

# Curriculum Vitae

## Personal information

Name: Francesco Brasili

## Research interests

Plasmonics. Development and characterization of multi-responsive, hybrid bio-plasmonic systems made up of metallic nanocolloids, based on their aggregation, surface modification and/or conjugation with other agents for imaging, sensing and theranostics purposes. Fabrication and characterization of SERS-active substrates based on the molecular driven self-assembly of plasmonic nanoparticles.

Ultrasounds. Analysis *in vitro* of the ultrasound interaction with cells, in both cavitation and subcavitation regimes: study of the effects on the biological membrane and of the activation of cytotoxic and/or inflammatory patterns. Development and characterization of new generation ultrasound contrast agents (microbubbles, phase-change microdroplets) for theranostics purposes; modelling their acoustic response.

Biophysical models. Modelling of several biophysical processes, such as electric field driven growth of giant unilamellar vesicles (GUV), drug release kinetics from submicrometric polymeric vectors, cell viability upon drug treatments, microbubble-to-microdroplet relaxation dynamics, and linear oscillations of microbubbles stabilized by thick elastomeric shells undergoing megasonic irradiation.

Soft matter. Synthesis and characterization of lipid membrane models, both water dispersed vesicles and solid supported bilayers. Molecular dynamics simulation of lipid monolayers at the air-water interface.

Surface science. Development and characterization, mainly by Atomic Force Microscopy (AFM) and Atomic Force Spectroscopy, of several systems and devices on solid support, such as “polymer brushes” functionalized with enzymes, lipid membranes, acoustic active microbubbles patterns, electron beam lithography micropatterning of polymer layers and SERS-active substrates.

## Research experience

October 2019 – currently

Research fellow

Physics Dept., Sapienza University of Rome

Prof. Roberto Di Leonardo

July 2019

Small Angle Neutron Scattering Measurements

Helmholtz Zentrum Berlin, BERII neutron source (V16), Berlin (Germany)

Proposal n. 191-08365-ST: Interaction of lysozyme with gold nanoparticles: A SANS study

June 2019

FTIR micro-Spectroscopy Measurements

SOLEIL Synchrotron, SMIS beamline, L'Orme des Merisiers Saint-Aubin (France)

Proposal n. 20181452: Interaction of lysozyme with gold nanoparticles: A Surface Enhanced Infrared Absorption study

September 2018

Small Angle X-Ray Scattering Measurements

SOLEIL Synchrotron, SWING beamline, L'Orme des Merisiers Saint-Aubin (France)

Proposal n. 20180833: Modulation of the interparticle spacing and optical behaviour of lysozyme decorated gold nanoparticle assemblies: a SAXS study

October 2017 – October 2019

Research fellow

Chemical Science and Technologies Dept., University of Rome Tor Vergata

Dr. Fabio Domenici

July 2016 – June 2017

Research fellow

Physics Dept., Sapienza University of Rome

Prof. Federico Bordi

April 2014 – March 2015

Research fellow

Physics Dept., Sapienza University of Rome

Prof. Federico Bordi

November 2013 – May 2017

Ph.D. in Physics

Vito Volterra School in Astronomy, Astrophysics, Chemistry, Earth Sciences, Mathematics and Physics, Sapienza University of Rome

Project title: Bio-plasmonic systems with tunable photo-thermal response

Supervisors: Prof. Federico Bordi, Dr. Fabio Domenici

May 2012 – October 2012

Master thesis

Laboratoire de Physique de la Matière Vivante (LPMV), École Polytechnique Fédérale de Lausanne

Supervisors: Prof. Giovanni Dietler, Dr. Dusan Vobornik

Activity: Development and characterization of three frequency modulation AFM for imaging and force spectroscopy on biological molecules in UHV, air and water environment, respectively; High spatial resolution measurements for the study of the DNA-probe interactions.

## Experimental techniques and computational methods

Microscopy

Digital Holographic Microscopy, Quantitative Phase Imaging, Atomic Force Microscopy, Confocal Laser Scanning Microscopy

Spectroscopy

UV-Vis absorption Spectroscopy, Raman micro-Spectroscopy, FTIR micro-Spectroscopy, Acoustic attenuation Spectroscopy, Atomic Force Spectroscopy

Photo-correlation

Dynamic Light Scattering, Phase Analysis Light Scattering

Small Angle Scattering

Small Angle X-ray Scattering, Small Angle Neutron Scattering

Samples handling

Proteins, colloids (metallic nanoparticles, microbubbles, phase-change contrast agents), functionalization of particles and solid substrates

## Publications

- \* F. Brasili, A. Capocéfalo, D. Palmieri, F. Capitani, E. Chiessi, G. Paradossi, F. Bordi and Fabio Domenici; *Assembling patchy plasmonic nanoparticles with aggregation-dependent antibacterial activity*; Journal of Colloid and Interface Science 580, 419-428 (2020). doi:10.1016/j.jcis.2020.07.006
- B. Cerroni, F. Righi Riva, L. Oddo, F. Domenici, E. Tortorella, Y. Toumia, F. Brasili and G. Paradossi; *In vitro Analysis of the Trajectories of Adhesive Microbubbles Approaching Endothelial Cells*; Journal of Colloid and Interface Science 578, 758-767 (2020). doi:10.1016/j.jcis.2020.06.009
- D. Caprara, F. Ripanti, A. Capocéfalo, A. Sarra, F. Brasili, C. Petrillo, C. Fasolato and P. Postorino; *DNA-functionalized gold nanoparticle assemblies for Surface Enhanced Raman Scattering*; Colloids and Surfaces A: Physicochemical and Engineering Aspects 589:124399, 1-8 (2020). doi:10.1016/j.colsurfa.2019.124399
- F. Domenici, A. Capocéfalo, F. Brasili, A. Bedini, C. Giliberti, R. Palomba, I. Silvestri, S. Scarpa, S. Morrone, G. Paradossi, M. Frogley and G. Cinque; *Ultrasound delivery of Surface Enhanced InfraRed Absorption active gold-nanoprobes into fibroblast cells: a biological study via Synchrotron-based InfraRed microanalysis at single cell level*; Scientific Reports 9:11845, 1-13 (2019). doi:10.1038/s41598-019-48292-0
- Y. Toumia, B. Cerroni, F. Domenici, H. Lange, L. Bianchi, M. Cociorb, F. Brasili, E. Chiessi, E. D'Agostino, K. Van Den Abeele, S.V. Heymans, J. D'Hooge, G. Paradossi; *Phase Change Ultrasound Contrast Agents with a Photopolymerized Diacetylene Shell*; Langmuir 35:31 10116-10127 (2019). doi:10.1021/acs.langmuir.9b01160
- A. Capocéfalo, D. Mammucari, F. Brasili, C. Fasolato, F. Bordi, P. Postorino and F. Domenici; *Exploring the potentiality of a SERS-active pH nanosensor*; Frontiers in Chemistry 7:413, 1-11 (2019). doi: 10.3389/fchem.2019.00413
- L. Chronopoulou, F. Domenici, S. Giantulli, F. Brasili, C. D'Errico, G. Tsaouli, E. Tortorella, F. Bordi, S. Morrone, C. Palocci and I. Silvestri; *PLGA based particles as "drug reservoir" for antitumor drug delivery: characterization and cytotoxicity studies*; Colloids and Surfaces B: Biointerfaces 180, 495-502 (2019). doi:10.1016/j.colsurfb.2019.05.006
- \* F. Domenici, F. Brasili, L. Oddo, B. Cerroni, A. Bedini, F. Bordi and G. Paradossi; *Long term physical evolution of an elastomeric ultrasound contrast microbubble*; Journal of Colloid and Interface Science 540, 185-196 (2019). doi:10.1016/j.jcis.2018.12.110
- F. Domenici, F. Brasili, S. Giantulli, B. Cerroni, A. Bedini, C. Giliberti, R. Palomba, I. Silvestri, S. Morrone, G. Paradossi, M. Mattei and F. Bordi; *Differential effects on membrane permeability and viability of human keratinocyte cells undergoing very low intensity megasonic fields*; Scientific Reports 7:16536, 1-10 (2017). doi:10.1038/s41598-017-16708-4
- M. Diociaiuti, C. Giordani, G. S. Kamel, F. Brasili, S. Sennato, C. Bombelli, K. Y. Meneses, M. A. Giraldo and F. Bordi; *Monosialoganglioside-GM1 triggers binding of the amyloid-protein salmon calcitonin to a Langmuir membrane model mimicking the occurrence of lipid-rafts*; Biochemistry and Biophysics Reports 8, 365-375; (2016). doi:10.1016/j.bbrep.2016.10.005
- F. Domenici, C. Fasolato, E. Mazzi, L. De Angelis, F. Brasili, F. Mura, P. Postorino and F. Bordi; *Engineering microscale two-dimensional gold nanoparticle cluster arrays for advanced Raman sensing: an AFM study*; Colloids and Surfaces A: Physicochemical and Engineering Aspects 498, 168-175 (2016). doi:10.1016/j.colsurfa.2016.03.043
- S. Capece, F. Domenici, F. Brasili, L. Oddo, B. Cerroni, A. Bedini, F. Bordi, E. Chiessi and G. Paradossi; *Complex interfaces in "phase-change" contrast agents*; Physical Chemistry Chemical Physics 18, 8378-8388 (2016). doi:10.1039/c5cp07538f
- \* F. Brasili, E. Mazzi, L. De Angelis, P. Postorino, F. Bordi, F. Domenici, C. Fasolato and F. Mura; *Gold Nanoparticle Cluster Arrays for Advanced Optical Sensing: an AFM Study*; Nanotechnology (IEEE-NANO 2015), Proceedings of the 15th International Conference on Nanotechnology 1023-1028 (2015). doi:10.1109/NANO.2015.7388794

C. Fasolato, F. Domenici, [F. Brasili](#), F. Mura, S. Sennato, L. De Angelis, E. Mazzi, F. Bordi, P. Postorino; *Self-Assembled Nanoparticle Aggregates: Organizing Disorder for High Performance Surface-Enhanced Spectroscopy*; AIP Conference Proceedings 1667(020012), 1-7 (2015). doi:10.1063/1.4922568

\* main author

## Conferences, workshops and seminars

### Oral presentations

*Fabrication of antibacterial nanozymes with tunable properties*, Invited seminar at Thursday Morning Science, University of L'Aquila (AQ) July 9 2020;

*Design and AFM characterization of SERS-active gold nanoparticle cluster arrays to improve biosensing*, Nanoscience & Nanotechnology 2014, INFN - Laboratori Nazionali di Frascati (RM) October 6-7 2014;

### Posters

S. Giantulli, [F. Brasili](#), E. Tortorella, D. Palmieri, A. Bedini, G. Paradossi, S. Morrone, S. Scarpa, F. Domenici, I. Silvestri; *In vitro biological effects induced by ultrasounds cell interaction*; 2019 SIBBM Seminar; Bologna, June 11-13 2019.

[F. Brasili](#), S. Giantulli, E. Tortorella, D. Palmieri, A. Bedini, S. Morrone, I. Silvestri, G. Paradossi, F. Domenici; *In vitro analysis of the mechanical and biological effects induced by the ultrasound-cell interaction*; Biophysics@Rome 2019; Rome, May 15-16 2019.

F. Domenici, S. Cerra, D. Palmieri, [F. Brasili](#), L. Oddo, Y. Toumia, E. Chiessi, G. Paradossi; *Development of new polymeric contrast platforms*; The 24th European symposium on Ultrasound Contrast Imaging; Rotterdam, January 17-18 2019.

A. Capocceffalo, D. Mammucari, [F. Brasili](#), C. Fasolato, P. Postorino, F. Domenici; *SERS active pH-nanosensor with tunable properties*; 26th International Conference on Raman Spectroscopy ICORS 2018; Jeju Island (Korea), August 26-31 2018.

[F. Brasili](#), A. Capocceffalo, A. Bedini, F. Domenici; *Synchrotron Radiation SEIRA signalling of a gold nanoprobe in sonicated cells*; Plasmonica 2018; Florence, July 4-6 2018.

A. Capocceffalo, D. Mammucari, [F. Brasili](#), C. Fasolato, P. Postorino, F. Domenici; *SERS active pH-nanosensor*; Plasmonica 2018; Florence, July 4-6 2018.

F. Domenici, D. Palmieri, [F. Brasili](#), L. Oddo, B. Cerroni, I. Angelini, S. Cerra, G. Paradossi; *Optically triggered phase-change contrast agents with polymer/surfactant hybrid shells*; Leeds Microbubble Symposium 2018; Leeds, July 16-17 2018.

L. Chronopoulou, A. Di Nitto, A. Amalfitano, G. Nocca, A. Arcovito, I. Silvestri, F. Domenici, S. Giantulli, [F. Brasili](#), C. Palocci; *Innovative nanofabrication methodologies for the preparation of drug delivery systems*; Nanomedicine Rome 2018; Rome, June 18-20 2018.

F. Domenici, D. Palmieri, [F. Brasili](#), L. Oddo, A. Bedini, G. Paradossi; *Polymer/lipid hybrid shelled microdroplets behave as attractive ultrasound and photo-thermal phase-change integrated systems*; The 23rd European symposium on Ultrasound Contrast Imaging; Rotterdam, January 18-19 2018.

[F. Brasili](#), A. Capocceffalo, D. Palmieri, E. Chiessi, P. Postorino, G. Paradossi, F. Bordi, Fabio Domenici; *Tuning the optical properties of hybrid bio-plasmonic colloids*; Plasmonica 2017; Lecce, July 5-7 2017.

A. Capocceffalo, [F. Brasili](#), P. Postorino, F. Domenici; *Thermophilic rearrangement of bio-plasmonic aggregates: morphological and plasmonic related evidences*; Plasmonica 2017; Lecce, July 5-7 2017.

A. Capocceffalo, [F. Brasili](#), B. Cerroni, S. Sennato, G. Paradossi, F. Bordi, F. Domenici; *Biomimetic giant vesicles electroformation*; BioMaH - BIOMATERIALS FOR HEALTHCARE: Biomaterials for Tissue and Genetic; Rome, October 17-20 2016.

[F. Brasili](#), D. Palmieri, A. Capocceffalo, S. Sennato, F. Bordi, F. Domenici; *Aggregation and stability in solution of plasmonic active nano-biocolloids*; ECIS 2016 – 30th Conference of The European Colloid and Interface Society; Rome, September 4-9 2016.

A. Capocceffalo, F. Domenici, [F. Brasili](#), S. Sennato, B. Cerroni, F. Bordi; *Biomimetic giant vesicles electroformation: biophysical evidences*; ECIS 2016 – 30th Conference of The European Colloid and Interface Society; Rome, September 4-9 2016.

[F. Brasili](#), F. Domenici, C. Fasolato, E. Mazzi, F. Mura, L. De Angelis, P. Postorino, F. Bordi; *Nanoengineering and characterization of gold nanoparticle cluster arrays for advanced optical sensing*; 15th International IEEE Conference on Nanotechnology; Rome, July 27-30 2015.

F. Domenici, L. Oddo, [F. Brasili](#), G. Paradossi; *Poly(vinyl alcohol) based microbubbles: A study on the chemical and mechanical ageing*; The 21st European symposium on Ultrasound Contrast Imaging; Rotterdam, January 21-22 2016.

C. Fasolato, F. Domenici, [F. Brasili](#), F. Ripanti, F. Bordi, P. Postorino; *Folate conjugated, SERS active gold nanoparticles for selective targeting of human cancer cells*; Meeting IIT@Sapienza, Istituto Italiano di Tecnologia; Rome, June 9 2015.

S. Sennato, [F. Brasili](#), F. Domenici, F. Rinaldi, C. Fasolato, L. Chronopoulou, C. Palocci, C. Bombelli, G. Mancini, M. Carafa, M. Belardinelli, A. Musarò, G. Paradossi, F. Bordi; *Drug Delivery Strategies into Muscle and Motor Neuron cells*; Meeting IIT@Sapienza, Istituto Italiano di Tecnologia; Rome, June 9 2015.

L. De Angelis, C. Fasolato, F. Domenici, E. Mazzi, [F. Brasili](#), S. Sennato, F. Mura, F. Bordi, P. Postorino, *Multilayer effects in nanoparticle aggregates: exploiting collective plasmonics for high performance SERS*, Plasmonica 2014; Rome, June 30-July 2 2014.

## Awards

2019

SAXS proposal n. 20191601 at SOLEIL Synchrotron, SWING beamline  
Title: SAXS investigation on the temperature-driven plasmon coupling in gold nanoparticles adsorbed to PNIPAM microgels

2018

FTIR micro-Spectroscopy proposal n. 20181452 at SOLEIL Synchrotron, SMIS beamline  
Title: Interaction of lysozyme with gold nanoparticles: A Surface Enhanced Infrared Absorption study

2018

SANS proposal n. 191-08365-ST at Helmholtz Zentrum Berlin, BERII neutron source (V16)  
Title: Interaction of lysozyme with gold nanoparticles: A SANS study

2018

SAXS proposal n. 20180833 at SOLEIL Synchrotron, SWING beamline  
Title: Modulation of the interparticle spacing and optical behaviour of lysozyme decorated gold nanoparticle assemblies: a SAXS study

2017

Molecular dynamics simulation project n. HP10CV7EZ3 at CINECA ISCRA, MARCONI A2 (KNL) machine  
Title: Lipid interface in phase-change ultrasound contrast agents (LINUS)

2015

Finanziamento Progetti Universitari Sapienza prot. C26A15MHHJ  
Project title: Sviluppo di nanovettori biopolimerici ad alta efficienza per la veicolazione della doxorubicina nelle cellule di carcinoma mammario

2012

Scholarship for the preparation of the master thesis abroad, Sapienza University of Rome

## Teaching

2015/16 – 2016/17

Mathematics Tutor  
Facoltà di Scienze Matematiche Fisiche e Naturali, Corso di Laurea Triennale in Scienze Naturali, Sapienza University of Rome  
Prof. Carlotta Maffei

2015/16

Assistant  
Laboratorio di Meccanica, Corso di Laurea Triennale in Fisica, Sapienza University of Rome  
Prof. Andrea Messina

2015

TFA, Teaching qualification in Mathematics and Physics for secondary schools  
Sapienza University of Rome, July 14

2014/15 – 2016/17

Assistant  
Fisica Generale 1 per Matematici, Corso di Laurea Triennale in Matematica, Sapienza University of Rome  
Prof. P. Dore, Prof. Roberto Bonciani

## Education

2017 September 20

Ph.D., Sapienza University of Rome  
Vito Volterra School in Astronomy, Astrophysics, Chemistry, Earth Sciences, Mathematics and Physics  
Project title: Bio-plasmonic systems with tunable photo-thermal response  
Supervisors: Prof. Federico Bordi, Dr. Fabio Domenici

2014 June 8-13

SISN Summer School  
Small Angle Neutron Scattering and Neutron Imaging  
San Giovanni in Valle Aurina (BZ)

2013 September 26

Master Degree in Physics, Sapienza University of Rome  
Thesis title: Development of KolibriSensor based FM-AFM for high resolution imaging and spectroscopy on biological samples  
Final grade: 110/110,  
Supervisors: Prof. Federico Bordi (Sapienza), Prof. Giovanni Dietler (EPFL Lausanne)

2006 February 27

Bachelor Degree in Physics, Sapienza University of Rome  
Thesis title: Modulazione della luce utilizzando celle di Pockels  
Final grade: 110/110 *cum laude*  
Supervisor: Prof. Paolo Mataloni