-Bicocca”

Call made by the Dipartimento per le Pari Opportunità della Presidenza del Consiglio dei Ministri (15K€, coPI)

PLS2019: “Labex: laboratorio per la fisica interattiva”

PI (19k€)

MAHRE17: “Pesticides used in the Maldives archipelago: an integrated approach between remote sensing data and ecotoxicological surveys for risk assessment for coastal and inland marine water systems”

Winner (together with R.Colombo and A.Finizio) of the call “Maldives - 20 researchers x 20 projects”, to present projects for the 2018 research campaign at the MaRHE Center, autonomous research centre of the Università degli Studi di Milano-Bicocca located on Magoodhoo island (Faafu Atoll, Maldives).

PLS2015: “Labex: laboratorio per la fisica interattiva”

PI (32k€)

NETWORKS AND MEMBERSHIPS

[2020] **Member of the Società Italiana di Fisica**

[2018] **Member of the Società Italiana di Biofisica Pura e Applicata**

[2014] **Member of the PhD Faculty in Physics and Astrophysics**

[2015] **Member of NeuroMi, Milan Center for Neuroscience**

OTHER ACTIVITIES

Scientific Collaborations

DKFZ German Cancer Research Center. Division of Vascular Oncology and Metastasis, Heidelberg (D. Inverso);

Open Innovation Hub for Antimicrobial Surfaces, University of Liverpool, Liverpool, United Kingdom (Y.A.Diaz Fernandez);

Institut de Chimie Moléculaire de l'Université de Bourgogne, Université de Bourgogne, Dijon, France (F. Denat);

University of Tel-Aviv and Sagol School of Neuroscience (P.Blinder);

Scientific and Technological Department, University of Verona (H.Molinari);

Telethon Institute at the Venetian Institute for Molecular Medicine, Padova (M.Zaccolo);

S.C. Regenerative Medicine, National Institute for Cancer Research, Genova (M.Rocco);

Dynamics of Immune Responses, Division of Immunology, Transplantation and Infectious Diseases, San Raffaele Scientific Institute, Milano (M.Iannacone);

Istituto Superiore di Sanità, Roma (F.Mazzei, S.Soddu);

San Raffaele Fundation, Milano (V.Caiolfa);

LAMBS-INFM, Physics Department, University of Genoa, and IIT (A.Diaspro);

Chemistry Department, University of Milano (M.Panigati, D.Maggioni, S.Maiorana, E.Licandro);

Chemistry Department, University of Pavia (P.Pallavicini);

Biochemistry Department, University of Parma (S.Bettati, A.Mozzarelli);

Biotechnology and Biosciences Department, University of Milano-Bicocca (F.Granucci, I.Zanoni, L.Cipolla , S.Colombo, E.Martegani);

Environmental Sciences Department, University of Milano-Bicocca (P.Mantecca, M.Camatini);

Experimental Medicine Department, University of Milano-Bicocca (I.Rivolta, G.Miserocchi, G.Sancini);

Neurological Institute Carlo Besta, Milano (F.Acerbi);

Physics Department, Politecnico di Milano (G.Cerullo, D.Polli, M.T.Raimondi);

Tumour National Institute Regina Elena, Roma (G.Piaggio).

Cericol, Colorobbia Research Center (G.Baldi);

Physics Department, Università degli Studi di Milano (G.Tiana, M.Potenza, S.Cialdi);

Biology Departmet, Università degli Studi di Milano (S.Carra, F.Cotelli);

IRCCS Istituto Auxologico Italiano, Cusano Milanino (S.Carra);

Pharmacology and Biomolecular Sciences Department, Università degli Studi di Milano (A.Polissi, P.Sperandeo).

Teaching

Since 2003 LD held teaching charges for the Physics Department of the Universita' di Milano-Bicocca, for both the Bachelor (LF) and the Master (LSF) Degree in Physics.

- aa 03/04: (LF) Laboratory of Biological and Medical Physics (in collaboration with Prof. Amaldi);
- aa 04/05: (LSF) Biophysics laboratory I mod;
- aa 05/06 and 06/07: (LF) Laboratory of Biological and Medical Physics, and (LSF) Biophysics laboratory I mod;
- aa 07/08: (LF) Laboratory of Biological and Medical Physics, Recitations for the course Physics III, and (LSF) Biophysics laboratory I mod;
- aa 08/09: (LF) Laboratory of Biological and Medical Physics, Recitations for the course Physics III;
- aa 09/10 and 10/11: (LF) Laboratory of Biological and Medical Physics;
- aa 11/12: (LF) Recitations for the course Physics I (II mod), and (LSF) Biophysics laboratory;
- aa 12/13: (LF) Recitations for the course Physics I, and (LSF) Biophysics laboratory;
- aa 13/14: (LF) Recitations for the course Physics I, and Complements of Physics I, and (LSF) Biophotonics Laboratory II;
- aa 14/15: (LF) Lecturer of the course Elements of Medical and Environmental Physics, and (LSF) Biophotonics Laboratory II;
- aa 15/16-17/18: (LF) Lecturer of the course Elements of Medical and Environmental Physics, Lecturer of the course Physics I for the Bachelor Degree in Chemical Sciences and Technologies, and (LSF) Biophotonics Laboratory II;
- aa 18/19-present: (LF) Lecturer of the course Physics I, and (LSF) Biophotonics Laboratory I.

Moreover from 1998 to 2003 LD has held assistant teaching charges at the Politecnico di Milano for Proff. M.Marangoni, S.Taccheo e R.Osellame.

LD has been the supervisor of several thesis for the Master Degree in Physics and stages for the Bachelor Degree in Physics.

Since 2008 LD is involved for the Biophysics group in the stages for the students of the secondary school.

LD has been member of commissions for PhD defenses and has been enrolled three times (2006, 2011, 2017) as a member for the board for the PhD admission valuation procedure.

PUBLICATIONS

[2021] **Multiphoton laser fabrication of hybrid photo-activable biomaterials**

http://dx.doi.org/10.3390/s21175891

Bouzin, M., Zeynali, A., Marini, M., Sironi, L., Scodellaro, R., D'alfonso, L., et al. (2021). Multiphoton laser fabrication of hybrid photo-activable biomaterials. SENSORS, 21(17) [10.3390/s21175891].

[2020]

Multiphoton Fabrication of Proteinaceous Nanocomposite Microstructures with Photothermal Activity in the Infrared

http://dx.doi.org/10.1002/adom.202000584

Zeynali, A., Marini, M., Chirico, G., Bouzin, M., Borzenkov, M., Sironi, L., et al. (2020). Multiphoton Fabrication of Proteinaceous Nanocomposite Microstructures with Photothermal Activity in the Infrared. ADVANCED OPTICAL MATERIALS, 8(13) [10.1002/adom.202000584].

[2020]

Photothermally active nanoparticles as a promising tool for eliminating bacteria and biofilms

http://dx.doi.org/10.3762/BJNANO.11.98

Borzenkov, M., Pallavicini, P., Taglietti, A., D'Alfonso, L., Collini, M., & Chirico, G. (2020). Photothermally active nanoparticles as a promising tool for eliminating bacteria and biofilms. BEILSTEIN JOURNAL OF NANOTECHNOLOGY, 11, 1134-1146.

[2019]

Photo-activated raster scanning thermal imaging at sub-diffraction resolution

http://dx.doi.org/10.1038/s41467-019-13447-0

Bouzin, M., Marini, M., Zeynali, A., Borzenkov, M., Sironi, L., D'Alfonso, L., et al. (2019). Photo-activated raster scanning thermal imaging at sub-diffraction resolution. NATURE COMMUNICATIONS, 10(1) [10.1038/s41467-019-13447-0].

[2019]

Adaptive optics microspectrometer for cross-correlation measurement of microfluidic flows

http://dx.doi.org/10.1117/1.JBO.24.2.025004

Collini, M., Radaelli, F., Sironi, L., Ceffa, N., D'Alfonso, L., Bouzin, M., et al. (2019). Adaptive optics microspectrometer for cross-correlation measurement of microfluidic flows. JOURNAL OF BIOMEDICAL OPTICS, 24(2), 1 [10.1117/1.JBO.24.2.025004].

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING C1 **READING** C2 **WRITING** C2

SPOKEN PRODUCTION C2 **SPOKEN INTERACTION** C2

German

LISTENING A2 **READING** B1 **WRITING** B1

SPOKEN PRODUCTION B1 **SPOKEN INTERACTION** B1

According to law 679/2016 of the Regulation of the European Parliament of 27th April 2016, I hereby express my consent to process and use my data provided in this CV

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