Decreto Rettore Università di Roma "La Sapienza" n 1828/2018 del 12/07/2018

Leonetta Baldassarre
Curriculum Vitae

Roma, Italia
24th August 2018

Part I – Education

Type	Year	Institution	Notes (Degree, Experience)
University graduation	2004	Università "La Sapienza" di Roma	Mark: 110/110 Thesis topic: Effect of charge ordering on the optical conductivity of Na_xCoO_2 Thesis supervisors: Prof. S. Lupi; Prof. P. Calvani
PhD	2007 Dec.	Università "La Sapienza" di Roma, Scuola di dottorato Vito Volterra Dottorato in "Scienze dei Materiali" PhD in Materials Science	Thesis Title "An infrared study on the metal to insulator transition in correlated oxides". Thesis supervisor: Prof. S. Lupi External Thesis Referee: Prof. L. Degiorgi (ETH Zurich)
PhD summer school	2005	International School of Physics "Enrico Fermi", Varenna (SIF)	Polarons in Bulk Materials and System with Reduced Dimensionality

Part II – Appointments

IIA – Academic Appointments

Start	End	Institution	Position
Dec 2007	Nov 2008	Augsburg Universitaet Augsburg (Germany); Chair for experimental physics 2	**Post-doctoral researcher** Position funded by two competitive grants awarded on comparative basis by the "Della Riccia" and "Bavarian Science" Foundations (reported at a subsequent point of the titles list). Research topics: Insulator to Metal transitions of strongly correlated electron systems at Extreme Conditions (High Pressure/Low Temperatures).

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Dec 2008	May 2011	ELETTRA Synchrotron, Trieste (Italy)	**Post-doctoral research scientist at the synchrotron infrared beamline SISSI.** Addressed topics: -Far-Infrared Synchrotron radiation studies of the properties of correlated electron systems under external pressure with IR Synchrotron radiation. -Protein conformational changes under external pressure - Organic LED degradation. -Development of a low-temperature/high pressure setup, still in used as user facility at the infrared SISSI beam line.
Sept 2010	Feb 2011	**5 months maternity leave**	
Feb 2012	Sept 2015	Istituto Italiano di Tecnologia, Center for Life NanoScience (IIT@Sapienza)	**Post-doctoral position** Planning and setup of the laboratory for "Infrared Nano-imaging". Organization of an international call for tender (150 kEUR) to buy a novel infrared near-field microscope. Setup of first experiments of nano-spectroscopy beyond diffraction limit. Topics: - Nano-spectroscopy of biomolecules with quantum cascade lasers; - Plasmonics in the mid-infrared; - Characterization of Silicon Photonics chips and Nano-spectroscopy in the infrared;
Jan 2015	Aug 2015	**8 months maternity leave**	
Oct 2015	present	Università di Roma "Sapienza", Department of Physics	**Fixed-term researcher position (Ricercatore a tempo determinato legge n. 240/ 10 di tipo A)** PI of the project "MINDS: Mid-Infrared Naonospectroscopy with Doped Semiconductors" funded by the Italian Ministry of Research under the (MIUR-S.I.R. program (Scientific Independence of Young Researchers, competitive personal grant, 423 kEUR/3 years) Topics: - Plasmonics in doped semiconductors and 2D materials - Engineering of resonant scanning probes -Nano-spectroscopy of single molecular monolayers In these years, besides tutoring of two master thesis students and fourth-year laboratory students, L.B. has hired a fellow (assegno di ricerca) to work on her MINDS project.

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Part III – Teaching experience

Year	Institution	Lecture/Course
aa2017/ 2018	Università di Roma "Sapienza"	Electromagnetism module in General Physics class, Ingegneria Informatica e dell'automazione
aa2016/ 2017	Università di Roma "Sapienza"	Electromagnetism module in General Physics class, Ingegneria Informatica e dell'automazione
aa2015/ 2016	Università di Roma "Sapienza"	Teaching assistant; General Physics I class (FISICA1) Mathematics (Prof. Paolo Dore)
aa2005/ 2006	Università di Roma "Sapienza"	Teaching assistant; General Physics Biology (Prof. F. Sebastiani)

Part IIIb – other teaching experience

aa2013/ 2014	Università di Roma "Sapienza"	External Master thesis supervisor: E. Falomi "Apparato per la calibrazione dello spettro d'emissione di Laser a Cascata Quantica in cavità esterna"
aa2014/ 2015	Università di Roma "Sapienza"	External Master thesis supervisor: L. Rossi "Misure intracellulari di nano-spettroscopia infrarossa: la distribuzione proteica nelle cellule HeLa."
aa2016/ 2017	Università di Roma "Sapienza"	Master thesis supervisor: A. Sorgi "Nanospettroscopia nel medio infrarosso di guide d'onda di germanio integrate su silicio"
aa2018	Università di Roma "Sapienza"	Master thesis supervisor: R. Polito "Studio di cambi conformazionali alla nanoscale di proteine fotosensibili"
aa2018	SIOF (Società Italiana di Ottica e Fotonica) - "Plasmonica" International Doctoral School	Lecture on plasmonic approaches to IR spectroscopy

Part IV – Fellowships, Habilitation, Society memberberships,

Year	Title
2007/2008	**Fellowship** from the "Della Riccia Foundation"(Italo-Swiss foundation) awarded on comparative basis. Project title: "Optical investigation of strongly correlated electron systems." **(Grant:10.2 kEUR/1yr)**
2007/2008	**Fellowship** for post-doctoral research awarded by the "Bayerische Forschungsstiftung" (Bavarian Research Foundation) awarded on comparative basis **(Grant: 29.52 kEUR/1yr)**

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2008	**Fellowship for post-doctoral research** awarded from the Alexander von Humboldt Foundation awarded on comparative basis. Project title: "Infrared study of $NiS_{2-x}Se_x$ under external pressure at low-temperature" **Grant: 27 kEUR** for 1st year, renewable *L. Baldassarre has declined this fellowship in order to join the infrared beam line at the Elettra synchrotron in Trieste.*
2012 /2013	**Habilitation (ASN)** for Associate professor (II fascia)– Scientific Area: FIS03 02/B1 (granted on 12-12-2013; valid till Dec 2019)
2018	**Habilitation (ASN)** for Associate professor (II fascia)– Scientific Area: FIS03 02/B1 (granted on 26-7-2018; valid till 2024)
2016-2018	Member of the Italian Society for Optics and Photonics (SIOF)
2017-2018	Elected member of the Steering Committee of the SIOF working group on plasmonics
2004-2018	User at several international experimental facilities [Molecular Foundry, Berkeley (CA, USA); Free Electron Laser FELBE, Dresden (DE); Bessy II Synchrotron, Berlin (DE), ANKA Synchrotron, Karlsruhe (DE); ELETTRA Synchrotron, Trieste (IT)]; access granted via comparative evaluation of experimental proposals

Part V - Funding Information [grants as PI-principal investigator or I-investigator]

Year	Title	Program	Grant value
2015/ 2019	"Mid Infrared Nano-optics: approaching plasmonics with Doped Semiconductors – MINDS". (project code: RBSI14IT0D) (**PI**)	MIUR S.I.R. (Scientific Independence of young Researchers)	423.5 kEUR
2014/ 2015	Infrared Study of oxide interfaces (**PI**)	CNR SEED project	6000 EURO
2014/ 2017	FP7 Future Emerging Technology GEMINI: Germanium for Mid Infrared Plasmonic Sensing (**I**)	European Commission	Tot: 1.4 MEUR Sapienza unit: 289 kEUR
2017/ 2020	H2020 Future Emerging Technology (FETopen) FLASH: Far Infared Laser Assembled using Silicon Heterostructures (**I**)	European Commission	Tot: 1.9 MEUR Sapienza unit: 40 kEUR
2017/ 2019	Progetto Ricerca Ateneo (**I**) Tailoring the electronic properties of transition-metal dichalcogenides via hydrogen-assisted phase, strain and band gap engineering (PI: M. Felici)	Sapienza Università di Roma	13.4 kEUR
2016/ 2018	Progetto Ricerca Ateneo (**I**) Osservazione con nanospettroscopia infrarossa di nanoparticelle di niobato di litio all'interno di cellule (PI: P. Calvani)	Sapienza Università di Roma	11 kEUR

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Part VI – Research Activities

Keywords	Brief Description
Fourier Transform Infrared Spectroscopy Nano-IR Quantum Cascade Lasers Low-energy electrodynamics of solids Atomic Force Microscopy Doped semiconductors/ Silicon photonics Metal-insulator transitions Plasmonics; mid-IR sensing Protein conformational changes Phonon-polaritons	During her scientific carrier Leonetta Baldassarre (L.B.) has exploited infrared spectroscopy to assess diverse scientific topics: from the study of low-energy electrodynamics in solids, to plasmonic approaches in the mid-infrared for nano-spectroscopy and sensing. To tackle her scientific goals, she has used conventional Fourier Transform Infrared Spectroscopy, as well as spectroscopy with Synchrotron Radiation, with Quantum Cascade Lasers and with AFM-based near-field setups. **- Metal-insulator transitions and strongly correlated electron systems (2004-2015)** L.B. has worked for long time on the low-energy electrodynamics of solids, by means of Fourier Transform Infrared (FTIR) spectroscopy complemented by means of Raman spectroscopy and photoemission. Her PhD thesis has dealt with the study of Insulator to Metal transitions (MIT) of several vanadium oxides compounds considered to be the prototype of strongly correlated electron systems. She has then extended her studies on other classes of materials. Her studies have highlighted for example: - the role of subtle lattice parameters modification in triggering the MIT in V_2O_3 (PRB77, 2008; Nat Comms1:19, 2010); - the existence of a metallic phase in the Peierls-distorted VO_2 (PRL98, 2007) at high pressure; - the key role of bonding/antibonding splitting in the S-S (Se-Se) dimer in the MIT of $NiS_{(2-x)}Se_x$ (PRB 81, 2010); - the strength of electron – electron correlation in Cs3C60 (Sci. Rep 5, 2015) **- Mid-Infrared Plasmonics and IR spectroscopy and imaging beyond diffraction limit (2012-2018)** At the Center for Life NanoScience@Sapienza, novel joint center among the Italian Institute of Technology and the University of Rome "Sapienza", L.B. has been in charge of planning and setting up a laboratory for infrared nano-spectroscopy and imaging. In order to attain such scientific goals L.B. has worked to efficiently translate the plasmonic antenna concepts from the visible range to the mid-infrared, enabling IR spectroscopy of few molecules or nanostructures. In these years L.B. has been using both commercial and research-grade quantum cascade lasers coupled to atomic force microscopes. In 2015 her research project MINDS (Mid-Infrared Nano-optics: approaching plasmonics with Doped Semiconductors) has been

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funded via the S.I.R. (Scientific Independence of young Researchers) program of the M.I.U.R. (Ministero dell'Istruzione, Università e Ricerca).
Her work can be divided into two intertwined topics, detailed below.

Novel materials for plasmonics in the mid-IR:
L.B. and her collaborators have pioneered the possibility of using a highly n-doped Ge-on-Si material platform for integrated sensing devices. Her work has for example:
- demonstrated the existence of localized resonant plasmonics modes in germanium nanoantennas on silicon substrates (NanoLett15, 2015)
- assessed the role of losses in the plasmonic response of n-doped Ge (PRB94, 2016) also benchmarking germanium nanostrusctures against those made with noble metals (ACS Photonics 2018)
- demonstrated the robustness of phonon-polaritons in ultra-thin flakes of hBN against remote screening from free-carriers in adjacent layers (APL112, 2018)

The MINDS project aims at understanding, designing and developing 3-dimensional (3-D) mid-infrared antennas, to be used as near-field proximal probes in Scanning Tip Microscopes for infrared vibrational spectroscopy. L.B. and coworkers have:
- demonstrated the functionalization of scanning probe tips with epitaxial semiconductor material (Small Methods 2017)
- identified a clear role of the free-electron plasma in the heavily doped germanium tip in building the scattering imaging contrast (Phys Rev Applied 5, 2017)

Infrared Nano-spectroscopy of conformational changes of few proteins:
Part of the work of L.B. is aimed at infrared imaging (and spectroscopy) on biological and inorganic samples well below the diffraction limit. To this aim she is using a photo-thermal based setup based on a tunable quantum cascade laser and an atomic force microscope. The main results already achieved are:
- the measurement of natural heterogeneity of transmembrane protein conformation on individual patches of purple membrane (5 nm thick, about 10^2 protein measured). (Small 13, 2017)

Recent work is instead devoted to assessing the conformational changes induced by external stimuli (i.e. visible light absorption) in photo-active transmembrane proteins.

Part VIb – Established collaborations

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2017-present	Part of the research group of the **EU H2020 FET-Open** funded project **FLASH**. The consortium members are University of RomaTre, University of Glasgow (UK), ETH Zurich (CH), IHP Leibniz-Institut für innovative Mikroelektronik Frankfurt Oder (DE), NextNano Munich (DE). LB's role in the project is the infrared characterization of intersubband transition in SiGe quantum wells and pump-probe experiments at Free Electron Laser facility.
2015-present	L.B. has coordinated the work of an international research team, aimed at the study of the infrared response of a small number of bacteriorhodopsin (a transmembrane protein) in purple membranes. The work is a result of a close collaboration among research groups in Italy (Physics Department - Sapienza University and Center for Life Nano Science - IIT@Sapienza) and in Germany (Humboldt Universitaet Berlin and Helmoltz Centrum Berlin). Results have been recently published in V. Giliberti et al, Small 2017
2014-2017	Part of the research group involved in the **EU FP7** funded project **GEMINI**. Partners of the project have been Politecnico di Milano (Lead partner), University of Constant (Germany), University of Glasgow (UK) and Sapienza University of Rome. The project aimed at exploiting group-IV semiconductors for plasmonics in the mid-IR in a "lab-on chip" perspective. L.B. has dealt with the infrared spectroscopy of the pristine material and the of on-chip plasmonic devices. The proof-of-priniciple of sensing with n-doped Ge antennas was published in L. Baldassarre, E. Sakat et al. Nano Letters 2015
2008-2015	Part of international research groups aimed at the study of infrared constants of crystalline solids under external pressure. L.B.'s expertise, gained during her PhD years, has allowed her to establish independent collaborations with researchers of other scientific institutions. Results of these studies have been published for example in PRL112, PRL103 (reported in the full list of publications)

Part VII – Summary of Scientific Achievements

Part VIIa – Publications

Product type	Number	Data Base	Start	End
Total number of products [international]	87 (88)	Scopus (ISI WoS)	2005	2018
Papers [international]	(63)	(ISI WoS)		
Peer-reviewed Conference Proc.	(25)	(ISI WoS)		

Total Citations	1084 (1011)
Average Citations per Product	12,46 (11,49)
Hirsch (H) index	17 (18)

Product type	Number	Data Base	Start	End

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Total number of products [international]	80 (79)	Scopus (ISI WoS)	2008	2018
Papers [international]	(59)	(ISI WoS)		
Peer-reviewed Conference Proc.	(20)	(ISI WoS)		

Total Citations	818 (769)
Average Citations per Product	10.22 (9.86)
Hirsch (H) index	15 (15)

Part VIIb –Talks at conferences & conference organization

Year	Conference	Presentation title
07-2018	ICPS 2018; Montpellier (FR) International Conference on the Physics of Semiconductors	Observation of phonon-polaritons on thin flakes of hBN on gold
05-2018	ISTDM / ICSI 2018; Potsdam (DE)	Mid-Infrared plasmonic platform based on Ge on Si: molecular sensing with germanium nanostructures
05-2018	RomeSC2018; Rome (IT)	Phonon-polaritons in thin flakes of hexagonal boron nitride on gold
10-2017	Sci-X- The Great Scientific Exchange; Reno NV (U.S.A.)	Nanoinfrared Spectroscopy of Cell Membranes and Extracellular Vesicles **(INVITED SESSION)**
09-2017	NanoInnovation 2017; Rome (IT)	Infrared nano-spectroscopy study of the heterogeneity of protein conformation in purple membranes
09-2017	EMN meeting on photonics 2017; Budapest (HU)	Engineered Germanium Nanostructures for photonics in the mid- infrared (**INVITED**)
07-2017	Plasmonica 2017; Lecce (IT)	Mid-Infrared plasmonic platform based on Ge-on Si: waveguiding and molecular sensing with germanium nano-structures
09-2016	Infrared, Millimeter and THz waves Conference (IRMMW-THz) 2016; Copenhagen (DK)	Mid-Infrared plasmonic platform based on n-doped Ge-on Si: molecular sensing with germanium nano-antennas on Si
09-2016	Near-Field Optics (NFO) 14; Hamamatsu (Japan)	Mid-IR Molecular sensing with germanium antennas on silicon
06-2016	Fotonica 2016, in the Special Session "Plasmonics"; Rome (IT)	Mid-Infrared Molecular Sensing with Germanium Antennas on Silicon
03-2016	Optical Nanospectroscopy III, Cost Action Nanospectroscopy (MP1302); Rome (IT)	Mid-infrared molecular sensing with electron-doped Germanium nanoantennas
09-2015	COST Action MP1302 Nanospectroscopy, Workshop on Nanospectroscopy for Medical Applications; London (UK)	Mid-infrared Nano-Spectroscopy on Single Cells
09-2014	Infrared Millimeter and THz waves Conference (IRMMW-THz) 2014; Tucson, AZ (USA)	Mid-infrared plasmonic platform based on heavily doped epitaxial Ge-on-Si: Retrieving the optical constants of thin Ge epilayers (**INVITED KEYNOTE**)
05-2013	MAMA-Trend: Trends, challenges and emergent new phenomena in multi-functional materials	Insulator to Metal transition in Cs3C60 under pressure
06-2012	New Generation in Strongly	Towards metallic states: infrared spectroscopy of

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	Correlated Electron Systems (NGSCES) 2012; Portoroz (SL)	strongly correlated systems under pressure. (**INVITED**)
07-2011	Stripes 2011; Rome (IT)	Metal to Insulator Transition and Phase separation in Cr-doped V2O3
06-2010	New Generation in Strongly Correlated Electron Systems (NG-SCES) 2010	Metal to Insulator Transition and Phase separation in Cr-doped V2O3

09-2014	Rome (IT)	TOWARDS OXIDE BASED ELECTRONICS (TO-BE) Cost Action (MP1308) Fall Meeting 2014 (Organizing committee)
06-2014	Rome (IT)	Plasmonica 2014 (Organizing committee)

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